Peer Learning Schemes at ULiège
User Experience, Efficacy Conditions, and Socioacademic Effects



Doctoral thesis presented on the 29th of May 2026 by

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In partial fulfilment of the requirements for the academic degree of
Doctor in Psychology

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Faculty of Psychology, Speech and Language Therapy, and Education
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Résumé

Cette thèse de doctorat, structurée en sept études, examine les trois premières années de mise en œuvre de deux programmes de parrainage au sein de dix facultés de l'Université de Liège.

Les deux premières études proposent une description générale des programmes SI-PASS et PEPPS à l'aide d'indicateurs quantitatifs standardisés. La troisième étude évalue, au moyen d'une étude randomisée, l'impact du dispositif SI-PASS sur la performance académique d'étudiants inscrits à un cours de statistiques en psychologie. La quatrième étude réplique et prolonge une étude suédoise visant à identifier, à partir de verbes d'action auto-rapportés, les pratiques d'apprentissage à l'œuvre lors des séances. La cinquième étude mobilise un codage comportemental d'enregistrements de séances SI-PASS afin d'en analyser les dynamiques interactionnelles. La sixième étude explore, à travers des entretiens semi-directifs, la perception des leaders SI-PASS quant à leur rôle. Enfin, la dernière étude développe et valide une échelle destinée à mesurer et comparer les deux programmes de parrainage selon huit dimensions perceptives.

Afin d'éviter la fragmentation souvent associée aux thèses par articles, la discussion adopte une perspective intégrative des résultats. Elle en synthétise les implications théoriques et pratiques, ainsi que les limites et les perspectives de recherche futures.

Abstract

This PhD thesis, structured around seven studies, examines the first three years of implementation of two peer-led programs across ten faculties at the University of Liège.

The first two studies provide a general description of the SI-PASS and PEPPS programs using standardized quantitative indicators. The third study assesses, through a randomized study, the impact of SI-PASS on the academic performance of students enrolled in a psychology statistics course. The fourth study replicates and extends a Swedish study aimed at identifying, through self-reported action verbs, the learning practices at play during sessions. The fifth study uses behavioural coding of recorded SI-PASS sessions to analyse their interactional dynamics. The sixth study explores, through semi-structured interviews, SI-PASS leaders' perceptions of their role. The final study develops and validates a scale designed to measure and compare the two peer-tutoring programs across eight perceptual dimensions.

To avoid the fragmentation often associated with article-based theses, the discussion develops an integrative perspective on the results. It synthesizes their theoretical and practical implications, as well as their limitations and avenues for further research.

"Education is an admirable thing, but it is well to remember from time to time that nothing that is worth knowing can be taught."

Oscar Wilde

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Foreword

Higher education is currently facing unprecedented challenges (Hazelkorn et al., 2022), driven by the increasing diversity of student populations (National Center for Education Statistics, 2023), the rapid development of new learning technologies (Samala et al., 2024), and a growing emphasis on student-centered approaches (Wright, 2011). Recent European data (OECD, 2025) highlight an ambitious objective: significantly increasing academic success rates despite increasingly heterogeneous student profiles (Gale & Parker, 2017).

However, this ambition contrasts with persistent structural tensions. Expanding access to higher education and increasing demand for student funding (Žalėnienė & Pereira, 2021) coexist with relatively low academic success rates: approximately 60% in French-speaking Belgium (Kahu & Nelson, 2018; Perret & De Clercq, 2022). The consequences of academic failure are substantial, both at the societal and individual levels. Students may experience psychological difficulties, including reduced self-confidence (Noyens et al., 2017), while institutions face significant financial costs. In Belgium, the annual cost per university student ranges between €6,291 and €7,786 (De Clercq, 2024), with approximately 43,000 new students enrolling each year; representing a 35% increase in the total student population over the past 20 years without a corresponding increase in funding. More specifically, the total cost of support measures related to failure, reorientation, and dropout is estimated at €180,000,000 annually (De Clercq, 2024). The diversity of student trajectories further complicates the implementation of effective support systems, highlighting the need for optimized resource allocation and more efficient assistance programs (Gale & Parker, 2017).

In this context, the *Paysage* Decree (Communauté française, 2013) introduced a series of structural reforms in the Wallonia-Brussels Federation, including a dedicated focus on student success support, particularly during the first year of study. Yet an important question remains: what do students themselves perceive as meaningful support? Mouhib's report on academic success (2018) provides valuable insight. Based on responses from 30 students (pp. 85-86), the most valued forms of support include teacher availability (43.3%), online resources (34.5%), language courses (34.4%), methodological support (33.7%), written course materials (32.8%), and library services (21.2%); all of which are already widely implemented in higher education institutions. By contrast, forms of support such as remediation (19.3%), orientation services (17.5%), tutoring (14.5%), study advisors (10.4%), assisted study sessions (9.9%), and diagnostic tests (3.2%) are less consistently available across institutions. Peer learning, the central focus of this dissertation, appears near the bottom of this ranking (9.3%).

This dissertation was undertaken to analyse, across multiple dimensions, two implementations of peer-led support: SI-PASS (Supplemental Instruction - Peer-Assisted Study Sessions) and PEPPS (Perception, Establishment of a Plan, Progress, Preparation, Exam Session). Where do these programs stand within the broader landscape of academic support? In what ways do they serve as a resource for students? How are they implemented in practice? What impact do they have on students' experiences in higher education? Are they worth the financial investment made by institutions and the time invested by all stakeholders? And could they provide a partial response to the growing tension between limited human resources and increasing student populations? These questions form the foundation of the present dissertation, which explores the potential of peer-led programs in contemporary higher education.

Section 1 : Theoretical Introduction

In constructing the first section of this thesis, a deliberate choice was made to deviate from the conventional "funnel technique", which typically moves from broad theoretical frameworks toward increasingly specific applications. Instead, this section begins with a detailed presentation of the peer-led programs, SI-PASS and PEPPS, that form the core context of this research. This choice was necessary because every subsequent theoretical and practical discussion in the thesis repeatedly refers to these two programs. Introducing them at the outset avoids repetitive explanations of program-specific features in later chapters and provides readers with a clearer contextual grounding.

Once the peer-led programs have been presented, the second chapter examines the psychological and pedagogical theories underpinning their mechanisms. By situating these approaches directly after the program descriptions, the thesis clarifies the theoretical justifications behind the practical applications previously outlined. This ordering creates a coherent link between implementation and theory, helping readers understand why and how these programs may influence students' academic and social experiences.

The third chapter then expands toward broader institutional perspectives, addressing student transitions and institutional support structures. Once the theoretical foundations of peer-learning mechanisms have been presented, it becomes necessary to consider the practical conditions within which these programs operate in higher education. This chapter discusses the transitional challenges students face, the role of institutional structures, and how peer-led initiatives may address these challenges.

Finally, the following sub-chapter presents an overview of existing peer-learning models beyond the two central programs examined, situating SI-PASS and PEPPS within the wider landscape of peer-led support.

Chapter 1. Peer-learning

"*Defining the role of peer tutor is very difficult, and getting tutors to understand the role themselves is, perhaps, an even more perplexing problem. Peer tutors are often defined by what they are not. Peer tutors are not teachers.*" (Falchikov, 2001, p. 5)

1.1. SI-PASS

This program, one of the two implemented at ULiège, combines the broader framework of Supplemental Instruction (SI) with the specific designation Peer Assisted Study Sessions (PASS). Given its central role in this dissertation, it is presented here in detail.

1.1.1. Historical background

In 1972, the Higher Education Act was signed in the United States under President Richard Nixon. This legislation marked an important turning point in higher education by promoting broader access and financial support for students. As a result, student populations became more diverse, and universities increasingly admitted profiles that had previously been underrepresented. This diversification brought issues of retention to the forefront and highlighted the need for complementary support structures to ensure student success. In this context, cost-effective interventions became necessary to reduce dropout rates and improve academic outcomes.

In response to high attrition rates in health care programs, Dr. Deanna Martin at the University of Missouri-Kansas City developed Supplemental Instruction in 1973 as an alternative to traditional remedial approaches. Her model was grounded in several key observations (Martin & Arendale, 1992).

First, academic difficulties were not confined to specific student groups but were concentrated in historically difficult, high-risk courses: "*The characteristics that identify a course as being historically difficult or 'high-risk' include: large amounts of weekly readings from both difficult textbooks and secondary library reference works, infrequent examinations that focus on high cognitive levels, voluntary and unrecorded class attendance, and large classes in which each student has little opportunity for interaction with the professor or the other students*" (Arendale, 1994, p. 11). This reframed the issue from individual deficiency to structural characteristics of courses, leading to an intervention focused on courses rather than students.

Second, existing support structures, such as study skills courses and tutoring, were often reactive, stigmatizing, and fragmented. Students frequently sought help only after early failure, at which point recovery was more difficult (Arendale, 2022b, pp. 2-3). Martin therefore emphasized the need for proactive, course-integrated, and non-stigmatizing support. As Wallace noted: *"PASS intends to project a positive, proactive, developmental image in which students of all abilities can gain something from engaging with PASS. The PASS model aims to target high risk course material, as opposed to high-risk students."* (1995).

Third, successful students consistently reported relying on informal peer collaboration, such as study groups and shared explanations. However, access to such networks was uneven and often dependent on students' social or academic capital (Arendale, 2022b, p. 4). The SI model formalized and democratized these practices by embedding collaborative learning opportunities within course structures.

Finally, instructors often lacked the time to provide repeated explanations and interactive support outside formal lectures. SI therefore introduced trained peer leaders to facilitate sessions, increasing opportunities for engagement without replacing faculty (Martin & Arendale, 1992, pp. 11-12).

These elements led to the development of Supplemental Instruction, now widely recognized as a structured model of collaborative learning in higher education. Since the 1980s, it has been endorsed and disseminated internationally, notably with support from the U.S. Department of Education (Arendale, 2002). Unlike traditional tutoring, SI-PASS does not aim to reteach content but to facilitate collaborative engagement with course material, encouraging students to deepen their understanding, solve problems, and develop higher-order thinking skills. SI-PASS sessions are led by trained peer leaders (students who have previously succeeded in the course) and are designed to promote active learning within an inclusive and supportive environment.

According to the Supervisor Training Manual (European Centre for SI-PASS, 2018), the main objectives of SI-PASS are:

- Improving students' academic performance and material retention.
- Increase students' engagement with the course and its thorough understanding.
- Complement existing lectures and have organized peer-study groups as facilitators.
- Enhance students' learning experience and have them perceive their peers as learning resources.
- Support a smooth transition to higher education by developing a sense of belonging in students, promoting academic success and progression, and encourage student's wellbeing through the process.

The program was later adopted internationally, notably in South Africa following the end of Apartheid, as part of broader efforts to expand access to higher education. It was introduced in the United Kingdom in 1991, Sweden in 1994, Australia in 2004, Canada in 2008, and at the University of Liège in 2019, where it became the first implementation in the French-speaking academic context.

1.1.2. 21 principles

To support its international dissemination, the SI-PASS model is defined through a set of 21 general principles that delimit both its scope and its boundaries. These principles, detailed in the Supervisor Training Manual (European Centre for SI-PASS, 2018), serve as a reference framework for identifying what constitutes SI-PASS and what falls outside its intended design.

1. SI-PASS programs:
    1. are managed by a certified SI-PASS Supervisor who has undertaken training with a Certified Trainer, based at a National or Regional Centre (*e.g.*, European Centre at Lund University).
    2. are student-driven with participants determining the content of SI-PASS sessions facilitated by SI-PASS Leaders.
    3. are monitored and evaluated through attendance data, student feedback, and students' final marks. Outcomes are reported to stakeholders where appropriate.

2. SI-PASS sessions:
    1. are small supplementary study groups in which there are no more than 20 participants, with groups of 8-12 being best practice.

Sessions are facilitated by SI-PASS Leaders working individually or in pairs dependent on what is appropriate at the Institution.

2. are voluntary and are open to all students enrolled in the unit/subject/course.
3. are not linked to the awarding of marks for the unit/course/subject.
4. are facilitated by a student who is at least one year beyond the level of the target unit in their own studies and has successfully completed the unit they are supporting.
5. are designed to supplement existing learning opportunities open to all students, such as lectures, tutorials, practicals, etc.
6. are aligned with unit/subject/course content, with SI-PASS Leaders planning regular sessions and related activities based upon the previous week's lecture(s) or core content.
7. integrate both course content and related study skills.
8. provide an active, positive collaborative peer learning environment.
9. do not deal directly with assessable tasks (anything that has marks attached homework/ assignments).
10. have their attendance is taken and Leaders are regularly observed and monitored by a SI-PASS representative and provided with guidance and feedback for on-going improvement.
11. are attached to a class or discipline, never a student and are non-remedial in their approach.

3. SI-PASS supervisors:
    1. and senior Leaders/Mentors/Coordinators model SI-PASS principles and facilitation skills both in training and on-going professional learning in order to inform best practice. The same is true of other locally specified roles such as Mentors (senior Leaders) and Coordinators.

2. work collaboratively with academic colleagues to ensure SI-PASS is linked appropriately into the course schedule and course content.

2. SI-PASS leaders:
    1. are recognized and rewarded (some institutions pay their Leaders, some offer academic credit or other appropriate compensation).
    2. are provided with an initial minimum two-day training program and on-going professional learning.
    3. are provided with resources to support them in their role.
    4. do not reteach the course material. They are specifically trained and supported in order to develop students as independent learners and to ensure that SI-PASS sessions do not become another lecture or a replacement for tutorials.
    5. have regular contact with course teaching team so that they are knowledgeable about what is occurring in the course to ensure that the following aims are met:
        i. Leaders are modelling good study behavior
        ii. Marketing the purpose and benefits of SI-PASS
        iii. Leaders are maintaining currency in subject content/ relevant unit information in order to support preparation
        iv. Leaders have awareness of difficult content
        v. Leaders are able to provide feedback to inform the course teaching team.

These guidelines function as defining criteria: a peer-learning scheme can only be considered as SI-PASS insofar as it remains aligned with these principles. They also act as safeguards against drift, particularly the risk of the program being reinterpreted as a form of teaching or remedial instruction. Consequently, local adaptations of the scheme must remain anchored in this

framework if the SI-PASS designation is to be retained. This issue is addressed in the present dissertation, notably in study 5, which examines how these principles are enacted in practice at the University of Liège.

1.1.3. Four techniques

In addition to the 21 principles, the SI-PASS model specifies four core facilitation techniques that structure the role of student leaders. These techniques are intended to ensure that leaders support learning processes without taking on a teaching role. The following definitions are drawn from the Supervisor Training Manual (European Centre for SI-PASS, 2018):

- Student to student interaction: "Collaborative learning can be defined as a learning method in which students work in groups toward a common academic goal. The patterns of interaction in a collaborative learning environment, like SI-PASS sessions, should be primarily student-to-student rather than student-leader or leader-student."
- Redirecting questions: "Redirecting questions can be considered the process most central to the SI-PASS program. The process itself is fairly simple to understand but difficult to practice without a context in which to do so. The goal of this process is to encourage more and better student-to-student interactions in the sessions. It is based on the concept that we all learn better when we have to explain something to someone else. The natural tendency for anyone is to answer questions asked; this process requires the leader to suppress that tendency and redirect questions back to the group."
- Checking for understanding: "The learning strategies that SI-PASS leaders use in their sessions are designed to promote student-to-student interactions. We cannot automatically assume, however, that the students are gaining understanding from their interactions. Instead, we

must check for understanding by asking the students to confirm that they have learned the content."

- Wait time: "Wait-time is the time that elapses between an SI-PASS leader-initiated question and the next behavior (student response or the leader talking again). There are two kinds of wait-time:
    1. The time the leader waits after asking a question
    2. The time the leader waits after a response."

As with the 21 principles, these techniques form part of the defining features of SI-PASS. Their implementation is monitored locally through session observations and feedback processes, typically supported by structured observation grids. The present dissertation contributes to this evaluation in two ways: study 3 includes an example of such an observation grid, and study 5 analyses how these techniques are implemented in practice at the University of Liège.

1.1.4. Figures - 2024 European Report

The most recent European report compiling cross-institutional SI-PASS data was published in January 2024 (Malm et al., 2024). Key figures are:

- A total of approximately 384 higher education members are trained supervisors involved in SI-PASS.
- About 2285 courses are targeted by SI-PASS each year.
- About 7400 leaders are hired each year.
- These leaders conduct on average fifteen sessions per academic year, which last from 30 minutes to three hours in general for a total of about 73000 hours per year.
- They animate sessions for an average of 132000 students per year.
- Amongst these students, 67900 attend at least one meeting per year (51% of signed-up students).

- In terms of attendance, an average of 11 students per session is reached, with 31% total attendance average.

This initiative responds to a demand from participating institutions for access to international benchmarks, both for positioning and for program development purposes. The report provides an overview of SI-PASS implementation across 74 universities and one high school in eleven European countries. The data reveal substantial heterogeneity between institutions in terms of key implementation features, including the number of leaders, remuneration policies, number of targeted courses, and training duration. For instance, most Scandinavian institutions, as well as Belgian ones (*e.g.,* ULiège and Artevelde University of Applied Sciences, Ghent), compensate leaders financially, whereas British institutions more often rely on alternative forms of recognition. These figures offer a valuable comparative framework for situating the SI-PASS implementation at the University of Liège. Such benchmarking is explicitly mobilized in study 1 and further examined from a process perspective in study 5.

1.2. ULiège

1.2.1. SI-PASS

SI-PASS was first implemented at the University of Liège in 2019 within the Faculty of Bioengineering (Gembloux). Since then, the program has been extended to the Faculties of Applied Sciences, Psychology, and Sciences, each applying it to a single course identified as particularly challenging. Course selection is based on first-session failure rates, which implies that targeted courses may evolve over time. This has been the case in the Faculty of Psychology, as illustrated in the appendix 2 of study 1.

Once a course is selected, a call for applications is issued to recruit second- or third-year students as SI-PASS leaders. After completing administrative procedures, selected students attend a compulsory six-hour training session covering SI-PASS principles, facilitation techniques, and the boundaries of the role. Leaders are expected to organize one session following each lecture and to maintain this rhythm throughout the semester, typically resulting in twelve to thirteen sessions. While this pace is encouraged, some variability may occur due to contextual constraints (*e.g.,* health issues or scheduling conflicts). In addition, two voluntary "mini-cursus" sessions are organized each semester to provide ongoing supervision and support from SI-PASS coordinators. A compulsory mid-semester reflective activity is also implemented to reinforce role awareness and revisit key principles. At the end of each semester, both leaders and participants complete exit surveys designed to assess their experience and the perceived usefulness of the sessions (see Appendices 1a and 1b).

The SI-PASS leader position is a paid student job within the university. Funding is provided by the "Student Quality of Life" service, which oversees student support initiatives. General coordination is ensured by IFRES, with additional support from faculty-level contact persons responsible for logistical aspects such as course selection and leader recruitment. This dual coordination structure has proven effective in other ULiège support programs (Verpoorten et al., 2019). In two of the four participating faculties, leaders are also authorized to request room bookings through faculty administrative services and to have SI-PASS sessions integrated into student timetables.

A notable local observation concerns the stability of the program once implemented. In most faculties, the selected course remains unchanged across years, with the Faculty of Psychology being the only exception. It is also worth

noting that no faculty has withdrawn from the program since its introduction. However, none has expanded the scheme to additional courses. This contrasts with practices observed in some international institutions, where SI-PASS may be implemented across multiple courses or even at the level of entire first-year curricula.

1.2.2. PEPPS

Since its introduction in 2019, the PEPPS program has been implemented across several faculties at the University of Liège, including Architecture, Law, Medicine, Philosophy, Sciences, Social Sciences, and Veterinary Medicine. Developed locally at ULiège, PEPPS was designed to support first-year students during their transition from secondary education to university, a phase often characterized by uncertainty and adjustment challenges. The program offers peer-led sessions structured around key aspects of academic and social integration, providing a space where students can share concerns, strategies, and experiences with more advanced peers who have successfully completed their first year. These peers, referred to as “buddies”, receive a four-hour initial training session before being assigned to a group of students. Their role is to facilitate discussion rather than provide direct instruction, in line with the peer-support philosophy underlying the program.

The PEPPS framework is organized around five thematic sessions distributed across the semester:

- Perception: where students reflect on their initial impressions of university life.
- Establishment of a plan: which helps them develop effective strategies for notetaking and organization.
- Progress: where students assess their own development and mastery of the course materials.

- Preparation: which focuses on preparing for the exam session.
- Session: a reflective post-exam meeting aimed at reviewing their experience.

At the end of the academic year, both buddies (Appendices 2a and 2b) and participants (Appendices 3a and 3b) complete exit surveys evaluating their experience. In addition, buddies complete attendance lists after each session to monitor participation (Appendices 4a and 4b).

Similarly to SI-PASS, the buddy role is a paid student position within the university, although with a lower time allocation (15 hours compared to 32 hours for SI-PASS). Administrative and logistical aspects are organized in a comparable way. A major distinction, however, lies in the program's scope: unlike SI-PASS, PEPPS is a locally developed initiative and does not benefit from an international framework or benchmarking system. While this limits external comparability, it also offers greater flexibility, allowing the program to evolve more freely in response to local needs. Beyond this structural difference, the two programs diverge in their primary focus. SI-PASS targets academic performance within a specific high-risk course, whereas PEPPS adopts a broader approach, emphasizing transition support, skill development, and social integration.

1.2.3. Which one to choose?

Faculties did not uniformly adopt SI-PASS, and several opted for PEPPS instead, for a variety of structural and pedagogical reasons. One key factor relates to the difficulty of identifying a single "high-risk" course, which is a prerequisite for SI-PASS implementation. In some faculties, the diversity of curricula, the coexistence of multiple departments, or the presence of numerous specialization tracks made such identification challenging. Some

faculties, such as Sciences, initially implemented both programs on a limited scale but did not systematically evaluate their respective outcomes to inform strategic expansion or reconfiguration. Two additional cases illustrate different implementation trajectories. The Faculty of Law first introduced PEPPS and later complemented it with SI-PASS to target "bridge students". Conversely, the Faculty of Architecture approached a lecturer responsible for a high-risk course to introduce SI-PASS alongside an already existing PEPPS scheme. These configurations highlight an important, yet still underexplored, issue: the potential complementarity or competition between different student-support interventions (Verpoorten et al., 2019).

Overall, faculties' experiences with both programs appear sufficient to justify their continued implementation, yet insufficient to trigger significant expansion. With the exception of adjustments to targeted courses in Psychology, most faculties continue to operate a single program per semester, often maintaining the initial configuration. This relative stability can be explained by several reinforcing factors. First, both programs align closely with institutional priorities related to first-year academic integration, with additional benefits for social integration (Tinto, 1975). Second, the financial model reduces barriers to adoption, as leader compensation is centrally funded rather than borne by faculties. Third, the programs place minimal demands on teaching staff, although voluntary involvement has increased over time. Finally, central coordination by the Teaching & Learning Centre (IFRES) absorbs most of the organizational workload. Over time, these elements have contributed to the institutionalization of both programs, supported by consistently positive feedback from participants and leaders, including perceived learning gains. The international recognition of SI-PASS as a structured and certified model, combined with its framing as a "student-as-partner" initiative (Verpoorten, 2021), has further strengthened its legitimacy.

Interestingly, student perspectives can also play a direct role in program continuity. In the Faculty of Psychology, for instance, SI-PASS was maintained despite the absence of measurable performance effects in a randomized controlled trial (presented here as study 3 or Puttaert et al., 2025), as discontinuation was perceived as potentially detrimental to student satisfaction and engagement. This example illustrates the complexity of evaluating student-support programs, where perceived value and experiential benefits may weigh as heavily as measurable academic outcomes.

1.3. Synthesis

This chapter provides a comprehensive overview of peer-learning initiatives at the University of Liège, focusing on the structured implementation of SI-PASS and the institutionally developed PEPPS program. The SI-PASS model, originally developed by Deanna Martin in the 1970s to reduce attrition in high-risk courses (Martin & Arendale, 1992), emphasizes collaborative learning, student-to-student interaction, and structured peer facilitation. It is governed by a set of 21 international principles and four core leader techniques designed to promote autonomy, metacognition, and active learning without replacing formal instruction (European Centre for SI-PASS, 2018). At ULiège, SI-PASS is implemented selectively in faculties where a clearly identifiable high-risk course can be targeted, and its consistency is ensured through leader training, structured observation, and iterative feedback. By contrast, the PEPPS program addresses the broader transitional challenges faced by first-year students by fostering study skills, social integration, and reflective thinking across five structured sessions. While PEPPS does not benefit from the same level of international standardization or recognition as SI-PASS, its local adaptability and generalist orientation make it more accessible and easier to implement in faculties where course-based targeting is less feasible. Together, SI-PASS and PEPPS illustrate two complementary forms of peer-led support:

the former prioritizing academic performance within specific high-risk courses, and the latter emphasizing holistic student development and integration. Both initiatives are consistent with research highlighting the effectiveness of peer-supported learning environments (Topping, 2005; Dawson et al., 2014), and reflect institutional strategies aimed at enhancing student engagement, retention, and overall well-being during the early stages of university life. These distinctions provide the conceptual basis for the psychological and pedagogical analyses developed in the next chapter.

Chapter 2. Psychological and pedagogical approaches to peer-learning

Peer learning can be broadly defined as *"students learning with and from each other as fellow learners without any implied authority to any individual"* (Keerthirathne, 2020, p. 1), a definition consistent with earlier work on peer-assisted learning (Boud, 2001; Topping, 2005). This definition emphasizes two elements: learning and participants' equivalent status; and is broad enough to fit various types of peer-led programs. This definition is also based on the idea that "students learn a great deal by explaining their ideas to others and by participating in activities in which they can learn from their peers" (Boud, 2001, p. 9). Although often presented as a relatively new innovation, forms of peer-supported learning can be traced back to earlier education practices, where more advanced learners supported others in structured settings. For instance, letters of Seneca the younger mention that Aristotle would use Archons (from the Greek *archon*, ἄρχων, ruler), which can be loosely interpreted as a form of peer facilitation (Sturdivant & Souhan, 2011).

One of the earliest structured models of peer-based instruction was developed by Andrew Bell, a Scottish Anglican priest best known for his Madras System of Education (or Monitorial System). In 1787, Bell traveled to Madras and was appointed superintendent of an orphan asylum where he saw Malabar children teaching their peers the alphabet by drawing in the sand. From this observation, he decided to develop a similar method and designated more advanced children to lead the others (Bell, 1807). Topping (1988) explains that Bell's structured method required the predetermination of learning goals and the definition of the roles of tutors and tutees. The approach declined over time before re-emerging in various forms during the twentieth century (Eisen, 2000).

During the 1960s and the 1970s, two major approaches became particularly influential: collaborative and cooperative learning (Yang, 2023). Collaborative learning is commonly used as an umbrella term for multiple educational approaches to small-group, including problem-based learning, study groups, team-based learning, peer tutoring, etc. (Udvari-Solner, 2012). On the other hand, cooperative learning emphasizes interdependence among students, where each member is responsible for both their own learning and that of their peers, often through clearly defined roles and shared goals (Johnson & Johnson, 2009). Hence, the distinction between the two approaches led to confusion. Moreover, these terms were used interchangeably by some scholars, while others considered them as two ends of a continuum, and others made a clear distinction between the two terms (Barkley et al., 2014). These historical and conceptual distinctions provide the basis for examining the psychological foundations of peer-learning.

2.1. Psychological models

Educational psychology has long provided a robust theoretical foundation for understanding how students learn, interact, and grow within academic settings. These theoretical frameworks are especially relevant to initiatives such as peer-learning programs, which aim to create collaborative, student-centered environments conducive to academic and social development. The following analysis explores the contributions of key psychological currents (Behavioral Learning Theory, Cognitive Developmental Theory, Social Interdependence Theory, and Interpretive/Critical Theory) to the principles and implementation of peer-learning programs.

2.1.1. Behavioral learning theory

As advanced by behaviorist theorists such as Watson and Skinner, and later extended by related perspectives emphasizing modeling and cognitive

structuring (*e.g.* Bandura, Ausubel), this approach underscores the central role of reinforcement and modeling in shaping learning outcomes. Skinner's concept of positive reinforcement is particularly salient in peer-learning settings, where facilitators or group dynamics provide immediate and constructive feedback to participants, reinforcing desirable behaviors such as active engagement, persistence, and collaboration (Skinner, 1953). For instance, study 7 suggests that participation in SI-PASS is associated with higher lecture attendance. This aligns with studies showing that reinforcement increases motivation and engagement in learning environments (Loes, 2022).

Bandura's social cognitive theory extends behavioral perspectives by emphasizing modeling and self-efficacy (Bandura, 1977), where participants learn by observing peers, a practice central to many peer-learning initiatives. Research indicates that peer modeling enhances self-efficacy and academic persistence, particularly in challenging courses (Schunk & Zimmerman, 2007). In the present context, leaders and buddies of the two schemes are second- or third-year students. First-year students can therefore exchange with someone who was in their position not so long ago. The structured and incremental approach often adopted in peer-learning also reflects Ausubel's emphasis on meaningful learning and structured knowledge organization, making it easier for students to assimilate complex concepts (Ausubel, 1968; Novak, 2010). Here, each SI-PASS session is organized after a lecture, therefore closely following the learning process pace given by the lecturer. In PEPPS, all sessions are modeled to match in the best possible way the succession of elements that students are facing as the semester goes by.

Moreover, the emphasis on observable outcomes, a hallmark of behavioral approaches, resonates with the focus of peer-learning on tangible academic outcomes, such as improved understanding and retention rates (Roediger &

Butler, 2011), which is the aim of SI-PASS sessions and is measured in studies 1 and 3 of the present thesis. Through structured interventions and feedback loops, peer-learning ensures that students not only engage in productive behaviors but also recognize the causal links between their efforts and academic success (Anderson et al., 2000). The structured use of feedback and reinforcement within SI-PASS sessions can be interpreted through this lens, and the perceived benefits of students' participation are highlighted in studies 1, 3, and 7.

2.1.2. Cognitive developmental theory

As articulated by Bruner, Piaget, Flower, and Hayes, this theory provides insights into the construction of knowledge within peer-learning environments. Piaget's theory of assimilation and accommodation highlights how learners integrate new information into existing cognitive frameworks (Inhelder & Piaget, 1958; Piaget, 1952), a process that is central to interactions in peer-learning groups. For example, during group discussions, participants encounter perspectives that challenge their prior knowledge, prompting cognitive restructuring and deeper understanding (Vosniadou, 1994). This is the type of process that SI-PASS is designed to support. Bruner's work on discovery learning, and subsequent developments of scaffolding are related to the role of more experienced peers or facilitators, who provide just enough support to help participants move beyond their current level of competence without undermining their autonomy (Bruner, 1961). This scaffolding principle has been linked to higher order thinking skills and academic resilience (Van de Pol et al., 2010; Wood et al., 1976). When linked to peer-led schemes, this is what is expected of leaders and buddies: to frame the meetings to allow for interaction but not teach the group.

2.1.3. Sociocultural and interactionist perspectives

Drawing on authors such as Vygotsky, Bakhtin, Geertz, Doyle, and Erickson, this perspective offers a complementary framework for understanding the collaborative dynamics of peer-learning programs. Vygotsky's concept of the Zone of Proximal Development (ZPD) is particularly relevant, as it is defined as *"the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers"* (Vygotsky, 1978, p. 86). Peer-learning environments can be interpreted as operating within this zone, where group leaders facilitate discussions that push participants just beyond their current abilities. Furthermore, the work on recent course material leads to discussion about points that have not been fully understood by students, which supports the relevance of interpreting these interactions through the lens of the ZPD.

Bakhtin's theory of dialogism offers a useful retrospective lens through which to interpret why collaborative meaning-making may be particularly effective in peer-learning settings. SI-PASS relies on learners actively working through concepts together, testing interpretations, and refining understanding through collective reasoning; a process that aligns with Bakhtin's view that meaning emerges through interaction rather than passive reception. In his own words: *"The word in language is half someone else's. It becomes 'one's own' only when the speaker populates it with his own intention, his own accent, when he appropriates the word, adapting it to his own semantic and expressive intention."* (Bakhtin & Holquist, 1981, p. 293). In other words, learners are more likely to internalize knowledge when they actively engage with it, reshape it through their own perspective, and make it personally meaningful rather than simply absorbing information as it is presented. Besides, research shows that dialogic learning increases student engagement and conceptual

understanding (Mercer et al., 2004). Geertz's (1973) and Erickson's (1987) emphasis on the sociocultural context of learning can be related to the way peer-learning situates academic discussions within the broader social fabric of the educational community, helping participants build not only intellectual skills but also social capital. This approach aligns with evidence suggesting that peer interactions promote a sense of belonging and academic persistence (Thomas, 2012; Tinto, 1997). From a complementary perspective, Doyle's (1983) analysis of academic work highlights how the structure of classroom tasks shapes students' participation and engagement. In peer-learning contexts, the cooperative and interdependent organization of activities further supports the collective construction of knowledge, as each participant contributes to and benefits from the group process (Johnson & Johnson, 2009). By engaging in collaborative problem-solving, participants develop skills that extend beyond the academic domain, preparing them for future professional and interpersonal challenges.

2.1.4. Critical pedagogy

As articulated by Freire, Apple, and Kozol, this theory provides a lens for examining the emancipatory potential of peer-learning programs. Freire's concept of education as a process of liberation is pertinent, as peer-learning seeks to empower participants to take control of their learning journeys (Freire, 1970). Studies on critical pedagogy highlight the transformative potential of such approaches in encouraging agency and critical awareness among learners (Kincheloe, 2004; McLaren, 2015). By positioning participants as active agents in their education, rather than passive recipients, peer-learning embodies the principles of critical pedagogy. Apple's critique of traditional education systems highlights the role of peer-learning in challenging hierarchical structures, as these programs promote a horizontal relationship between facilitators and participants (Apple, 1979). Kozol's critique of

educational inequalities in general education can be paralleled to peer-learning's commitment to creating inclusive spaces where all voices are heard, and diverse perspectives are valued (Kozol, 2012). Experts' discussions on the topic and research confirm that student-centered learning environments enhance engagement and equity in education (Barr & Tagg, 1995; Hooks, 2014). Through these critical pedagogical practices, peer-learning is likely to contribute not only to academic engagement but also to a sense of agency and belonging among participants, contributing to their overall development as individuals and members of a learning community.

2.1.5. Student-as-partner

A more recent conceptual development, the student-as-partner (SaP) approach, provides a conceptual lens through which peer-learning initiatives can be interpreted. This approach conceptualizes students not merely as passive recipients of knowledge or occasional contributors, but as co-creators of the educational experience. In the context of peer-learning, it offers a broader pedagogical and philosophical framework that recognizes the legitimacy of students' voices and experiences in shaping teaching and learning processes (Cook-Sather et al., 2014; Healey et al., 2016). Although SI-PASS does not fully embody this formal co-design-with-teachers model (course instructors generally remain relatively peripheral to the program), some dimensions resonate with the partnership ethos in a broader institutional sense. In this broader perspective, where partnership extends beyond direct teacher-student co-design, SI-PASS leaders collaborate with the central Teaching & Learning Center (IFRES) through training, structured supervision, and iterative program adjustments. They contribute to the refinement of the scheme by sharing insights from their sessions, helping coordinators adjust training needs, and informing small-scale program improvements. Such involvement aligns with SaP principles that value student expertise and recognize students as legitimate

contributors to institutional learning processes (Mercer-Mapstone et al., 2017). It is important, however, to distinguish this from the forms of collaboration observed between students during SI-PASS sessions. While these interactions promote mutual support and co-construction of understanding, they do not constitute SaP in the strict sense of partnership between students and academic staff (Felten et al., 2013). Rather, peer collaboration operates at the level of learning interactions, complementing the partnership dynamics observed at the program level. Taken together, these complementary layers support students' sense of agency and belonging and contribute to a learning culture in which students are positioned as active participants in shaping their educational experience (Cook-Sather & Luz, 2015).

2.2. Pedagogical approaches

2.2.1. Skills development

Skills development is a central objective of higher education, equipping students with competencies necessary for academic success and future professional endeavors. Peer-led programs have emerged as effective platforms for encouraging these skills. For instance, Preszler (2009) found that replacing traditional lectures with peer-led workshops in an introductory biology course not only enhanced student engagement but also improved learning outcomes. These workshops provided students with opportunities to collaboratively solve problems, thereby reinforcing their understanding of the material and promoting the development of critical thinking and communication skills. Similarly, Riser et al. (2021) reported that peer leaders experienced gains in content knowledge, academic success, and career readiness, highlighting the reciprocal benefits of peer-led initiatives. By engaging in peer-led programs, leaders tend to deepen their grasp of subject matter while also cultivating transferable skills such as leadership, teamwork, and effective communication, which are highly relevant across academic and

professional contexts. Further discussion of skill development among leaders can be found in study 6.

2.2.2. Pedagogical dynamics

Peer-led programs aim to promote deep learning by encouraging active engagement, critical thinking, and collaborative problem-solving, rather than superficial strategies oriented toward exam survival. Yet the evidence is mixed. Some researchers have warned that peer tutors may, often unintentionally, reinforce strategic or exam-driven approaches instead of deeper conceptual engagement. Ashwin (2003a), for instance, suggested in his mixed-method study at a British university that students involved in PAL often orient their participation toward assessment demands, adapting their learning behaviour strategically rather than conceptually. This concern is echoed by studies highlighting that students' perceptions of effective learning strategies in higher education are strongly tied to exam efficiency rather than deep learning mechanisms (Elen & Lowyck, 1998).

Other authors, however, argue that this shift can be mitigated through structured tutor training that emphasizes facilitation strategies aligned with meaningful learning principles, rather than content transmission. At the same time, students' learning choices are often shaped by their goals and perceived task demands. Anastasakis et al. (2017), for instance, focus on students' general choice of educational resources in undergraduate mathematics; which, like Elen and Lowyck (1998), points to a broader pattern of exam-driven metacognitive preferences rather than a phenomenon limited to peer learning itself. On a more positive note, evidence from medical education suggests that peer-assisted learning can yield gains beyond exam performance. Rees et al.'s (2016) meta-analysis, for example, found that PAL improves clinical

knowledge and skills when compared to traditional teacher-led passive learning.

2.2.3. Time on task

A frequently discussed, and sometimes competing, explanation for the positive outcomes often associated with peer-led learning is the additional time students spend engaging with course content. Kenney and Kallison (1994) propose that SI-PASS participants benefit at least partly from increased exposure to the material, which might explain their improved outcomes: *"Perhaps students in the SI group earned higher grades because the group participation systematically exposed them to the course material more rather than because they experienced the benefits of a program that combined appropriate study skills with course content*." (p. 77). This suggests that part of the observed effectiveness of peer-led programs may be linked to structured opportunities to revisit, apply, and discuss course content beyond regular class hours. By engaging in repeated interactions with material in an interactive setting, students are likely to develop stronger conceptual understanding, which may contribute to academic success. Additionally, working with a peer tutor may help students recognize the importance of dedicated study time for academic achievement. Burmeister et al. (1996) emphasize that leaders often convey the importance of substantial time investment required to succeed in mathematics, a reality that first-year students may often overlook.

2.2.4. Reciprocal teaching

Reciprocal teaching offers a useful conceptual backdrop for understanding certain pedagogical dynamics observed in peer-led programs. As a well-established instructional approach, it involves students alternately adopting the roles of summarizer, questioner, clarifier, and predictor during collaborative reading activities; which helps them develop essential comprehension and

metacognitive skills (Palincsar & Brown, 1984). This method not only strengthens understanding but also improves self-regulation and critical thinking as students actively participate in the learning process (Rosenshine & Meister, 1994). Research indicates that reciprocal teaching enhances both cognitive skills and engagement, particularly in domains requiring higher-order reasoning (Carter, 1997; Hattie, 2008). By encouraging collaborative learning and shared responsibility, reciprocal teaching offers a structured way to engage with complex material, further illustrating the potential of peer-led initiatives to support academic engagement.

2.3. Synthesis

By integrating principles from these diverse psychological currents, peer-learning programs exemplify a holistic approach to education that addresses both academic and socio-emotional needs. Behavioral approaches (Skinner, 1953), complemented by social cognitive perspectives (Bandura, 1977), provide a foundation for structuring and reinforcing productive behaviors, while Cognitive Developmental Theory highlights the importance of scaffolding and iterative knowledge construction (Bruner, 1961; Piaget, 1952). Sociocultural perspectives emphasize the value of collaborative learning and cultural context (Mercer et al., 2004; Vygotsky, 1978), and critical pedagogical perspectives challenge traditional power dynamics, empowering participants to take ownership of their education (Freire, 1970; McLaren, 2015). Together, these theoretical frameworks illuminate the multifaceted nature of learning and underscore the potential of peer-learning to contribute to shaping educational experiences in meaningful ways. The student-as-partner approach further integrates pedagogical, organizational, and community dimensions by recognizing experienced students as active contributors to the success of newcomers.

From a pedagogical perspective, peer-led programs complement psychological theories by offering concrete mechanisms for student development. They promote essential academic and transferable skills such as critical thinking, communication, and leadership (Preszler, 2009; Riser et al., 2021). Peer-led sessions also increase time on task, giving students additional opportunities to engage with course content in structured yet flexible ways (Kenney & Kallison, 1994). These environments help make explicit the level of effort and persistence required to succeed in higher education, especially for newcomers (Burmeister et al., 1996). Moreover, approaches such as reciprocal teaching illustrate similar principles by encouraging learners to alternate between roles, thereby promoting autonomy and metacognition (Hattie, 2008; Palincsar & Brown, 1984). Altogether, these pedagogical approaches reinforce the idea that peer-learning extends beyond academic support: it is a participatory model that empowers students, strengthens engagement, and supports the holistic development of learners within inclusive, student-centred communities.

Chapter 3. Student transitions and institutional support

3.1. Student transition

The shift from secondary school to higher education represents a significant period of change and adaptation for students. According to De Clercq (2017), this transition can be characterized as a period of instability and disruption, often requiring students to develop new skills, roles, and daily routines to adjust to their academic environment. Zittoun (2008, 2009) emphasizes that the transition is not just a shift in educational settings but a profound life change where students experience a rupture in their familiar paths, which necessitates major adjustments in attitudes and behaviors. This transition process is sometimes referred to as a "transition shock" (Jenert et al., 2017, p. 88), as students encounter an array of new challenges, including social separation from high school peers, a more impersonal educational environment, and a need for increased independence and self-regulation. This academic transition period, therefore, is a critical phase during which students gradually adapt, with implications for both academic success and personal development (De Clercq, 2017).

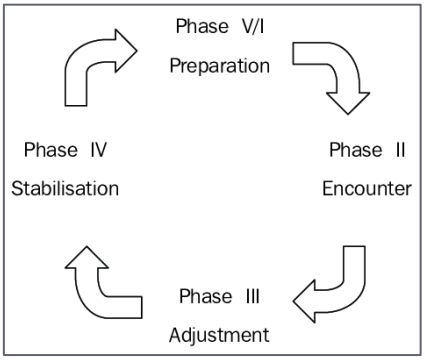
3.1.1. Nicholson's transition cycle

Nicholson's transition cycle (Nicholson & West, 1988) provides a well-established framework for understanding the psychological adjustments students undergo when transitioning from secondary school to higher education (Figure 1). It is marked by shifts in academic expectations, social environments, and levels of independence, making it a critical period of adjustment.

1. Preparation: Students form expectations about university life based on prior experiences, institutional communication, and peer information. They may engage in activities such as orientation programs or discussions with former students to mentally prepare for the transition.
2. Encounter: Upon arrival at university, students confront the reality of academic and social life, which may not fully align with their initial expectations. They may experience "transition shock"**,** particularly in adapting to independent learning, new assessment methods, and managing workload. This stage can be marked by feelings of anxiety, uncertainty, or excitement.
3. Adjustment: As students progress, they begin adapting to their new academic environment by developing effective study habits, forming peer support networks, and engaging in extracurricular activities. Institutional support, such as peer-led learning programs (*e.g.,* PEPPS and SI-PASS) and mentorship, can play an important role in helping students navigate this stage (Tinto, 1993).
4. Stabilization: Many students reach a point of relative equilibrium where they feel confident in their academic abilities and social integration. They establish routines, become more autonomous learners, and develop a clearer sense of their academic and career goals.

Nicholson and West (1988) highlight that transitions are cyclical and cumulative, meaning that a successful adaptation in one phase positively impacts future transitions, such as moving from undergraduate to postgraduate studies or entering the workforce. Understanding this cycle can inform the design of institutional support systems to facilitate student success, such as the peer-led programs currently implemented at ULiège and other institutions.

Figure 1 - Nicholson's transition cycle (1988). Implemented on several months, both programs can hit the four phases.



3.1.2. Dropout

The challenges associated with this transition contribute to relatively high dropout rates, as academic demands can overwhelm students who may be insufficiently prepared for the sudden increase in academic responsibility and self-directed learning. According to Yorke and Longden (2004), dropout rates are often linked to students' insufficiently informed choices about their academic programs and to mismatched expectations. For some students, the pedagogical methods or cognitive demands may exceed their current level of preparation, while others struggle with large class sizes and the limited availability of faculty support outside of formal class hours. External factors, such as financial burdens, long commutes, or family obligations, further compound the risk of dropout (Sauvé et al., 2006). Dropout is therefore shaped by the interaction of personal, academic, and environmental factors, highlighting the complexity of student retention and the need for supportive institutional structures.

3.1.3. The role of teaching quality

High-quality teaching plays an important role in easing the transition and improving retention rates. Effective teaching strategies, which bridge theory and practice and emphasize student understanding, help students engage more

deeply and feel connected to the academic environment (Romainville & Michaut, 2012). According to Lizzio et al. (2002), one of the strongest predictors of student success is the quality of teaching, with supportive instruction encouraging a deep approach to learning that is essential for academic progress. Institutions that prioritize a "learner-centered" approach can provide diverse learning opportunities and resources, such as supplemental instruction, peer tutoring, and faculty mentorship, to aid student engagement and success. When faculty are accessible and provide structured yet flexible learning opportunities, students are better equipped to develop the skills and resilience needed for higher education, underscoring the importance of teaching in academic transitions (De Clercq et al., 2015).

3.1.4. Social integration

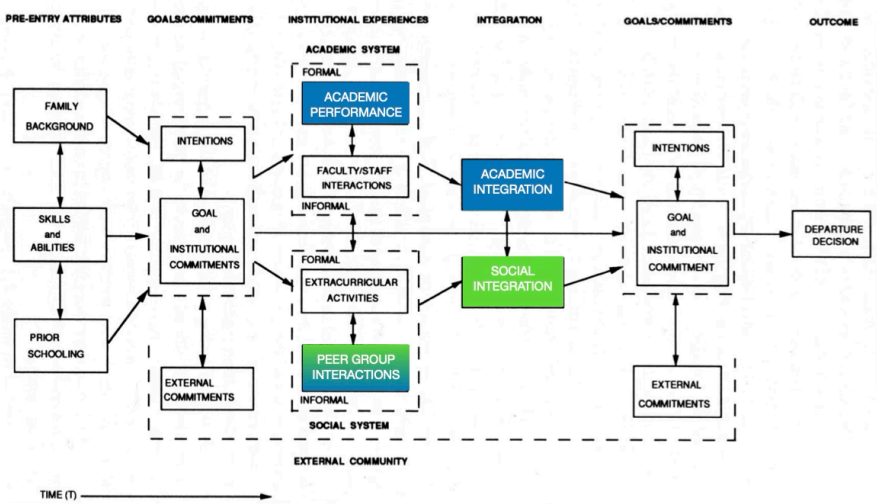
Social integration is a key factor in student success, particularly during the transition to higher education, where it aids in building a sense of belonging and academic motivation. According to De Clercq (2017), the shift from secondary education often disrupts familiar social networks, requiring students to construct new support systems within the university environment. This process of social integration is linked to stronger retention rates and academic engagement, as students who successfully establish social connections tend to experience less isolation and greater academic satisfaction (Tinto, 1997). The formation of peer networks and positive relationships with faculty offers both emotional and academic support, creating a collaborative environment where students feel better equipped to address academic challenges (Jenert et al., 2017). This need for social connection is particularly pronounced in large, often impersonal lecture settings where students may otherwise feel anonymous. As such, institutional programs that support early social integration can have a significant impact on students' well-being, ultimately

contributing to a more inclusive and supportive academic experience (Noël & Parmentier, 1998). The PEPPS program represents one such initiative.

Tinto's Student Integration Model (1975, 1993) is one of the most widely recognized frameworks for understanding student persistence and retention in higher education (Figure 2). The model emphasizes that a student's decision to stay or leave university is influenced by their academic and social integration into the institution. Academic integration refers to a student's ability to adapt to the intellectual and structural demands of university life. This includes their academic performance (grades, coursework, engagement with lectures) and their sense of belonging within the academic community (interactions with faculty, participation in study groups, and involvement in academic activities). Tinto (1993) argued that students who feel academically supported and engaged are more likely to persist in their studies. Peer-led learning programs, such as SI-PASS or study groups, play a key role in encouraging academic integration by providing structured opportunities for students to interact with course material and develop collaborative learning skills. Social integration refers to a student's involvement in the social aspects of university life, including forming friendships, participating in extracurricular activities, and engaging in student organizations. A lack of social integration can lead to feelings of isolation, which increases the likelihood of dropout (Thomas, 2002). Tinto (1975) emphasized that peer networks and mentoring relationships significantly contribute to student persistence. For instance, students who engage in university societies, residence hall activities, or peer mentorship programs are more likely to feel connected and committed to their institution. SI-PASS and PEPPS are perceived by students (studies 1, 2 and 7) to facilitate socialization.

Tinto's model also highlights that a student's personal motivation and institutional commitment play a central role in their decision to persist. Students with clear academic and career goals are more likely to remain enrolled, especially if they perceive that their institution aligns with their aspirations. Institutional support (such as career counseling, faculty mentorship, and student advising) can strengthen a student's commitment to both their educational goals and their university (Yorke & Longden, 2004). Tinto also stressed that academic and social integration are interdependent: students who experience difficulties in one area are likely to struggle in the other. For example, a student who feels socially isolated may become disengaged from coursework, while a student struggling academically may withdraw from social activities due to stress. Universities that create holistic support systems, combining academic mentoring with social engagement opportunities, are more likely to retain students. This is precisely the synergy offered by SI-PASS and PEPPS, albeit with different emphases: SI-PASS primarily supports academic integration with secondary benefits for social integration, whereas PEPPS adopts the opposite balance.

Figure 2 - Tinto's student integration model (1975, 1993). ULiège programs' specificities are color coded (SI-PASS in blue and PEPPS in green).



3.2. Forms of academic support

3.2.1. Online support

During the COVID-19 pandemic, higher education institutions worldwide rapidly transitioned to virtual learning environments to maintain instructional continuity amid widespread school closures (Dhawan, 2020). This shift necessitated the adoption of various digital platforms and tools to facilitate remote education (Adedoyin & Soykan, 2020). Universities implemented online learning support services, including virtual tutoring, online workshops, and digital resources, to aid students in virtual or blended learning environments (García-Peñalvo et al., 2021). These services were designed to enhance remote learning and ensure that students continued to receive quality education despite the challenges posed by the pandemic (Hodges et al., 2020). Research has also emphasized the importance of digital literacy and robust online learning infrastructures in addressing the diverse needs of students (Flores et al., 2021). The pandemic accelerated the integration of online learning into mainstream education, underscoring the necessity of institutional preparedness for future disruptions. Additionally, online support services are accessible to a broader student population, providing flexible learning options and facilitating inclusivity for non-traditional students or those balancing work and study commitments (Allen & Seaman, 2013).

One might, however, question the compatibility of online tutoring with the intrinsically interactive nature of peer-led learning. Malm et al. (2022b) reported several case studies of universities that switched to online meetings during the pandemic. The main struggle was to maintain and monitor students' engagement during this time, but findings suggest that these online sessions were generally well received by students who were otherwise largely isolated from in-person interaction. This finding highlights the social aspect of peer-led meetings and therefore calls for caution regarding the overuse of online

meetings. While the pandemic context undeniably transformed the delivery and perception of peer-led learning, a detailed examination of its long-term implications on program efficacy and student engagement would require a dedicated investigation. As such, the present dissertation does not aim to assess the impact of COVID-19 on peer learning, as this would extend beyond the scope of the present work and could merit a separate study.

3.2.2. Academic workshops

Academic workshops and skill-building programs offer students with targeted instruction in essential academic skills, such as time management, exam preparation, note-taking, and critical thinking. These programs are typically organized by university learning centers or academic success offices and are designed to address specific skills that support student learning and productivity (Pintrich, 2004). Workshops allow students to learn strategies to improve study habits and performance, helping them develop a proactive approach to learning. Research suggests that skill-building programs can increase students' motivation and performance by promoting effective learning strategies and self-regulation (Zimmerman, 2002). These workshops appear particularly beneficial for first-year students, who may be unaccustomed to the demands of higher education.

3.2.3. First-year seminars

First-year seminars contribute to students' transition into higher education by combining academic, social, and institutional forms of support. The literature consistently indicates that these seminars can strengthen academic skills, promote a sense of belonging, and improve retention, notably through the development of competencies including critical thinking, time management, and effective study strategies (Permzadian & Credé, 2016). Participation in such seminars has also been associated with higher first-year grade point

averages and an increased likelihood of persistence into the second year (Schnell & Doetkott, 2003). Beyond these academic effects, first-year seminars provide structured opportunities for students to engage with faculty and peers, thereby reinforcing their connection to the institution and creating a supportive learning environment (Keup et al., 2011; Young & Hopp, 2014).

At ULiège, this type of support is no longer limited to the international literature and constitutes a concrete institutional reality. In particular, the Faculty of Social Sciences now offers first-year seminars as small-group courses designed to support students' adaptation to university life, help them develop early academic skills, create social ties, and discover themes related to their field through non-traditional pedagogical approaches (ULiège, Faculté des Sciences Sociales, 2025). In 2025, the program was organized around four seminars, each comprising five 90-minute sessions in groups of approximately 20 to 25 students. This local development is particularly relevant to the present dissertation because it illustrates the diversification of first-year support at ULiège and shows that institutions may complement peer-learning schemes such as SI-PASS or PEPPS with more faculty-led transition formats. These seminars therefore occupy an intermediate position between academic support, social integration, and institutional acculturation, and should be considered part of the broader ecosystem of first-year support measures.

3.2.4. Teacher (faculty) mentoring

Teacher or faculty mentoring is another important form of academic support that contributes significantly to student retention, integration, and academic performance, particularly during the transition into higher education (Campbell & Campbell, 1997). Faculty mentors offer guidance that extends beyond subject content by providing academic coaching, emotional support, and orientation within the institutional environment (Campbell & Campbell,

1997). Research has shown that students who establish meaningful mentoring relationships with faculty report higher levels of academic engagement, motivation, and satisfaction (Komarraju et al., 2010). These relationships can also promote a stronger sense of belonging and institutional commitment, both of which are critical predictors of student persistence (Tinto, 1993). Effective mentoring helps students develop confidence in their academic abilities, navigate institutional expectations, and cultivate professional and personal growth (Crisp & Cruz, 2009). Moreover, teacher mentoring is particularly effective for underrepresented or first-generation college students, who may lack informal access to institutional knowledge and support networks (Schwartz et al., 2016). Furthermore, ULiège is, to our knowledge, the only university of the Wallonia-Brussels Federation that has implemented faculty mentoring (Huart et al., 2023).

3.3. Various forms of peer-led programs

Topping (2005) identifies thirteen organisational dimensions along which peer-learning initiatives can differ, including the type of curriculum content addressed (1), the size and configuration of helper-learner groups (2), whether peers come from the same or different institutions (3) or years of study (4), their relative ability levels (5), the stability of their roles (6), as well as the time (7) and place (8) in which support occurs. He also notes that peer-learning schemes may vary in the characteristics of helpers (9) and recipients (10), in their intended outcomes (cognitive, social, emotional, or institutional) (11), in whether participation is voluntary or compulsory (12), and in the type of reinforcement provided (13). Together, these dimensions illustrate that peer-learning programs are not fixed templates, but rather flexible organisational constructs. Their configuration can shift across contexts and evolve over time. In this sense, the dimensions provide a conceptual framework for

understanding both the diversity of peer-led models and the structural commonalities that link them despite local variability.

3.3.1. Peer-mentoring programs

Peer mentoring programs pair experienced students, often in later years of study, with incoming students to provide guidance on both academic and social aspects of university life. Unlike peer tutoring, which focuses on specific academic support, peer mentoring addresses broader areas of transition and adjustment to university, such as time management, study techniques, and navigating campus resources (Terrion & Leonard, 2007). Research suggests that peer mentoring can enhance retention and academic success by helping new students acclimate to the demands of higher education and build a sense of belonging within their academic community (Fox et al., 2010). This holistic support is particularly valuable in the first year, a critical period for student persistence and well-being (Jacobi, 1991). This approach emphasizes long-term psychosocial and academic support over the course of a semester or year, often through one-to-one or small group relationships with a focus on integration and belonging rather than content mastery. In this respect, peer mentoring programs are conceptually close to the PEPPS program developed at ULiège in terms of approach and focus.

3.3.2. Buddy programs

Buddy programs are peer-support initiatives in which experienced students, often in the same faculty or academic discipline, are paired with incoming students. This model was initially developed for international or Erasmus students to provide informal guidance during their transition into university life. These programs typically focus on non-academic support such as navigating campus life, understanding institutional procedures, and building early social connections. For example, the International Buddy Program at the

University of Minnesota pairs incoming international students with returning students to ease their transition to life at the university (University of Minnesota, 2025). Research has shown that such programs help reduce feelings of isolation, promote a sense of belonging, and positively influence students' emotional well-being during their early university experience (Beltman & Schaeben, 2012; Colvin & Ashman, 2010). Unlike formal mentoring structures, buddy programs are typically short-term, voluntary, and less hierarchical, offering a more relaxed and student-driven approach to peer support (Lindblom-Ylänne et al., 2006). Although buddy programs share conceptual ground with mentoring, they are best understood as a relatively low-intensity form of peer mentoring; a subcategory situated at the informal end of the mentoring spectrum, where emphasis is placed on practical orientation and social acclimatisation rather than long-term developmental guidance. Their flexible and low-pressure format makes them particularly effective at easing the social transition into higher education, especially for first-year students unfamiliar with university expectations and culture. In this broader sense, the PEPPS program at the University of Liège can be understood as building on this logic.

3.3.3. Learning communities

Learning communities are a form of peer-learning in which students are grouped within the same academic program or interest area to take shared courses and participate in collaborative study activities. Unlike other peer-learning models, learning communities focus on creating a cohesive peer group that extends beyond a single course or session, often including co-curricular or residential components (Tinto, 2000). This integrated approach helps students form supportive networks, promotes a sense of belonging, and encourages active learning and engagement. Research suggests that learning communities can enhance retention, academic success, and overall student satisfaction by

providing an inclusive environment that promotes mutual support and persistence (Zhao & Kuh, 2004). Learning communities therefore emphasize cohort-wide integration and long-term social and academic support, rather than temporary academic assistance tied to a specific subject.

3.3.4. Reciprocal peer tutoring (RPT)

Reciprocal peer tutoring (RPT) is a structured instructional model in which students regularly alternate roles as tutor and tutee within the same session or across successive sessions (Bailey et al., 2018). These role reversals typically occur at predefined intervals (such as every 10-20 minutes during collaborative exercises), or at the end of each task segment, ensuring that each student experiences both the responsibility of explaining content and the opportunity to receive guidance. RPT is most often implemented in dyads (one-to-one), a format that maximises accountability and minimises the risk of peripheral participation, although small groups of three or four students are also used in some settings. The alternation of roles is deliberate and systematic: students tutor one another using worked examples, problem-solving steps, or concept explanations provided by the instructor, and then switch roles to complete new items or apply the same procedure from another angle. This approach is grounded in the idea that teaching is a powerful learning tool; students gain a deeper understanding of the material as they explain it to others (Fantuzzo et al., 1989).

Studies suggest that RPT provides a collaborative learning environment where students not only improve their academic knowledge but also develop critical social and communication skills (Griffin & Griffin, 1998). RPT is particularly effective in improving performance and motivation in subjects that benefit from repeated practice and problem-solving, such as mathematics and science (Fantuzzo et al., 1989). This approach is distinctive in that it blurs the tutor-

tutee distinction, encouraging equal participation and mutual responsibility for learning across peers.

3.3.5. Peer-led team learning (PLTL)

Peer-Led Team Learning (PLTL) is a structured instructional model in which small groups of students work collaboratively on problem-solving activities under the guidance of a trained peer leader. Although the facilitation role resembles that of SI-PASS (promoting discussion, questioning, and collective reasoning), the key distinction lies in the program's institutional integration. PLTL sessions are not merely supplemental or voluntary add-ons: they are embedded within the curriculum as mandatory components linked to course requirements. Originally developed for chemistry courses, PLTL has been shown to improve both cognitive and affective outcomes by creating a learning environment where students actively engage in solving complex problems collaboratively (Tien et al., 2002). Research suggests that PLTL leads to significant gains in understanding and retention, especially in STEM courses, by promoting critical thinking, teamwork, and self-efficacy (Hockings, 2009). PLTL emphasizes peer-to-peer interaction, supporting students in developing skills essential for success in both academic and professional settings (Gosser, 2001). In this sense, PLTL differs from SI-PASS not in pedagogical intent but in its curricular positioning, functioning as an integrated component of the course rather than an optional parallel support.

3.3.6. Supplemental instruction (SI)

Supplemental Instruction (SI) is a widely used peer-learning model designed to support students in challenging courses by offering sessions led by trained student facilitators, often called SI leaders. These leaders, typically former students who excelled in the same course, hold regular study sessions where they help current students review and consolidate their understanding of the

material through collaborative exercises (Arendale, 1994). Research by Dawson et al. (2014) suggests that SI is effective in improving academic performance and retention by promoting active engagement and developing study skills. Sessions emphasize strategies like self-monitoring and active learning techniques, including problem-solving, summarizing, and clarifying difficult concepts. SI's structured, collaborative approach has been found to reduce failure rates significantly, especially in introductory courses (Dawson et al., 2014). SI can be described as a course-attached, content-driven model built around high-risk courses, with a well-established methodology and a focus on academic performance.

3.3.7. Peer-assisted study sessions (PASS)

Peer-Assisted Study Sessions (PASS) are functionally equivalent to Supplemental Instruction (SI), as both consist of structured, peer-led group sessions focused on collaboratively revisiting course material, practising problem-solving, and developing effective study strategies under the guidance of an experienced student. Much like SI leaders, PASS leaders facilitate discussion rather than deliver content, promoting a participatory learning environment where students can articulate difficulties, test understanding, and learn from peers. Research suggests that PASS improves academic performance and reduces failure rates, particularly in high-demand courses (Malm et al., 2012). PASS sessions have been shown to support a collaborative learning environment, where students benefit from peer-led discussions that promote critical thinking and problem-solving skills (Boud et al., 2014). PASS has been associated with positive outcomes, including improved confidence, academic resilience, and social connectedness (Dawson et al., 2014).

In practice, however, the distinction between SI and PASS varies considerably across institutions. Internationally, the two terms are often used

interchangeably because their pedagogical foundations, facilitation methods, and target populations are largely comparable. Some universities, such as the University of North Florida (2025), have articulated local differences (*e.g.*, attendance policy, grading integration, session frequency), but these distinctions reflect institutional choices rather than theoretical or structural divergences. They should therefore not be generalised to the global PASS/SI literature.

Given this variability, SI and PASS are best understood as part of the same family of structured peer-led academic support, one subcategory within the broader umbrella of peer-learning initiatives. Their shared characteristics include a focus on specific high-risk courses, the use of trained near-peer facilitators, regularly scheduled sessions aligned with lecture pacing, and a strong emphasis on collaborative meaning-making rather than direct instruction. In contrast to other peer-learning approaches (*e.g.*, mentoring, buddy programs), SI and PASS can be considered co-curricular, in the sense that they sit alongside (but not inside) the formal curriculum: they support academic success in a specific course without being a mandatory or credited component of that course. Other peer-support initiatives that do not engage directly with course content (*e.g.,* buddy programs, general mentoring) fit more naturally into extra-curricular categories (Lochtie et al., 2024).

Because the SI/PASS boundary is more historical than conceptual, and because terminology varies significantly across countries and institutions, the literature increasingly treats SI and PASS as pedagogically equivalent within the structured peer-learning spectrum. This terminological convergence reinforces the value of analysing them jointly as a coherent subcategory of peer-led learning.

The diversity of peer-led programs reviewed in this section illustrates the extent to which peer learning cannot be reduced to a single model. To clarify these distinctions, Table 1 summarizes the main characteristics of the peer-led models discussed above. It should not be read as a rigid classification, since local implementations often vary across institutions, but rather as a synthetic framework for positioning SI-PASS and PEPPS within the broader landscape of peer-learning initiatives.

Table 1 - Comparison of all peer-led programs.

Program	Structure	Focus	Training Required	Assessment and Oversight
Peer Mentoring	One-on-one or small groups; experienced student guides newcomers	Academic and social integration	Yes, varies by program	Moderate, often informal
Buddy Programs	Experienced student paired with newcomer; informal support	Social adjustment and emotional support	Minimal, institution-specific	Low, informal feedback
Learning Communities	Students grouped by program or interest; shared courses	Social support and academic integration	Not typically required	Low to moderate
Reciprocal Peer Tutoring (RPT)	Students alternate roles as tutor and tutee	Mutual learning, active engagement	Usually, no formal training	Low to moderate, depending on setting
Peer-Led Team Learning (PLTL)	Small groups led by trained peer leader; subject-focused	Critical thinking and problem-solving in STEM	Yes, structured peer leader training	High, with regular supervision
Supplemental Instruction (SI)	Regular group sessions led by trained SI leaders; course-attached	Academic improvement and collaborative study	Yes, certified SI training required	High, formal observation and feedback
Peer-Assisted Study Sessions (PASS)	Structured sessions led by trained student peers; course-attached	Collaborative learning, study strategies, and academic support	Yes, peer leader training	Moderate to high, depending on institution

3.4. Synthesis

As shown throughout this chapter, the transition to higher education is not merely academic; it is a multidimensional process that shapes students' trajectories. Models such as Nicholson's transition cycle (Nicholson & West, 1988) and Tinto's student integration framework (Tinto, 1993) provide key analytical lenses through which to understand the personal and institutional factors that shape student adjustment and retention. These transitions are most effectively navigated when students are supported both academically and socially, reinforcing the need for holistic support structures within universities (Yorke & Longden, 2004). Peer-led initiatives such as SI-PASS and PEPPS at ULiège aim to address these challenges: while SI-PASS targets academic integration by reinforcing course content through collaborative learning and guided peer support (Dawson et al., 2014), PEPPS places stronger emphasis on social integration and skill-building, helping students form peer networks and develop autonomy. Together, these programs exemplify a complementary approach to institutional support, addressing the dual challenge of academic success and student belonging at a critical point in students' educational trajectories.

Section 2 : Experimental Part

Objectives and Methods Summary

The second section of this dissertation comprises seven independent studies, each examining one or several aspects of the two peer-led schemes implemented at the University of Liège. The overall methodological architecture is grounded in mixed-method, multimodal, and longitudinal designs, providing both breadth and depth in the analysis of peer-led learning programs. The methodological choices were guided by the multifaceted nature of peer-led academic support and by the practical constraints inherent to higher education research contexts. Approaches ranging from experimental designs to qualitative and mixed methods were selected in alignment with the specific objectives of each study. This methodological framework is consistent with calls in the literature for more triangulated, multi-faculty, and evidence-based evaluations of peer-led schemes (Järvelä et al., 2021; Malm et al., 2024).

1. **A three-year multi-faculty evaluation of 16 SI-PASS schemes - Attendance thresholds, performance gains and standardised metrics** *(Accepted in the Journal of Peer Learning, April 2026)*

Research Question: What do participation, performance, perception, and cost indicators reveal about the implementation and effects of SI-PASS across faculties over time?

This longitudinal mixed-method study examines SI-PASS through four complementary dimensions: participation, perception, performance, and cost. Participation was documented through attendance records and exit surveys; perception was analysed through qualitative responses and chi-square analyses; performance was examined using exam scores and t-tests; and cost was estimated from institutional financial data. By combining these indicators

across four faculties and three academic years, the study provides a multi-dimensional account of how SI-PASS was implemented and what effects were associated with participation. Its main specificity lies in the possibility of situating the ULiège implementation within a broader comparative frame through standardized European metrics reported by Malm et al. (2024). This benchmarking strengthens the interpretation of local participation, performance, and implementation patterns while keeping the analysis compatible with the constraints of a naturalistic university setting.

2. A longitudinal examination of PEPPS scheme - Participation, perception, and performance over three years in a Belgian university

Research Question: What do participation, performance, perception, and cost indicators reveal about the implementation and effects of PEPPS across faculties over time?

This longitudinal mixed-method study examines PEPPS through the same four complementary dimensions used in study 1: participation, perception, performance, and cost. Participation was documented through attendance records completed by buddies and exit surveys; perception was analysed through qualitative responses and chi-square analyses; performance was examined using exam scores and t-tests; and cost was estimated from institutional financial data. This parallel structure allows PEPPS to be compared with SI-PASS while respecting its distinct program logic. Unlike SI-PASS, PEPPS is a locally developed scheme primarily oriented toward first-year transition, social integration, and student engagement rather than course-specific academic mastery. In the absence of an external benchmark comparable to the European SI-PASS indicators, the study provides an institutional baseline for understanding PEPPS at ULiège and situates it within

the broader literature on peer mentoring and first-year support schemes (Terrion & Leonard, 2007).

3. **Effects of SI-PASS on a high-risk course - A randomized controlled trial** *(Published in the Journal of Learning and Instruction, February 2025)*

Research Question: What is the effect of assignment to SI-PASS on students' exam performance in a high-risk statistics course?

This study is the only fully experimental component of the dissertation. It uses random assignment to allocate students in a statistics course either to the SI-PASS condition or to a control condition. Data were analysed through multilevel regression models and included variables such as adjustment, motivation, and exam performance, in line with approaches used in recent peer-learning research (Dekker et al., 2023). The randomized controlled trial (RCT) design strengthens internal validity and makes it possible to test whether assignment to SI-PASS produces measurable performance gains under controlled conditions. Such designs remain relatively rare in peer-learning evaluation and respond to calls for stronger empirical rigor and clearer causal inference in the field (Bengesai et al., 2023).

4. **Does SI-PASS promote deep learning? - A replication and extension of a study on action verbs**

Research Question: What cognitive processes are reported during SI-PASS and PEPPS sessions, as reflected in students' action verbs?

This study uses self-reported action verbs from participants and leaders to map reported learning activities onto the SOLO taxonomy (Biggs & Tang, 2011). Frequency tables and cross-tabulations were used to compare cognitive

processes across schemes (SI-PASS vs. PEPPS). The SOLO taxonomy has previously been applied in peer-learning contexts to investigate levels of learning depth (Holm, 2014; Malm, 2021a), and its use here provides a structured framework for interpreting otherwise difficult-to-observe cognitive processes. By combining a replication of Malm's approach with an extension through SOLO-based categorization, the study supports a more systematic comparison of the cognitive activities associated with the two programs.

5. **SI-PASS at ULiège - Session content analysis through a video behavioural coding program** *(Under review in Studia Paedagogica, April 2026)*

Research Question: How consistently are the core principles and techniques of the SI-PASS program implemented during sessions?

This study applies behavioural coding to 41 video-recorded SI-PASS sessions using The Observer XT software. Coded variables included leader speech, wait-time, group interactions, and adherence to SI-PASS principles. Inspired by cognitive ergonomics (Gómez-Bull et al., 2015; Leplat, 1997), this method provides a structured and systematic way to examine implementation fidelity, a critical component of process evaluation (Durlak & DuPre, 2008). Although resource-intensive, video-based behavioural coding offers strong ecological value because it preserves the temporal and interactional structure of sessions and allows repeated inspection of the same material. In this respect, Study 5 complements outcome-based analyses by documenting how SI-PASS principles are actually enacted in practice.

6. **SI-PASS at the University of Liège: Recruiting leaders, what key arguments?**

Research Question: What motivates students to become SI-PASS leaders, and how do they perceive the benefits and challenges of their role?

This study uses a convergent mixed-method design combining quantitative surveys and semi-structured interviews to explore the motivations and experiences of SI-PASS leaders across four faculties. Quantitative data were analysed through descriptive statistics and thematic clustering, while qualitative responses were coded using Braun and Clarke's (2006) framework. This dual approach was appropriate because leader motivations and role perceptions involve both general patterns and individual experiences. By focusing on leaders' perspectives, the study addresses a comparatively underexplored dimension of SI research and connects with broader work on peer mentors and student facilitators (Arendale, 1994; Fox et al., 2010; Terrion & Leonard, 2007).

7. **Development of a scale measuring the perceptive aspects of peer-learning schemes** *(Submitted to Assessment & Evaluation in Higher Education, April 2026)*

Research Question: Can a reliable and valid scale be developed to measure students' perceptions of academic support programs?

This study employs exploratory factor analysis (EFA), confirmatory factor analysis (CFA), and reliability testing (Cronbach's α) to develop a psychometric scale measuring students' perception of peer-led programs. Items were derived from existing survey data, transformed into z-scores, and tested through maximum likelihood estimation with oblimin rotation. The

methodological approach follows established recommendations for scale construction and validation (DeVellis & Thorpe, 2022; Hinkin, 1995). By developing a tool applicable to both SI-PASS and PEPPS, the study supports comparison across program types and faculties and provides a basis for more standardized monitoring of peer-led schemes.

Global contribution of used methodologies

Collectively, the methodologies used respond to international calls for multi-faculty, multimodal, and multi-year evaluations of peer-led schemes (Dawson et al., 2014). The dissertation's methodological architecture combines metrics, quasi-experimental comparison, randomized assignment, study replication, longitudinal monitoring, qualitative inquiry, video-based behavioural coding, and psychometric scale development. This convergence supports triangulation across outcomes, processes, perceptions, and implementation conditions, while remaining adapted to the constraints of a real university setting. Each method was therefore selected not as an isolated technical choice, but as part of a broader strategy for documenting how SI-PASS and PEPPS function, for whom, under what conditions, and with what perceived or measurable effects.

Table 2 summarizes the methodological architecture of the seven studies by identifying, for each study, the program examined, the main focus, the design and data sources, the analytical strategy, and its specific contribution to the dissertation.

Table 2 - Comparison of all peer-led programs.

	Main focus	Design	Main analytical strategy	Specific contribution
1	Participation, perception, performance, cost	Longitudinal mixed-method study across four faculties and three years	Attendance records, exit surveys, qualitative responses, chi-square analyses, exam scores, t-tests, institutional cost data	Provides a multi-dimensional evaluation of SI-PASS and situates ULiège within European benchmarks
2				Provides an institutional baseline for a locally developed scheme without external benchmark equivalent
3	Causal effect on academic performance	Randomized controlled trial in a high-risk statistics course	Multilevel regression including assignment condition, motivation, adjustment, and exam performance	Tests whether assignment to SI-PASS produces measurable performance gains under controlled conditions
4	Cognitive processes and learning depth	Replication and extension using self-reported action verbs	Frequency tables, cross-tabulations, SOLO taxonomy mapping	Compares reported cognitive activities across schemes and extends Malm's approach through SOLO-based categorization
5	Implementation fidelity	Video-based behavioural coding of 41 sessions	Observer XT coding of leader speech, wait-time, group interaction, and SI-PASS principles	Documents how SI-PASS principles are enacted in practice and complements outcome-based analyses
6	Leaders' motivations and role perceptions	Convergent mixed-method study	Descriptive statistics, thematic clustering, semi-structured interviews	Addresses the perspective of SI-PASS leaders
7	Scale development	Psychometric scale construction	EFA, CFA, reliability testing, t-tests	Develops a tool for standardized monitoring and comparison of peer-led schemes

Transition

This first study constitutes the empirical starting point of the dissertation by examining the implementation and effects of SI-PASS across multiple faculties at the University of Liège. It addresses a recurrent limitation in the peer-learning literature: the need for evaluations that move beyond isolated case studies and combine several indicators, including participation, performance, perception, and cost-related data (Dawson et al., 2014). Using a quasi-experimental and longitudinal approach, the study draws on attendance records, exit surveys, academic results, and financial information collected over three academic years.

Its contribution is also comparative. By relating the ULiège implementation to standardized European indicators reported by Malm et al. (2024), the study situates the local scheme within a broader international frame. This benchmarking does not aim to establish strict equivalence between contexts, but it provides useful reference points for interpreting participation levels, organizational choices, and implementation patterns.

Finally, the inclusion of cost-related indicators adds an institutional dimension to the evaluation. Beyond asking whether SI-PASS is associated with academic or perceptual benefits, the study also considers the resources required to sustain the scheme. In this sense, study 1 provides the foundation for the dissertation by combining outcome, process, perception, and sustainability concerns within a single evaluative framework.

Study 1

A three-year multi-faculty evaluation of 16 SI-PASS schemes - Attendance thresholds, performance gains and standardised metrics

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"The purpose of evaluating the SI program is twofold: (a) to determine the effectiveness of the SI program and (b) to provide a rationale for institutional financial support." (Hurley & Gilbert, 2008, p. 7)

Abstract

The study scrutinizes 16 iterations of a regular SI-PASS program across four faculties in a Belgian university over a three-year span. The large dataset enables inter-annually and inter-faculty comparisons, illuminating the program's convergent and varying traits. Throughout the study period, 78.32% of the targeted audience did attend at least one session. Participants' reported motives for attending primarily relate to improved understanding of course material and enhanced social integration. A quasi-experimental design exhibits a significant improvement of the mark at the exam in 10 instances. This performance gain is conditioned by five, six, seven, or eight participations depending on the faculty and year concerned. The results are intentionally reported according to standard indicators defined at the European level for SI-PASS and supplemented with locally developed metrics found useful to support program monitoring and institutional accountability. The paper concludes on a call to SI-PASS hosts to share similarly precise and standardized descriptors to uplift international comparability and collective learning.

1. Introduction

The contemporary educational landscape is continuously evolving, shaped by factors ranging from technological change to growing attention to evidence-based pedagogy (Grubaugh et al., 2023). Within this context, peer-facilitated learning continues to attract sustained interest, with "Supplemental Instruction - Peer Assisted Study Session" (SI-PASS) standing out as one of the most widely adopted models. Developed in the 1970s at the University of Missouri-Kansas City (Arendale, 2022b), SI-PASS emerged in response to high failure and attrition rates in particularly challenging courses. The model's distinguishing features lies in the structured facilitation of collaborative learning guided by trained near-peers (known as "leaders", official name for the peer in charge of a group of freshmen) who have previously mastered the course content (International Center for Supplemental Instruction, 2025). Unlike other forms of peer tutoring (Topping, 1996), SI-PASS does not center on content delivery but rather on promoting synergic learning environments where students can discuss, interrogate, and internalize concepts. Therefore, the leader does not act as a surrogate teacher, but as a facilitator of meaningful conversations on the course material (Martin & Arendale, 1992). Beyond academic facilitation, a substantial body of research suggests that near-peers can promote belonging, normalise struggle, and ease the transition into university life; making SI-PASS leaders potential socio-academic anchors for first-year students (Clements et al., 2025; Le et al., 2024)

Evidence over the past decades suggests that SI-PASS not only enhances academic performance (Adebola et al., 2020; Hoiland et al., 2020) but also bolsters student confidence (Bronstein, 2008; Zhang & Bayley, 2019), critical thinking skills, and promotes a sense of community (Abegglen & Morris, 2015). Its effectiveness has been credited to its capacity to bridge the formal instruction received in lectures with the informal, yet structured, collaborative

environment it offers (Dawson et al., 2014; Zamberlan & Wilson, 2015). Furthermore, being led by peers who have recently navigated the challenges of the course, SI-PASS sessions resonate with students, often demystifying complex topics and making them more approachable (Cheng & Walters, 2009; Malm et al., 2015). These outcomes do not arise from the model "itself," but from the mechanisms it enables: collaborative explanation, shared reasoning, and relational support embedded within structured peer interaction.

However, as with any pedagogical approach, the effectiveness of SI-PASS depends on contextual implementation. Detailed and transparent, documentation of SI-PASS practice is therefore essential not only for local program improvement, but also for broader field progression (Martin & Hurley, 2005). For universities considering a SI-PASS pilot for the first time or for seasoned SI-PASS practitioners, comprehensive contextualized accounts serve as blueprints or benchmarks, showcasing successes and difficulties and anchoring the model in real-world scenarios. This, in turn, enables better context-sensitive decisions through informed comparisons (Laming, 2004). Moreover, academia aspires to evidence-based practices (Slavin, 2007), which underscores the importance of collecting, disseminating, and putting into perspective sound descriptors and metrics from various support programs, including SI-PASS.

In response to these needs, the present study provides a systematic examination of SI-PASS at the University of Liège, using a common set of indicators to document participation, perceptions, performance, and cost in 16 program instances. This multi-year and multi-faculty design is intended as a concrete effort to establish a set of transparent, comparable descriptors that can inform both local monitoring and international dialogue about SI-PASS

implementation. It does so by combining existing standardised European SI-PASS indicators with locally developed metrics.

Two additional features align with this overarching aim. First, the study offers a three-year longitudinal perspective, which remains rare in the SI-PASS literature: neither Dawson et al.'s (2014) systematic review nor Zha et al.'s (2019) meta-analysis identified sustained, multi-cohort datasets, and Bengesai et al. (2023, p. 16) explicitly noted this gap. While some prior work has taken a longitudinal stance (for instance, Power and Dunphy, 2010), such studies have typically been confined to a single faculty (engineering) or to a narrower set of indicators. Malm et al. (2010, p. 38), while stressing the importance of comparing contexts, restrict their own to the same faculty of engineering. The present dataset keeps Engineering in view but broadens the lens to include Psychology, Science, and Bioengineering, thus enabling genuine cross-disciplinary insight. Secondly, the present study mobilizes multimodal data, defined as "data that originate from different data channels which are subjective and/or objective" (Järvelä et al., 2021, p. 2), whereas most existing SI-PASS studies rely primarily on unidimensional datasets (typically participation records, perception surveys, or performance scores). To address this limitation, the article adopts a "3P" approach (Verpoorten et al., 2021), combining "P"articipation (objective), "P"erception (subjective), and "P"erformance (objective) data. In addition, it introduces a fourth "P" for "P"rice (objective), enabling a cost-efficiency analysis seldom included in SI-PASS research. Such triangulation strengthens internal validity and offers a concrete and straightforward pathway to practitioners, who can face an abundance of descriptive reports but a relative lack of systematic and integrated approaches.

Such a multi-year, multi-faculty and multimodal design opens four avenues of inquiry (AOIs). Participation metrics (AOI 1) establish who attends SI-PASS sessions, how attendance varies across faculties and years, and whether group size align with established practice recommendations (*e.g.* “no more than 20 participants”; European Centre for SI-PASS, 2022, p.11). Perception data (AOI 2) explore what (de-)motivates students from engaging in peer-learning and whether these patterns differ contextually. Performance analyses (AOI 3) test whether SI-PASS participation correlates with improved grades and how many sessions are required for effects to emerge. Price estimations (AOI 4) quantify the financial investment associated with these outcomes, allowing institutions to evaluate cost-efficiency across cohorts. Where feasible, local data will be compared to the corresponding metrics reported in the “Status Report for European SI/PASS/PAL Programs” (SRE). This document, which compiles information from 74 European universities (Malm et al., 2024), represents the most substantial effort to date in sharing standardized data on SI-PASS programs.

2. Methodology

2.1. SI-PASS schemes at ULiège

The University of Liège implements a regular SI-PASS model that follows as closely as possible the recommendations outlined by the European Centre for SI-PASS in the official "Supervisor training manual" (2022, pp. 11-12). These guidelines specify the structural and procedural elements required to ensure program integrity for all stakeholders. A detailed appraisal of ULiège's compliance with these guidelines is provided in Appendix 1. Across the faculties of Applied Sciences, Bioengineering, Psychology, and Science; SI-PASS is delivered weekly during the semester, typically over 13 weeks. Leaders complete a 6-hour mandatory initial training and are offered refresher sessions, consistent with European Centre recommendations.

2.2. Data sources and methods

The data was collected from all faculties who run a SI-PASS program during the academic years 2019-2020, 2020-2021, and 2021-2022.

The first avenue of inquiry (AOI 1: Participation) was examined through attendance reports completed by SI-PASS leaders after each session. These reports recorded the session date and the identities (later pseudonymised) of all participants. Although leaders were instructed to submit a report for every meeting, occasional omissions occurred (these gaps are indicated in Table 1). Beyond functioning as a program quality indicator, participation data is a central analytic pillar of the study, given that SI-PASS effects are known to depend on exposure (Cheng & Walter, 2009). Without reliable participation metrics, performance outcomes (AOI 3) cannot be meaningfully interpreted.

To examine student perceptions (AOI 2), the study used an online exit survey administered between the final SI-PASS session and the exam in the targeted

course. The questionnaire combined Likert-type items with two open-ended questions prompting students to articulate their motives for either participating or not participating in SI-PASS. Qualitative responses underwent thematic analysis following Braun and Clarke's (2006) reflexive approach, supported by an iterative coding process. Survey non-response was addressed by reporting response rates and conducting analyses on available data. Given the descriptive purpose of this AOI, missingness was not considered. Links between perceptions and performance were explored through the item "SI-PASS will significantly contribute to my success at the exam of the target course", which allowed integration of AOI 2 with AOI 3.

Performance data (AOI 3) were obtained from RADIUS (ULiège's unit in charge of administrative data management), which provided the official exam marks of all students enrolled in the targeted high-risk courses. Analyses were conducted using independent-samples t-tests to compare participants and nonparticipants, and Tukey HSD post-hoc tests when multi-level attendance categories were compared. Because participation was voluntary, analyses are quasi-experimental and therefore interpreted cautiously in light of known selection biases. For this reason, results are discussed in alignment with participation intensity rather than simple binary contrasts.

Finally, the cost analyses (AOI 4) relied on aggregated financial data provided by the university's central accounting services. These data consisted of total annual expenditures associated with SI-PASS, including leader compensation, program coordination, and administrative support. While detailed cost breakdowns were not available, the global figures enabled the calculation of efficiency ratios by relating total expenditures to participation and performance indicators from AOI 1-3, thereby integrating the fourth dimension into a broader evaluation of program effectiveness.

Taken together, these four data streams were triangulated to produce a multimodal evaluation of SI-PASS schemes at ULiège. This structure mirrors the "3P" framework proposed by Verpoorten et al. (2021) and extends it by introducing a fourth "P" dedicated to cost-efficiency, thereby addressing a gap in SI-PASS evaluation, as economic and cost-related indicators remain rarely reported in the literature (Bengesai et al., 2023; Dawson et al., 2014).

2.3. Data treatment and ethical considerations

Quantitative analyses were conducted using JAMOVI (version 2.3). Depending on the variable structure, independent-samples t-tests, one-way ANOVAs, Tukey HSD post-hoc tests, and chi-square tests were used. When cell sizes were insufficient to satisfy test assumptions (*e.g.*, expected frequencies < 5), statistical tests were not performed; this is explicitly indicated in the corresponding tables. Qualitative analyses of open-ended survey responses were conducted using reflexive thematic analysis (Braun & Clarke, 2006). Missing or incomplete data (*e.g.*, occasional missing attendance reports, non-response to perception survey items) were not imputed. Analyses were carried out on available data, and missingness rates are reported where relevant. Potential biases due to survey non-response or incomplete attendance logs are acknowledged in the limitations.

Data collection followed approval from the Ethics Committee of the Faculty of Psychology, Speech Therapy, and Education Sciences (protocol 2122-098, amendment approved on 13/10/2023). All data were pseudonymised prior to analysis: names, student IDs, and leader identifiers were removed and replaced with numerical codes. Given the risk of re-identification through data triangulation (attendance patterns x course x year), raw data cannot be made publicly available. Only aggregated results are reported.

3. Results

3.1. Participation (AOI 1)

Table 1 provides a multi-year and multi-faculty overview of an SI-PASS program conducted in a French-speaking Belgian university. Bolded columns correspond to indicators already featured in the SRE and therefore "benchmark-ready". Remaining columns present additional metrics that proved useful in the ULiège experience and whose relevance could be discussed within SI-PASS community. The second semester of 2019-2020 and the first semester of 2020-2021 coincide with COVID-19 lockdown periods (18 March - 3 May 2020 and 2 November - 13 December 2020; Belga, 2021), a conceptual factor that should be taken into account when interpreting participation patterns and program delivery conditions since SI-PASS schemes were maintained but transitioned to an online format.

- Column 1 "FACULTY": four faculties implemented an SI-PASS scheme each semester, in one single course, during the considered period. The targeted courses remained consistent for three years in the faculties of Applied Sciences, Bioengineering and Sciences. In Psychology, three different courses were targeted (Appendix 2).
- Column 2 "ACADEMIC YEAR AND SEMESTER": as can be seen, the four faculties joined the program at different times.
- Column 3 "POTENTIAL PARTICIPANTS": all students officially registered in the target courses were informed about the SI-PASS and invited to participate although actual participation was voluntary.
- Column 4 "ACTUAL UNIQUE PARTICIPANTS": the number of unique participants, defined as students whose names appeared at least once in the attendance reports submitted by leaders.

- Column 5 “% PARTICIPATION”: the ratio of unique participants to potential participants (C4/C3). The percentage indicates the proportion of enrolled students who took part in SI-PASS at least once.
- Column 6 “NUMBER OF PARTICIPATIONS”: the total number of attendances recorded in the available attendance reports. Detailed records of attendance per meeting are provided in Appendix 3.
- Column 7 “AVERAGE NUMBER OF MEETINGS PER UNIQUE PARTICIPANT”: this ratio C6/C4 provides insight into the participation pattern, indicating whether a small number of students attended many sessions or a larger number of students attended sporadically.
- Column 8 “NUMBER OF QUESTIONNAIRES”: the number of exit surveys received, broken down into those from participants to at least one meeting (P) and from students who did not attend any meeting (NP).
- Column 9 “NUMBER OF LEADERS”: at ULiège, the number of leaders depends on the number of students enrolled in the targeted difficult courses, following the ratio of “one leader for every 15-20 students.” The slight flexibility is allowed based on whether the program is offered only to newcomers or also to repeating students.
- Column 10 “DILIGENT LEADERS”: completing attendance reports is a contractual obligation for leaders, as part of their 35-hour contract with the university. The time allocated for creating these attendance lists is included in the leaders' workload. This column counts the number of leaders who submitted attendance reports, also showing, when compared to C9, that some leaders did not return any attendance list and therefore failed to comply despite the obligation and reminders.
- Column 11 “THEORETICAL NUMBER OF MEETINGS / THEORETICAL CONTACT HOURS”: over the considered period, in all faculties, leaders were expected to organize 13 meetings per semester. This column

(C9*13) reflects the theoretical number of meetings, acknowledging that not all meetings may have occurred. Since each of the 13 meetings organized by leaders was supposed to last one hour, this column also represents the theoretical contact hours, although it may not always reflect the actual length of the meetings.

- Column 12 "ACTUAL NUMBER OF MEETINGS / ESTIMATED CONTACT HOURS": the actual number of meetings organized by SI-PASS leaders, based on the attendance reports submitted. This can only be calculated for diligent leaders (C10). Moreover, each of the 13 meetings organized by leaders was supposed to last one hour. This column therefore also represents the estimated contact hours, although it may not always reflect the actual length of the meetings.
- Column 13 "NUMBER OF THEORETICAL PARTICIPATIONS": the number of participations if all potential participants attended all meetings (C3*13 meetings organized).
- Column 14 "% ACTUAL MEETINGS ATTENDANCE": the percentage of effective participation ("occupied seats"), calculated as the Number of participations (C6) divided by the Number of theoretical participations (C13).
- Column 15 "AVERAGE NUMBER OF STUDENTS PER MEETING": the Number of participations divided by the number of actual meetings (C6/C12).
- Column 16 "COSTS": the total wage expenditure for the recruited leaders (C9*35*10) in euros (€).

The second semester of 2019-2020 and the first semester of 2020-2021 fell within COVID-19 lockdown periods (18 March - 3 May 2020 and 2 November - 13 December 2020; Belga, 2021). SI-PASS schemes were maintained but transitioned to an online format.

Table 1 - ULiège SI-PASS multi-year and multi-faculty data according to existing and new metrics.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Faculty	Academic year and semester	**Potential participants**	**Actual unique participants**	**% Participation**	**N participation**	Average meetings per unique participant	N questionnaires (P/NP)	**N leaders**	Diligent leaders	N theoretical meetings / Theoretical contact hours	**N actual meetings / Estimated contact hours**	N theoretical participations	**% Actual meetings attendance**	Average number of students per meeting	Costs in euros (€)
Applied Sciences	19-20 S2	**288**	**108**	**37.5**	**487**	4.5	117 (95/22)	**16**	10	208	**100**	3744	**13**	2.3	5600
	20-21 S1	**315**	**215**	**68.3**	**1146**	5.3	63 (57/6)	**15**	12	195	**144**	4095	**28**	5.9	5250
	20-21 S2	**358**	**164**	**45.8**	**825**	5.0	90 (74/16)	**10**	8	130	**99**	4654	**17.7**	6.3	3500
	21-22 S1	**222**	**208**	**93.7**	**1130**	5.4	127 (111/16)	**13**	13	169	**155**	2886	**39.2**	6.7	4550
	21-22 S2	**368**	**65**	**17.7**	**489**	7.5	66 (66/0)	**17**	6	221	**70**	4784	**10.2**	2.2	5950
Bioengineering	19-20 S1	**276**	**113**	**40.9**	**515**	4.6	15 (15/0)	**16**	16	208	**161**	3588	**14.4**	2.5	5600
	20-21 S1	**238**	**140**	**58.8**	**655**	4.7	30 (24/6)	**19**	19	247	**212**	3094	**21.2**	2.7	6650
	20-21 S2	**260**	**90**	**34.6**	**327**	3.6	55 (36/19)	**13**	13	169	**142**	3380	**9.7**	1.9	4550
	21-22 S1	**208**	**92**	**44.2**	**480**	5.2	46 (37/9)	**15**	15	195	**160**	2704	**17.8**	2.5	5250
	21-22 S2	**218**	**89**	**40.8**	**311**	3.5	22 (22/0)	**10**	10	130	**119**	2834	**11**	2.4	3500
Psychology	20-21 S2	**293**	**247**	**84.3**	**1777**	7.2	161 (129/32)	**36**	35	468	**377**	3809	**46.7**	3.8	12600
	21-22 S1	**303**	**253**	**83.5**	**1292**	5.1	141 (100/41)	**33**	27	364	**293**	3939	**32.8**	3.5	11550
	21-22 S2	**64**	**28**	**43.8**	**246**	8.8	45 (45/0)	**6**	6	78	**72**	832	**29.6**	3.2	2100
Sciences	20-21 S1	**45**	**15**	**33.3**	**102**	6.8	16 (14/2)	**3**	3	39	**39**	585	**17.4**	2.6	1050
	21-22 S1	**68**	**35**	**51.5**	**170**	4.9	20 (18/2)	**3**	3	39	**39**	884	**19.2**	4.4	1050
	21-22 S2	**171**	**64**	**37.4**	**408**	6.4	31 (31/0)	**9**	9	117	**106**	2223	**18.4**	3.5	3150
Total		**3695**	**1926**	**52**	**10360**	5.5	1045(874/171)	**229**	205	2977	**2218**	48035	**21.6**	**3.5**	81900

3.2. Participation (AOI 2)

3.2.1. Reasons to participate

Table 2 details the primary factors driving students to take part in the SI-PASS program. Among the 874 respondents who, over the three-year period considered, attended at least one session and completed the exit survey, 855 supplied 1370 distinct motivations (an average of 1.57 reasons per respondent). Inductive analysis revealed eight incentives. The dominant motivator (61.82 % of all statements) concerns a better grasp of course content ("1. Learn, Understand, Ask Questions"), followed from afar (13.8 %) by motives linked to social integration ("2. Socializing"). The third theme refers to the overall positive atmosphere of the sessions (6.13 %, "3. Ambiance"). Appreciation of guidance from more experienced peers ranks fourth (5.62 %, "4. Elder Leaders"), just ahead of the incentive to stay up to date with lectures (4.67 %, "5. Keeping pace"). Less frequently cited are the benefits of an alternative perspective on the material (4.31 %, "6. Other Approach"), the psycho-affective support offered by leaders (2.41 %, "7. Emotional Support"), and simple interest in trying the new peer-learning scheme (1.24 %, "8. Curiosity").

Table 2 - Frequency of motivational themes mentioned by SI-PASS students across faculties.

Themes	Applied Sciences	Bioengineering	Psychology	Sciences	Total	X^2	*p*
1.Learn, understand, ask questions	359*	186*	220*	82*	847	11.01	.012
2. Socializing	73*	21*	91*	4*	189	34.40	<.001
3.Ambiance	27	19	27	11	84	3.88	.275
4.Elder leaders	27*	17*	20*	13*	77*	7.91	.048
5.Keeping pace	22	16	26	0	64	.	.
6.Other approach	34	12	9	4	59	.	.
7.Emotional support	5	5	22	1	33	.	.
8.Curiosity	6	4	7	0	17	.	.
Total	553	280	422	115	1370		

Note: Statistically significant differences ($p < 0.05$) in response frequencies for each theme between faculties using a chi-square test are marked by (*). Not all chi-square analyses were conducted because several cells in the table contain frequencies below 5, violating the assumptions required for χ^2 testing (Cochran, 1954).

Provided adequate statistical power, subsequent Bonferroni-Holm-corrected pairwise post-hoc comparisons were applied to pinpoint the group differences driving the overall effect (Table 2). Out of the four categories tested, three were statistically significant:

1. Learn, Understand, Ask Questions: $X^2(3) = 11.01$, $p = .012$. Faculty of Psychology mentions this theme less than other faculties.
2. Socializing: $X^2(3) = 34.4$, $p < .001$. Faculty of Psychology mentions this theme more than other faculties.
3. Elder Leaders: $X^2(3) = 7.91$, $p = .048$. Faculty of Sciences mentions this theme more than other faculties.

Table 3 - Frequency of motivational themes mentioned by SI-PASS students from each faculty depending on the number of meetings they reported participating to.

N Meetings	Applied Sciences			Bioengineering			Psychology			Sciences			Total		
	1-5	6-10	>10	1-5	6-10	>10	1-5	6-10	>10	1-5	6-10	>10	1-5	6-10	>10
N Resp.	66	20	132	41	28	26	10	62	103	10	5	24	127	115	285
Theme 2	105	23	231	104	44	38	14	91	115	14	7	61	237	165	445
Theme 1	18	3	52	11	5	5	2	35	54	1	1	2	32	44	113
Total	123	26	283	115	49	43	16	126	169	15	8	63	269	209	558

Note: Chi-square analyses were not conducted because several cells in the table contain frequencies below 5, violating the assumptions required for χ^2 testing (Cochran, 1954).

Diving deeper into the theme repartition, additional χ^2 tests with Bonferroni-Holm correction were run to relate the two themes endorsement levels (Perception data) to session attendance (Participation data). "1. Learn, Understand, Ask Questions" showed a strong attendance effect, $\chi^2(6) = 238.07$, $p < .001$, and "2. Socializing" yielded a similarly significant result: $\chi^2(6) = 56.74$, $p < .001$. The pattern that emerges goes as follows: students who attend the most sessions (> 10) report both themes more often than those who did not,

except for the bioengineering students for which the pattern is inverted. Reasons for this disciplinary specificity remain unclear.

3.2.2. Reasons not to participate

To the question "This is/are the reason(s) why I did not get involved in the scheme", the 171 SI-PASS students who did not participate but took the exit survey mentioned a total of 144 units of meaning (Table 4), 38.19% invoke a "1. Lack of time" to attend, and 23.39% refer to a perceived "2. "Uselessness of the program. "3. Didn't know" relates to students who report the fact that they were not informed about the date and place of the meetings (19.44%). Finally, the following themes (4 to 7) are reported less frequently: some students had "4. No interest" in participating to the program in semester 2 after a first experience in semester 1 (6.25% - *e.g.* "Lack of motivation" or "Not a priority in my tight schedule", Bioengineering students). A few others reported having "5. Already tried" this way of learning without success (3.47%), and even less said that their leader never replied to their emails ("6. Absent leader", 2.78%), or that they felt too shy to show up ("7. Stress or timidity", 2.08%).

Table 4 - Frequency of reasons for non-participation mentioned by SI-PASS students from each faculty.

	Applied Sciences	Bioengineering	Psychology	Sciences	Total
1.Lack of time	23	15	13	4	55
2.Useless	12	14	11	3	40
3.Didn't know	4	1	22	1	28
4.No Interest	2	6	1	0	9
5.Already tried	3	2	0	0	5
6.Absent leader	0	1	3	0	4
7.Stress or timidity	3	0	0	0	3
Total	47	39	50	8	144

Note: Chi-square analyses were not conducted because several cells in the table contain frequencies below 5, violating the assumptions required for χ^2 testing (Cochran, 1954).

3.2.3. Suggestions from students

Table 5 summarizes the six themes that organize the 144 suggestions submitted by 205 students (each of whom attended at least one session) in response to the prompt: “For me to participate in more meetings it would have been necessary to…”. Two largely logistical themes dominate. “1. Better schedule” covers 41.9 % of comments and reflects the difficulty of fitting SI-PASS sessions into already crowded timetables: “If time slots allotted for the meetings could happen when we don’t have classes, we wouldn’t have to choose between the two” (Applied Sciences student). A closely related theme, “2. Better organization” (34.63 %), highlights the need for earlier notice: “Leaders should send emails with all practical details in advance so that we can plan ahead” (Bioengineering student). “3. No visio-conference” (13.17 %) concerns the compulsory online format imposed during the pandemic; many students found virtual sessions far less attractive than face-to-face meetings. This item is retained for completeness even though it pertains only to the two lockdown periods. Remaining themes are marginal. Students expressed a desire to meet with larger groups (“4. More participants”, 7.32 %), to have more sessions scheduled overall (“5. More meetings”, 1.46 %), and to receive clearer information about the program at the start of the semester (“6. More information”, 1.46 %). As one Psychology student noted, *“Had we known what the program really was about, I am sure more students would have enrolled.”*

Table 5 - Suggestions for more participation mentioned by SI-PASS students from each faculty.

	Applied Sciences	Bioengineering	Psychology	Sciences	Total
1.Better schedule	30	24	25	7	86
2.Better organization	36	19	15	1	71
3.No visio conference	9	6	10	2	27
4.More participants	9	2	2	2	15
5.More meetings	0	2	1	0	3
6.More information	2	0	1	0	3
Total	86	53	54	12	205

Note: Chi-square analyses were not conducted because several cells in the table contain frequencies below 5, violating the assumptions required for χ^2 testing (Cochran, 1954).

3.2.4. Performance perception

Table 6 displays the views of 561 students on the statement, "SI-PASS will significantly contribute to my success in the exam for the targeted course." Overall, 368 respondents (65.6 %) agreed or strongly agreed. Agreement increases steadily with session attendance: the more meetings a student attended, the more strongly they endorsed the statement. This progression is especially clear, for the four faculties, in the "Total % Respondents" row.

Table 6 - Frequency of students' perception of the significant contribution SI-PASS will have in helping them pass the exam from each faculty depending on the number of meetings they reported participating to.

N Meetings	Applied Sciences			Bioengineering			Psychology			Sciences			Total		
	1-5	6-10	>10	1-5	6-10	>10	1-5	6-10	>10	1-5	6-10	>10	1-5	6-10	>10
Total % Resp.	18	62	74	38	61	85	52	71	91	25	57	76	27	66	81
Strongly agree	1	9	27	0	5	9	1	25	57	0	1	13	2	40	106
Agree	12	30	67	8	11	14	9	21	35	3	3	7	32	65	123
Neutral	32	16	19	10	7	4	4	10	8	4	2	5	50	35	36
Disagree	9	5	10	0	2	0	1	3	1	3	1	1	13	11	12
Strongly disagree	16	2	3	3	1	0	4	5	0	2	0	0	25	8	3
Total	70	62	126	21	26	27	19	64	101	12	7	26	122	159	280

Note: Chi-square analyses were not conducted because several cells in the table contain frequencies below 5, violating the assumptions required for χ^2 testing (Cochran, 1954).

3.3. Performance (AOI 3)

Table 7 compares the scores obtained by students who attended SI-PASS and those who did not with a t-test. Out of the sixteen iterations, ten are statistically significant, in favor of engagement in the program. Amongst the six non-significant ones, three schemes took place in the pandemic period. The discrepancy between the number of participating students (*n* SI-PASS) in Table 7 and the 'Actual unique participants' shown in Table 1 (Column 4) occurs because some SI-PASS students did not sit the final exam (having withdrawn from the course, changed options, or similar) and were therefore excluded from the academic-performance analysis. In Science, the first semesters of 20-21 (n = 13) and 21-22 (n = 30) yield no effect, whereas the second semester of 21-22 becomes significant when participation rises to n = 63, hinting at a sample-size threshold. Yet that explanation fails in Applied Sciences, where large samples (n = 108 in the second semester of 19-20; n = 190 in the first semester of 20-21) also produce null results.

Table 7 - Number of students, mean grades, standard deviation, t-tests on academic performance for SI-PASS students and size effects (lockdown semesters are in italics).

Faculty, Academic Year & Semester	SI-PASS			Non-SI-PASS			*t*	*p*	Cohen 's *d*
	n	*M*	*SD*	*n*	*M*	*SD*			
Applied Sciences 19-20 S2	108	8.97	.45	176	8.27	.35	1.23	.22	.15
Applied Sciences 20-21 S1	190	7.13	.32	103	6.82	.42	0.58	.56	.07
Applied Sciences 20-21 S2	164	9.22	.47	122	7.10	.53	3.00	.003*	.36
Applied Sciences 21-22 S1	194	7.91	.34	101	6.07	.40	3.30	<.001**	.41
Applied Sciences 21-22 S2	63	11.86	.64	301	8.54	.32	4.35	<.001**	.60
Bioengineering 19-20 S1	108	8.64	.37	145	6.61	.32	4.14	<.001**	.53
Bioengineering 20-21 S1	127	9.77	.41	104	7.07	.42	4.60	<.001**	.61
Bioengineering 20-21 S2	75	9.83	.36	117	9.38	.28	0.98	.33	.15
Bioengineering 21-22 S1	88	8.52	.45	99	5.38	.45	4.93	<.001**	.72
Bioengineering 21-22 S2	82	6.49	.51	133	3.51	.31	5.28	<.001**	.74
Psychology 20-21 S2	175	11.90	.23	450	9.63	.19	6.65	<.001**	.59
Psychology 21-22 S1	220	7.86	.42	640	4.59	.21	7.68	<.001**	.60
Psychology 21-22 S2	24	6.17	.61	674	5.95	.14	0.30	.76	.06
Sciences 20-21 S1	13	7.15	.95	29	4.48	.82	1.5	.14	.50
Sciences 21-22 S1	30	6.10	.78	28	4.68	1.02	1.11	.27	.29
Sciences 21-22 S2	63	5.40	.68	93	3.42	.53	2.31	.022*	.38

Note: S1 and S2 stand for semester 1 and semester 2. Statistical significance is indicated by $p < .05$ (*), and by $p < .001$ (**).

Table 8 summarizes the minimum number of SI-PASS meetings needed to produce a statistically significant improvement in academic performance. Attendance thresholds at which group means begin to diverge significantly were calculated with a Tukey's honestly significant difference (HSD). A clear pattern emerges across contexts, faculties, years and semesters: significant grade gains appear only after five to eight meetings. Bioengineering is the most consistent, with improvement evident after five sessions in every cohort to date. Psychology is also constant but has never shown significance below eight. Science contributes a single significant datapoint (also at eight), while Applied Sciences oscillates between six and eight.

Table 8 - Significant threshold (number of meetings required calculated with Tukey tests for SI-PASS students).

Faculty, Academic Year & Semester	*N* Meetings	Estimate	*STD*	*t*	*p*
*Applied Sciences 19-20 S2**	.	.	.	.	.
*Applied Sciences 20-21 S1**	.	.	.	.	.
Applied Sciences 20-21 S2	7	5.51	2.24	2.46	.015
Applied Sciences 21-22 S1	6	2.92	1.19	2.46	.015
Applied Sciences 21-22 S2	8	4.59	2.28	2.02	.045
Bioengineering 19-20 S1	5	3.13	1.25	2.50	.013
Bioengineering 20-21 S1	5	3.34	1.06	3.17	.002
Bioengineering 20-21 S2*	.	.	.	.	.
Bioengineering 21-22 S1	5	4.27	2.07	2.06	.042
Bioengineering 21-22 S2	5	4.99	1.26	3.96	<.001**
Psychology 20-21 S2	8	3.04	1.22	2.85	.044
Psychology 21-22 S1	8	5.13	2.41	2.12	.034
Psychology 21-22 S2*	.	.	.	.	.
*Sciences 20-21 S1**	.	.	.	.	.
Sciences 21-22 S1*	.	.	.	.	.
Sciences 21-22 S2	8	8.70	1.90	4.58	<.001**

Note: S1 and S2 stand for semester 1 and semester 2. The iterations marked by an (*) produced no significant t-test result in Table 7 and were therefore excluded from the subsequent Tukey HSD test. Statistical significance is indicated by $p < .05$ (*), and by $p < .001$ (**).

3.4. Price expenditures

Over the past three years, and among the four faculties concerned, the total number of leaders added up to 229 (Table 1, Column 9). Leaders are formally employed by the university on 35-hour contracts and earn 10€ per hour. Their wages constitute the program's principal expense (Table 1, Column 16), as it amounts for a total of 81,900€ for the studied period and faculties. This sum only relates to the leaders' salary.

3.5. Faculties storylines

Across the four faculties, the results reveal four distinct SI-PASS "profiles" shaped by disciplinary culture, course affordances, student motivations, and local program history. These profiles help clarify patterns that remain partially concealed in aggregated multi-faculty analyses.

Applied Sciences shows the clearest pattern of academically driven participation. Students overwhelmingly cite mastery-oriented motives and attend strategically, with early-semester surges followed by steady attrition. Performance effects are present but inconsistent, appearing only when weekly attendance stabilises above mid-semester levels. This cohort might be particularly sensitive to workload peaks, treating SI-PASS as an efficiency-optimisation tool: a resource to use when needed, not a community to join.

Bioengineering, by contrast, displays the most regular performance gains, with significant effects emerging after exactly five sessions in every cohort. Despite variations in participation rates, these students consistently report pragmatic motives (keeping pace, verifying understanding) that translate into stable attendance behaviours. The Bioengineering profile therefore represents the most "aligned" case, where disciplinary culture, student expectations, and SI-PASS mechanisms converge to produce predictable effects.

Psychology presents a markedly different narrative. Participation is high, but for notably different reasons: social and affective motives dominate (*e.g.*, ambiance, emotional support, approachability of leaders). Students use SI-PASS not only for academic clarification but also as a space for belonging and reassurance. Performance gains emerge only after eight meetings, suggesting that the discipline's motivational profile enhances engagement but requires sustained exposure to translate into measurable grade improvements.

Sciences remains the smallest and least stable cohort. Participation is moderate and performances effects appear only once, in the semester where attendance increases substantially. Motivations tend to mirror those of Applied Sciences (academic clarification) but remain weaker in intensity. The small cohort sizes and the varied history of SI-PASS implementation in this faculty likely amplify

fluctuations. Sciences therefore represents a “low signal” context where conclusions must remain tentative.

4. Discussion

This study applies straightforward calculations and descriptive statistics to a large dataset for three purposes: documenting a French-speaking European SI-PASS initiative on (non-) participation, perception and performance; benchmarking the University of Liège results against the metrics established by the Status Report for European SI/PASS/PAL Programs (SRE); and advancing the scholarly conversation on SI-PASS through inter-year and inter-faculty comparisons, with particular attention to comparability across implementation. By triangulating multi-year, multi-faculty, and multimodal data, the study also provides a structured response to widespread concern regarding the scarcity of rigorous, transparently analyzed SI-PASS dataset (Bengesai et al., 2023; Dawson et al., 2014), offering practitioners a model for cumulative, internationally comparable evidence.

4.1. Participation

The multi-year coverage does not reveal any strong year or semester. The content-domain view is equally inconclusive: no single faculty emerges as a clear champion. Across the three-year dataset, levels of participation (C5) fluctuate both within and between faculties, with one noticeable similarity: the lowest values usually occur in the second semester (except Sciences 20-21, first semester). Two mechanisms may explain this "semester effect". First, new students, because they are diligent, curious or unsure, tend to sample every optional activity during their first months on campus (especially when SI-PASS sessions appear in their timetables and feel quasi-compulsory) as part of their search for academic and social footing (Byl et al., 2022). This aligns with broader findings that first-year students often "over-engage" early on as they explore available support before refining their study strategies (Kift, 2015; Tinto, 2017). However, a first semester at university can prove disillusioning. A proportion of the students remain officially enrolled in the second semester

(C3) while, for many reasons, they disengage from studies, shrinking the second semester pool. Conversely, the initial semester may also boost the self-confidence of other students enough to perceive SI-PASS as less necessary in the second semester.

Table 1 shows three outliers in C5: exceptionally high overall percentages of participation for the faculties of Applied Sciences in 21-22 first semester (93.7%) and Psychology in 20-21 second semester (84.3%) and 21-22 first semester (83.5%). Session logs (Appendix 3) suggest that these peaks were driven by unusually high first-week attendance followed by rapid attrition. Rather than a spread out "one-time visitor" phenomenon, a phrasing that overstates the exceptional nature of the pattern, it is more accurate to interpret this as a consistent behavioral tendency across cohorts, where students "vote with their feet": many attend the opening meeting to assess the perceived value of SI-PASS, then decide whether to continue. This early evaluative behavior aligns with broader findings that students strategically allocate time based on perceived usefulness, scheduling constraints, and competing demands (Entwistle & McCune, 2004). Attendance declines further across the semester (steady, but predictable) though a small uptick around the ninth meeting appears, plausibly tied to pre-exam anxiety; an established pattern in peer-learning and tutoring programs, where usage often spikes before major assessments (Arendale, 2022b; Palmer et al., 2009). This pattern also intersects with the academic calendar: attendance often rises in the weeks preceding major assessments, and leaders typically adapt by shifting sessions toward revision-oriented collaborative problem-solving, revisiting past difficulties, and allowing students to steer the agenda toward exam-relevant concerns, a form of responsive facilitation also noted in large-scale PASS implementations (Chi et al., 2008). Such adjustments help preserve a key concern of SI-PASS philosophy (starting from participants' evolving needs, including during peak-

stress periods) while simultaneously highlighting the risk of sessions being reduced to last-minute cramming, which does not align with SI-PASS intentions. Because of these twin declines (early attrition and gradual fading), ULiège's mean headcount per session (C15) remains well below the SRE benchmark of 11 (despite an unclear calculation process). Nonetheless, Liège matches the SRE figure of 51 % (C4) of eligible students attending at least one session (a notable result given that Liège reports by semester while the SRE uses a full academic year). In short, roughly half the cohort try SI-PASS, and about one quarter attend half of the sessions. The sudden and sharp attendance drop in Psychology during the second semester of 21-22 may hint at a third factor influencing attendance: target course selection. That semester, SI-PASS selected course changed towards one that involved no exercise and favoured rote learning, which may have reduced the perceived value of the SI-PASS specific method. This illustrates a broader point: course selection interacts with SI-PASS mechanisms, and future work should disentangle semester effects from course effects.

A structural factor likely to reduce overall attendance figures could be the number of prescribed meetings. At ULiège, leaders were contractually asked to run 13 sessions of one hour per semester (SRE by comparison: "*on average the leaders hold about 15 sessions during an academic year being 0.5-3 hours in length*"), yet the declared total (C12) rarely matches the theoretical target (C11). Interviews and attendance sheets revealed that many leaders simply could not squeeze 13 meetings into 15 weeks and that some of them compensated by running longer sessions (sometimes counting for one only in the presence report). Column 11 thus raises not only a factual discrepancy but a broader feasibility issue: the alignment between institutional expectations and actual operational constraints. After the study period, ULiège reduced the requirement to 12 sessions, a more realistic figure locally. Importantly,

feasibility affects not only attendance but also institutional outcomes: if session scheduling becomes unrealistic, fewer meetings occur, mechanisms weaken, and SI-PASS cannot fully contribute to early academic engagement; one of the strongest predictors of retention and progression (Kuh et al., 2006; Tinto, 1997). This link is consistent with the primary goals identified across European SI/PASS programmes, where improved retention and smoother transition into higher education are consistently reported as central motivations and outcomes (*e.g.*, Bournemouth University, Queen Margaret University, University of Bath as displayed in the SRE). Ensuring that the program remains operationally feasible is therefore a prerequisite not only for attendance, but also for securing the very institutional benefits (progression, reduced dropout, and academic adjustment) that justify SI-PASS investment.

Another consideration about attendance figures is that they might be higher than in Table 1, when attention is given to C9 and C10. Taken together, these columns materialize the difficulty of gathering exact data: six of 16 iterations lack attendance sheets (C10 < C9), meaning that some leaders, despite contract and reminders, do not provide listings. This mirrors a well-documented challenge in educational field research, where missing administrative records introduce uncertainty and may lead to underestimation of participation metrics (Bowen et al., 2005). It remains unclear whether these meetings took place without being logged in the shared file as required or if they were not organized. Nonetheless, most leaders are generally diligent in reporting attendance, and the number of missing records remains limited. If we go from students' attendance to "faculty attendance" to the program, C2, idly, shows that, in Liège, the number of faculties implementing SI-PASS has grown from one to four but that this number has not changed since.

Regarding the link between pandemic and attendance, in some cases, the COVID-19 pandemic boosted participation (*e.g.* Faculty of Bioengineering in the first semester of 20-21 compared to the second semester) and sometimes not (*e.g.* Faculty of Applied Sciences in the first semester of 20-21 compared to the second semester). These are the only two faculties for which both semesters of the same year are present and thus allow for comparisons. However, this measure could be considered a confounded variable with the previously mentioned pattern of the first semester being more attended to than the second one regardless of the year and faculty. Therefore, conclusions regarding a possible link between the pandemic and attendance ought to be nuanced. Even Malm et al. (2022b) highlighted several discrepancies between COVID sessions and regular ones, such as the complexity of monitoring engagement during online meetings, and the increased complexity of the leaders' tasks. These findings align with broader research on pandemic-ear learning, which shows both increased flexibility and reduced interactional quality in online peer-learning environments (Baber, 2021). Data from this specific time were presented for the sake of exactitude and relatedness to other work examining virtual meetings (Huijser et al., 2008; Watts et al., 2015).

4.2. Perception

The primary aim of SI-PASS is to help students master demanding courses, and participants' feedback confirms that it is viewed as an academic-integration program. The dominant theme ("*Better understanding of course materials*", and "Learn, Understand, and Ask Questions", Table 2) echoes the foundational SI-PASS objective of supporting mastery in high-risk courses, corresponding to the SRE's core focus on "grades and graduation." Motivations such as "Keeping pace" reflect the alignment between SI-PASS scheduling and lecture progression. Social motives, although secondary, are consistent and meaningful: "Socializing," "Ambiance," and "Emotional

support" indicate psychosocial gains that arise organically through the model's collaborative, conversational structure. The "Elder Leader" motive bridges academic and affective domains: students appreciate both the approachability ("*Helped me deal with my growing stress*") of near-peers and their ability to demystify complex material ("*Easier to ask questions to someone like us*"). As seen in Table 2, faculty patterns are almost caricatural: Sciences, Applied Sciences, and Bioengineering provide the largest share of performance-oriented motives, whereas Psychology contributes most of the social ones. Finally, higher attendance correlates with a much stronger appreciation of both academic and social dimensions (Table 6); occasional visitors notice the benefits but not enough to join the core group.

If students are to attend enough SI-PASS sessions to internalise the program's benefits (Table 6), logistics become a forefront enabler or impediment, as highlighted in Table 5. At faculty level, embedding SI-PASS in undisturbed timetables prevents competition with other academic activities. At leaders' level, scheduling sessions well in advance, installing routines in time and venue, and, as they are contractually expected, sending a weekly reminder to every student in their group is critical to attendance. Yet the data still contain complains about missing or late information. Until these basics are secured, overall participation (C5) and average attendance per session (C15) are unlikely to rise.

More broadly, these constraints mirror findings from large-scale peer-support programs internationally. For instance, the Queensland University of Technology (QUT)'s STIMulate initiative demonstrates how robust scheduling infrastructure (*e.g.,* daily drop-in availability, dedicated service spaces, and accessible volunteer facilitators) helps maintain accessibility and mitigate organizational friction in peer-learning services (Wilson et al.,

2017). Meanwhile, peer-support interventions in contexts like ours have encountered repeated challenges in sustainability and scaling when operational constraints (time, supervision, administration) were not addressed; even when student demand was present (Osborn et al., 2022).

4.3. Performance

Overall, the statistical results situate the ULiège SI-PASS experience within the long-standing positive pattern well-summarized in this statement from the university which is the cradle of the program: "*The data overwhelmingly show that students who attend SI on a regular basis do substantially better than students who scarcely attend or don't attend at all. This is true of each semester, and for the last 40 years at UMKC and internationally.*" (European Centre for SI-PASS, 2022, p. 21). Ten of the 16 iterations tested at Liège in Table 7 confirm that statement; six, however, do not. These non-significant cases are scattered across faculties and semesters, suggesting multiple interacting (and still unexplained) factors: sample size, cohort engagement, exam formats, online delivery constraints, varying levels of leader facilitation fidelity, degree of academic staff endorsement, etc. Half of the null iterations coincide with COVID-19 semesters, when sessions moved online. The data show both lower attendance and weaker appreciation of the online format, reinforcing the association developed throughout this article between participation, perception and performance. Untangling the interplay of cohort size and GPA at baseline, delivery mode, instructional context and program fidelity will require targeted future research. Identifying why some cohorts gain while others do not is now the key to refining SI-PASS implementation and maximizing its academic impact. However, clear pattern emerges across contexts: across faculties, years and semesters, significant grade gains appear only after five to eight meetings. These exposure thresholds may serve as additional meaningful standardized metrics for future cross-institutional

comparison, and they align with prior work showing that deeper collaborative mechanisms require repeated participation to stabilise (Gilman, 2025; Rokusek et al., 2022).

4.4. Price expenditures

The current scholarship encourages researchers to question the efficiency of student-support programs (Kraft, 2020). The issue of cost-effectiveness is nowadays especially pressing in French-speaking Belgium, where ARES, the overarching coordination of higher education, now requires institutions not only to supply evidence of impact but also to relate that evidence to program costs. Such financial data are still unusual: besides the wage figure reported here in Column 16, one of the few detailed estimates appears in Dekker's recent study "*The time spent by the SI leaders, the involved coordinators, trainers, project manager, and scheduler, times their respective salaries totaled €98 400. Divided by the 255 students who were granted access to the SI sessions is €385.88 per student.*" (2023, pp. 5-6). Applying the same formula (C16 / C4) to Liège yields a cost of €42 per participant, although it covers only the leaders' salaries and excludes overheads such as supervision and administration. Even with those omissions, the figure compares favourably with the annual salary of a full-time teaching assistant. Beyond direct costs, SI-PASS may contribute to institutional outcomes of major relevance: retention, progression, and cumulative credit accumulation. Research consistently shows that early academic engagement and belonging predict persistence into the second year (Kift, 2015; Tinto, 2012), and SI-PASS' combination of academic support and peer integration is precisely aligned with mechanisms known to reduce dropout risk. Thus, cost-benefit analyses should consider long-term institutional savings as well as short-term instructional costs.

4.5. Perspectives: Leveraging metrics for action

The metric set developed offers a roadmap for action at three complementary levels. Locally, faculties can identify where attendance thresholds fall short, where perception of value decline, or where cost per participant increases. This mirrors the emphasis in implementation science on using "local evidence loops" to support continuous program refinement through context-specific data (Fixsen et al., 2010). Institutionally, shared metrics enable cross-faculty comparison, highlight disciplinary specificities, support evidence-based decision-making for resource allocation, and demonstrate accountability to ARES and other external bodies; an approach consistent with broader higher-education governance trends emphasising transparency, equity, and data-driven quality enhancement (Tight, 2018). Internationally, aligning local metrics with the SRE strengthens global comparability and contributes to the collective development of SI-PASS research. The additional descriptors proposed here, such as the five-to-eight-session effectiveness threshold, the cost-per-participant estimates, and the cross-modal triangulation extend the common vocabulary and provide building-blocks for cross-institutional studies (participation, perception, performance, cost-benefit studies, international comparisons linking perception patterns to academic outcomes, and controlled trials that vary variables to test their causal impact). Such work would deepen theoretical understanding in joint research while feeding evidence-based refinements back into practice. Ultimately, these metrics and their triangulations are therefore not an end in themselves; they are decision tools. Used iteratively, shared and discussed to increase knowledge, they can steer continuous improvement locally, inform policy choices centrally, and enrich collective knowledge globally. As the founder of SI-PASS had already anticipated: "Collect, analyze, and report data each semester. Credibility relies

on careful and systematic program evaluation" (Martin & Hurley, 2005, p. 319).

4.6. Limitations

Several limitations qualify these findings. Data incompleteness is the first: six of the 16 iterations lack attendance sheets (C10 < C9). Although most leaders submitted records, a few did not, so the counts in Table 1 are almost certainly underestimates (although a slight counter effect of "over-reporting" cannot be totally ruled out despite trust and follow-up). Data gaps of this type are commonly reported in program-monitoring literature, where fidelity records and attendance logs are often incomplete or uneven (Carroll et al., 2007). Exit-survey participation was modest for both attendees and non-attendees, introducing possible non-response bias in the perception results (Porter &Whitcomb, 2005). Moreover, data from the most recent semester in Applied Sciences is incomplete due to unexplained lost records. Secondly, sample sizes are sometimes small, reducing statistical power despite three-year aggregation. This limitation is typical of voluntary academic-support programs, where participation variability constrains effect detection (Slavin, 2008). Third, although three years exceed the span of most published SI-PASS studies, they capture only the early institutionalization phase. Ongoing longitudinal tracking is needed to determine whether attendance patterns and effects levels continue to fluctuate or reach a point at which further measurement adds little value. Fourth, SI-PASS is voluntary. Compulsory participation would solve the small-sample problem and could streamline logistics for faculties, yet it might harm the program's ethos which remains anchored on the side of self-directed mastery-oriented learning. Finally, comparisons with other institutions remain constrained by variation in data availability and reporting practices; precisely the gap this study aims to help close. Cross-institutional inconsistencies in measurement and reporting have been identified as a major barrier to

cumulative SI/PASS research (Zha et al., 2019), underscoring the need for harmonised metrics such as those proposed here.

5. Conclusion

This article aimed not only to document SI-PASS implementation at ULiège but also to illustrate how multimodal, multi-year, multi-faculty evaluation can guide program development, strengthen cross-institutional comparability, and support evidence-based decision-making in the post-pandemic landscape. Its intended impact extends beyond local evaluation: it offers practitioners and researchers a concrete model of how to integrate diverse data streams into a coherent analytic narrative capable of informing both policy and practice across three years, four faculties, and four complementary data streams, this study provides the first integrated portrait of SI-PASS implementation at the University of Liège. By combining participation, perception, performance, and price data within a common analytical grid, it demonstrates that the effectiveness of peer-learning schemes does not arise from the model alone but from the contextual conditions that allow it to operate: timetabling, exposure, facilitation quality, etc.

The results reaffirm the long-standing international finding that sustained participation is associated with improved performance, yet they also illustrate that one size does not fit all. Faculties differ in their attendance patterns, threshold effects, and perception profiles; cohorts diverge in their responsiveness; and pandemic constraints further exposed the contextual sensitivity of SI-PASS. This variability should not be read as inconsistency, but as a reminder that SI-PASS is better understood as a framework that must be adapted, not simply adopted. At a local level, the metrics generated here offer ULiège an evidence-based foundation for iterative improvement. They allow faculties to identify logistical bottlenecks, recalibrate facilitation support, and align resource allocation with documented needs. The dataset also contributes to a wider institutional conversation about student participation. At

a broader level, the study's contribution lies in positioning these local findings within the emerging European movement toward comparable, cumulative SI-PASS knowledge. By using the indicators developed in the Status Report for European SI/PASS/PAL Programs (SRE) and proposing additional metrics (such as the five-to-eight-session exposure threshold and per-participant cost), the study encourages institutions to move from isolated case reports to shared frameworks. Such alignment enables cross-institutional benchmarking, supports the identification of context-specific adaptations, and may help program champions to make more informed decisions about where SI-PASS fits within their own pedagogical ecosystems.

Ultimately, the findings point to a simple but important conclusion: SI-PASS is effective when local conditions enable it to be so. The challenge for universities, whether in Liège or elsewhere, is not to assume universal applicability, but to identify the structural, cultural, and disciplinary conditions under which peer learning can genuinely flourish. Meeting this challenge requires academic leadership, evidence-informed programme design, and a commitment to ongoing evaluation and responsive monitoring. In this light, the present study offers both a mirror for local reflection and an invitation to the international SI-PASS community to collaborate in building more multi-faceted, nuanced, and transferable knowledge about the program.

6. *Appendices*

1. Comparative table between the essential elements for a certified SI-PASS program and the quality of its implementation at ULiège.

Essential Elements for a Certified SI-PASS Program	ULiège Implementation
SI-PASS Programs are…	
1. Managed by a certified SI-PASS Supervisor who has undertaken training with a Certified Trainer, based at a National or Regional Centre (*e.g.*, European Centre at Lund University).	1. In Liège, two certified supervisors monitor all aspects of the program.
2. Student-driven with participants determining the content of SI-PASS sessions facilitated by SI-PASS leaders.	2. Leaders' training puts huge stress on that aspect. Field observations confirm the good implementation of this aspect.
3. Monitored and evaluated through attendance data, student feedback, and students' final marks. Outcomes are reported to stakeholders where appropriate.	3. This very article demonstrates compliance to this criterion.
SI-PASS Sessions are…	
4. Small supplementary study groups in which there are no more than 20 participants, with groups of 8-12 being best practice.	4. Initial groups do not exceed 15 participants. Natural attrition reduces this number.
5. Voluntary and are open to all students enrolled in the unit/subject/course.	5. All students enrolled in the targeted course are offered to participate.
6. Not linked to the awarding of marks for the unit/course/subject.	6. Instructors of the targeted courses do not know who takes part.
7. Facilitated by a student who is at least one year beyond the level of the target unit in their own studies and has successfully completed the unit they are supporting.	7. Leaders are second- or third-year students selected because they are: 1) willing to help peers, 2) successful in the targeted course, 3) globally successful in their studies.
8. Designed to supplement existing learning opportunities open to all students, such as lectures, tutorials, practicals, etc.	8. Leaders are trained and supported in the management of sessions that materialize the unique tenets of SI-PASS. The seminal exhortation of "not to teach" is the repeated motto of the program so that it keeps its special space in the array of helps for academic success. Leaders must also keep in mind the distinctive "color" of their role which does not equate with being

9. Aligned with unit/subject/course content, with SI-PASS leaders planning regular sessions and related activities based upon the previous week's lecture(s) or core content.	a faculty or a teaching assistant (Note 1). 9. Each session takes place within the week following each course and is dedicated to the content covered of this course.
10. Integrate both course content and related study skills.	10. Leaders are trained to welcome both content and method-related issues.
11. Provide an active, positive collaborative peer learning environment.	11. These SI-PASS key-features are strongly highlighted during the initial leaders' training and recalled as often as possible.
12. Do not deal directly with assessable tasks (anything that has marks attached - homework/assignments).	12. The targeted courses do not organize marked tasks before the exam.
13. Attendance is taken and leaders are regularly observed and monitored by a SI-PASS representative and provided with guidance and feedback for on-going improvement.	13. Two or three voluntary debriefings as well as one compulsory field observation per leader takes usually place during the semester. Leaders experimenting difficulties must report to the supervisors. All leaders fill in an online attendance registry after every meeting.
14. Attached to a class or discipline, never a student and are non-remedial in their approach.	14. According to SI-PASS principles n° V and R, the program targets "high risk courses and not high-risk students". The targeted courses are selected by faculties among those recording high exam fail rates (to give an idea, at the exam of psychostatistics in the Faculty of Psychology in 2023: only 14% of all students passed the course in January).
SI-PASS Supervisors…	
15. And senior leaders/mentors/ coordinators model SI-PASS principles and facilitation skills both in training and on-going professional learning in order to inform best practice. The same is true of other locally specified roles such as mentors (senior leaders) and coordinators.	15. Initial and ongoing training is delivered by certified and seasoned supervisors who themselves practice SI-PASS principles and spirit. They regularly attend supervisors "master classes" offered by the European Center. There are unfortunately no senior leaders at ULiège.
16. Work collaboratively with academic colleagues to ensure SI-PASS is linked appropriately into the course schedule and course content.	16. Supervisors have a contact person in each faculty, helping to manage the practical aspects of the program. Low contact with teachers of the targeted courses is a weakness at ULiège.
SI-PASS Leaders/Facilitators are…	
17. Recognized and rewarded (some Institutions pay their leaders; some offer academic credit or other appropriate compensation).	17. Leaders sign a contract with the university and are financially retributed for their role at the official student job salary.

18. Provided with an initial minimum two-day training program and on-going professional learning.	18. An initial one-day training is mandatory for all leaders (new and confirmed). Ongoing training opportunities called “mini cursus” are provided as well as a compulsory reflective exercise on the practice.
19. Provided with resources to support them in their role.	19. An online platform is being created to provide leaders with resources: course-related material, SI-PASS cards, techniques covered at mini-cursus, FAQ gathering for four years all kinds of answers to all kind of issues, SI-PASS literature.
20. Do not reteach the course material. They are specifically trained and supported in order to develop students as independent learners and to ensure that SI-PASS sessions do not become another lecture or a replacement for tutorials.	20. This aspect is the key point during their training and is constantly reminded to them. The field observations confirm that this notion is well rooted in their practice.
21. Have regular contact with course teaching team so that they are knowledgeable about what is occurring in the course to ensure that the following aims are met: leaders are modelling good study behavior - marketing the purpose and benefits of SI-PASS - leaders are maintaining a currency in subject content / relevant unit information in order to support preparation - leaders have awareness of difficult content - leaders are able to provide feedback to inform the course teaching team.	21. Some teachers have sometimes provided agendas of their course. The online space of the course is open, on university LMS, to leaders. To be knowledgeable, the leaders rely on their own notes, handbook and exercises. They are officially paid one-hour work to prepare each meeting (content revision, activity planning). Contacts of leaders and supervisors with teachers are unfortunately scarce, even in the sharing of the collected feedback.

2. Courses targeted by SI-PASS

Applied Sciences

- First semester : Physique 1 (Pr. H. Caps)
  https://www.programs.uliege.be/cocoon/20232024/cours/PHYS2020-1.html
- Second semester : Physique 2 (Pr. H. Caps)
  https://www.programs.uliege.be/cocoon/20232024/cours/PHYS2021-1.html

Bioengineering

- First semester : Physique générale : Thermodynamique (Pr. B. Longdoz et Pr. G. Lumay)
  https://www.programs.uliege.be/cocoon/20232024/cours/PHYS3024-1.html
- Second semester : Mécanique des particules (Pr. B. Longdoz)
  https://www.programs.uliege.be/cocoon/20232024/cours/PHYS3025-1.html

Psychology

- Second semester 2020-2021 : Psychologie sociale (Pr. B. Dardenne)
  https://www.programs.uliege.be/cocoon/20232024/cours/PSYC0017-1.html
- First semester 2021-2022 : Psychostatistique descriptive et inférentielle (Pr. E. Quertemont)
  https://www.programs.uliege.be/cocoon/20232024/cours/PSYC5895-1.html
- Second semester 2021-2022 : Physiologie du système nerveux (Pr. P. Kohl)
  https://www.programs.uliege.be/cocoon/20232024/cours/PHYL0646-3.html

Sciences

- First semester : Analyse fondamentale, part. 1 (Prof. S. Nicolay)
  https://www.programs.uliege.be/cocoon/20232024/cours/MATH0071-1.html
- Second semester : Analyse fondamentale, part. 2 (Pr. S. Nicolay)
  https://www.programs.uliege.be/cocoon/20232024/cours/MATH0072-1.html

3. Detailed table of participations for each meeting (M)

Faculty	Academic year and semester	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	Total
Applied Sciences	19-20 S2	92	59	57	51	47	43	40	30	30	11	9	8	10	487
	20-21 S1	158	123	117	113	102	108	97	90	77	72	57	24	8	1146
	20-21 S2	135	98	85	80	59	62	52	54	50	50	41	34	25	825
	21-22 S1	167	122	110	98	96	74	84	78	84	80	80	37	20	1130
	21-22 S2	61	55	49	44	38	41	35	37	32	28	30	21	18	489
Bioengineering	19-20 S1	31	64	72	61	55	54	15	33	37	34	36	20	3	515
	20-21 S1	98	69	72	69	37	40	48	51	47	47	37	35	5	655
	20-21 S2	54	39	39	25	25	27	13	19	22	18	16	14	16	327
	21-22 S1	34	39	59	48	47	24	24	31	38	46	28	37	25	480
	21-22 S2	60	48	26	31	33	20	13	3	14	12	22	18	11	311
Psychology	20-21 S2	213	192	181	164	168	156	149	138	145	139	95	37	.	1777
	21-22 S1	166	142	144	142	110	88	90	75	80	72	68	65	50	1292
	21-22 S2	22	20	20	21	22	21	20	16	20	22	20	16	6	246
Sciences	20-21 S1	12	11	11	8	8	8	8	7	7	6	6	6	4	102
	21-22 S1	30	20	17	9	12	11	12	7	12	9	12	10	9	170
	21-22 S2	53	48	38	33	36	38	34	28	35	25	17	9	14	408
Total		1386	1149	1097	997	895	815	734	697	730	671	574	391	224	10360

Transition

Following the multi-faculty evaluation of SI-PASS in study 1, study 2 turns to PEPPS, a locally developed peer-led scheme at the University of Liège. Unlike SI-PASS, PEPPS is not attached to a specific high-risk course and is primarily oriented toward first-year transition, social integration, and broader student adjustment. Its evaluation therefore requires a different interpretive lens: academic performance remains relevant, but it cannot be treated as the sole or primary indicator of success.

To maintain methodological continuity with study 1, this study adopts a longitudinal mixed-method approach combining attendance records, online surveys, open-ended responses, and cost-related information. Thematic content analysis (Miles & Huberman, 1994) is used to examine students' perceptions and to capture motivational, social, and experiential dimensions that would be difficult to access through quantitative indicators alone.

Because PEPPS is a local creation, external benchmark data are limited. This makes a detailed institutional evaluation particularly important. By documenting participation, perceived usefulness, student engagement, and social integration, study 2 clarifies the role of PEPPS within the wider landscape of peer-led support at ULiège and contributes to broader discussions on peer mentoring and first-year transition schemes in higher education (Fox et al., 2010).

Study 2

From innovation to evidence: A multimodal and longitudinal evaluation of a locally created peer-led group-mentoring program in a French-speaking university

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"A student's colleagues often represent the least recognized, least used and possibly the most important of all the resources available to him." (MacKenzie et al., 1970, p. 126)

Abstract

The present study reports key metrics and outcomes of a peer-led group-mentoring program implemented at the University of Liège between 2019 and 2022 across seven faculties. Over that period, 47.8% of the targeted students attended at least one session. Participants' self-reported satisfaction mainly related to an improved understanding of course material and increased social interactions with peers. The most frequent reasons mentioned for withdrawal or non-participation were perceived limited usefulness and lack of time to attend the meetings. In addition, some students suggested that the program could be improved through more compatible schedules and a greater number of PEPPS meetings organized across the academic year. Lastly, quasi-experimental analyses did not reveal any statistically significant positive effect of the program on academic performance

1. Introduction

Higher education institutions must continuously adapt to ongoing technological and pedagogical advancements (Grubaugh et al., 2023). Peer-led initiatives, meant to support students during their transition to university, are part of this evolution. One widely adopted blend of these student-support approaches is peer mentoring. These programs typically pair incoming students (sometimes called 'protégés' as in Clutterbuck et al., 2017) with more experienced peers, aiming to facilitate adjustment to university life, improve time management, and reduce social isolation (Collings et al., 2014; Fox et al., 2010). By promoting interpersonal connections and informal guidance, peer mentoring initiatives contribute to students' sense of belonging and emotional support, which are particularly critical during the early stages of higher education (Cornelius et al., 2016).

Beyond traditional peer mentoring schemes, several related formats have emerged. Learning communities, for instance, group students around shared academic or personal interests, encouraging collaborative engagement and strengthening institutional attachment (Zhao & Kuh, 2004). Another prominent variation is the so-called "buddy programs", which typically rely on a small number of meetings during the first semester to support students' transition to university life. These programs aim to facilitate social integration and provide informal support structures during the early stages of university adjustment (Collings et al., 2014; Glass & Westmont, 2014). Originally designed to support international students, buddy programmes have progressively been extended to broader student populations (Alharthi, 2020; Naidoo et al., 2022; Nilsson, 2019). This evolution inspired the development of PEPPS at the University of Liège, where the model was adapted to local first-year students and developed into an original programme entitled "PEPPS". Its roots lie in a previously spontaneous initiative within the Faculty

of Philosophy and Letters, which later required a more structured framework. The rationalization effort sought to preserve the original blueprint: a light-touch first-semester format encouraging interactions between first-year students and more experienced peers, referred to as “buddies”, while aligning the initiative more explicitly with objectives related to social integration and the holistic transition into university life. In contrast to peer-led programs primarily focused on academic performance, such as SI-PASS or peer tutoring schemes, PEPPS aligns more closely with peer mentoring, buddy programs, and learning community approaches, emphasizing social integration and student adjustment rather than direct academic outcomes.

Several complementary reasons justify a thorough and systematic examination of the program:

- Foundational reason (program originality): As a recently established and original initiative, PEPPS has not yet undergone comprehensive scientific documentation. The absence of empirical analysis of its concrete and perceived outcomes calls for a foundational study that maps the programme’s objectives, implementation, and effects across key dimensions such as participation, perception, performance, and cost-effectiveness (or price). Such documentation provides a structured understanding of PEPPS’s implementation within the institutional landscape and establishes a baseline for future evaluation and refinement.
- Comparative institutional reason: PEPPS was implemented in parallel with SI-PASS, another peer-led support program, and at one point within the same faculty (Sciences). Although the two initiatives differ in structure and primary purpose (PEPPS emphasizing social integration and SI-PASS academic integration), both target first-year students and rely on peer interaction as their foundational mechanism.

Their coexistence creates an unusual opportunity to compare distinct student-support models within a single institutional ecosystem. Comparative institutional mapping of this kind is increasingly recommended to improve coordination and coherence among first-year support initiatives (Leduc et al., 2026).

- Governance and accountability reason: First-year support programs operate within higher education systems facing increasing demands for transparency, efficiency, and demonstrable impact, particularly regarding student retention and well-being (Gershenfeld, 2014; Leveille, 2005). While peer-led initiatives are often valued for their perceived benefits and may, in some contexts, involve relatively modest per-student costs ("the costs per student are low (€ 154)", Dekker et al., 2023, p. 6), they nevertheless require rigorous empirical validation to justify sustained funding and institutional support. The systematic assessment of standardized indicators (attendance, perceived usefulness, academic outcomes, and resource allocation) supports evidence-based decision-making and informs strategic resource allocation and policy development. This also aligns with contemporary demands for quality assurance (Gershenfeld, 2014).
- Transferability reason: PEPPS represents a concise and potentially replicable peer mentoring model. Its structure of five themed sessions addressing key aspects of the first academic year (see next section for detailed presentation), and its modest operational requirements make it particularly attractive for institutions with limited resources or those wishing to pilot socially oriented support schemes without committing to large-scale interventions. Robust documentation of its design, management, and outcomes not only consolidates its institutional

relevance at ULiège but also positions it as a model that could be adapted or scaled in other contexts.

- Scientific and geographic reason: Finally, PEPPS was implemented in a French-speaking academic context, where peer-led schemes remain comparatively less institutionalized. In contrast to Anglo-Saxon universities (where peer mentoring, tutoring, and Supplemental Instruction programmes benefit from extensive research traditions), French-speaking systems tend to host fewer formalized initiatives (Papaïoannou et al., 2015). Examining PEPPS therefore contributes to addressing a geographic and linguistic gap in the literature, broadens the international evidence base on peer-led learning, and enables cross-cultural comparison across institutional and educational systems.

Together, these reasons underscore the relevance of the present inquiry, which aims to provide a comprehensive account of how PEPPS unfolds as a variation of a peer-mentoring program. This objective requires the systematic collection of detailed metrics and data, structured around the following research questions:

- Participation (AOI 1): How many students attended at least one meeting? How many participants on average per meeting? Are there significant attendance differences between years and faculties?
- Perception (AOI 2): What motivates students to participate to peer-led programs? What demotivates them from doing so? Are there significant differences between years and faculties?
- Performance (AOI 3): Do students who participated to the program obtain better grades than those who did not?
- Price (AOI 4): What are the costs associated with the results of the first three questions? Are there significant differences between years and faculties?

The research questions guiding the study, as well as the data collected and the metrics derived from them, are deliberately structured in strict parallel with the previous chapter on SI-PASS. This duplication is fully assumed and intended to maximise comparison opportunities between the two programs.

2. Methodology

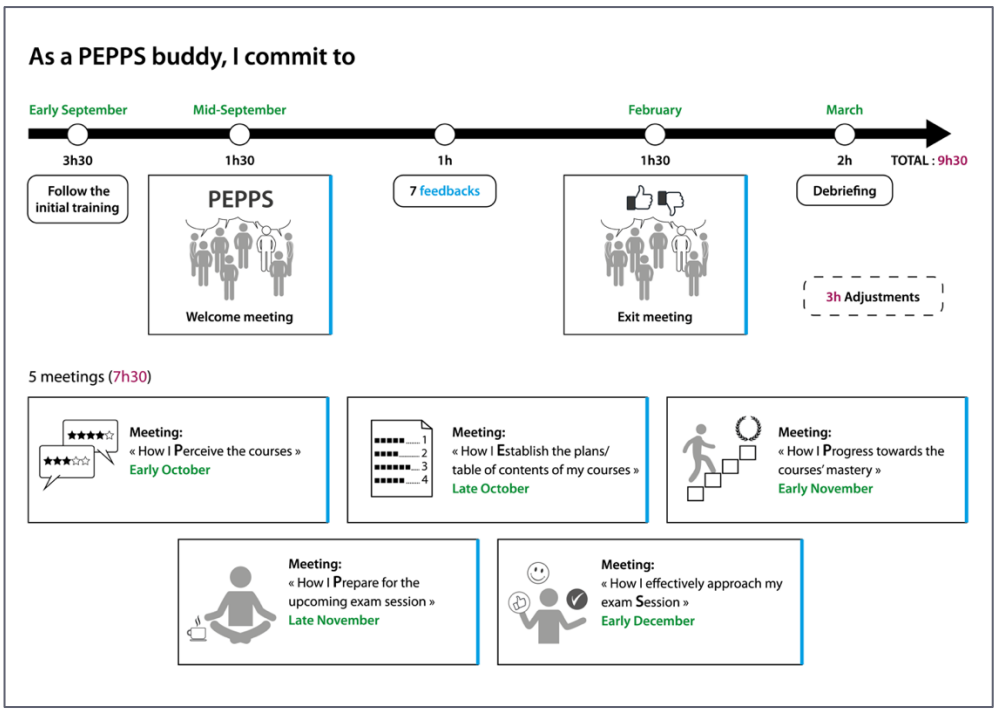
2.1. PEPPS at ULiège

The intended structure and content of the peer-led program are mirrored in its official name: PEPPS. Each letter of this acronym represents a theme closely tied to the first-year university experience and recommended for one dedicated meeting:

- P(erception): this meeting discusses students' initial impressions of the transition from high school to university.
- E(stablishment of a Plan): this meeting shares techniques for notetaking and study strategies.
- P(rogress): this meeting explores ways to self-assess progress toward mastering course material.
- P(reparation): this meeting focuses on how to organize and plan the study period leading up to the first exam session.
- S(ession): this meeting takes place after exams and encourages reflection on the examination experience.

As shown in Figure 1, the PEPPS program revolves around five sessions, each designed around one of these suggested core themes. All meetings take place during the first semester, as it is the moment where students benefit the most from social integration initiatives.

Figure 1 - Themes of each PEPPS meeting.



2.2. Analytical strategy

Quantitative analyses were conducted using JAMOVI (version 2.3). Depending on the variable structure, independent-samples t-tests, one-way ANOVAs, Tukey HSD post-hoc tests, and chi-square tests were used. When cell sizes were insufficient to satisfy test assumptions (*e.g.*, frequencies < 5), statistical tests were not performed, and this was explicitly indicated in the corresponding tables. Qualitative analyses of open-ended survey responses were conducted using reflexive thematic analysis (Braun & Clarke, 2006). Missing or incomplete data (*e.g.*, occasional missing attendance reports, non-response to perception survey items) were not imputed. Instead, analyses were conducted on available data, with missingness rates reported where relevant. Potential biases due to survey non-response or incomplete attendance logs are acknowledged in the limitations.

2.3.Data sources and treatment

The University of Liège designed its own peer-led scheme around five main themes buddies were asked to present in their meetings (one theme per meeting). The data collected corresponds to PEPPS students from academic years 2019-2020, 2020-2021, and 2021-2022 from the faculties of Architecture, Law, Medicine, Philosophy, Social Sciences, Sciences, and Veterinary Medicine. Data collection followed approval from the Ethics Committee of the Faculty of Psychology, Speech Therapy, and Education Sciences (protocol 2122-098, amendment approved on 13/10/2023). All data were pseudonymised prior to analysis: names, student IDs, and leader identifiers were removed and replaced with numerical codes.

1. Participation data (AOI 1) - Source: Buddies' reports

   AOI 1 is investigated through the compilation of attendance reports that all buddies were required to complete after each PEPPS session they had with their groups. This process provides a detailed list of participants and their personal attendance tracks.

2. Perception data (AOI 2) - Source: Exit surveys

   AOI 2 exploits data collected from an online survey that all participants filled in between the last PEPPS meeting and the exam in the targeted course. To link the Participation (AOI 1) issues to Perception data (AOI 2), this paper only analyzes the respondents' reasons to attend (or not), obtained from the questions "Here is what motivated me to participate…", answered by students who attended at least one meeting and "This is/are the reason(s) why I did not get involved in the scheme…", answered by non-participants. The answers to these open questions were divided into units of meaning and coded according to an inductive analysis (Bingham, 2023). When linking Performance

(AOI 3) and Perception data (AOI 2), the answers given by participants to the question “PEPPS will significantly contribute to my success at the exam of the targeted course” were analyzed.

3. Performance data (AOI 3) - Source: Final exams marks
   The main methodological difficulty of the PEPPS scheme lies in the fact that it is not tied to a specific course. To assess its potential impact on academic performance, students’ grades were therefore compared to the “grand mean” of the cohort for selected courses. The grand mean refers to the overall average grade obtained by all students enrolled in a given course, regardless of their participation in PEPPS, and thus provides a contextual benchmark for interpreting individual performance. AOI 3 was operationalized by selecting courses with relatively low overall performance, where potential effects of the scheme were more likely to be observable. Nominative marks for all students were provided by RADIUS (Institutional Data & Analytics Office). The effect of participation was then examined using t-tests and Tukey post-hoc comparisons within a quasi-experimental framework.

4. Price data (AOI 4) - Source: Central administration
   The costs associated with running the PEPPS program were assessed using financial data provided by ULiège’s accounting services. These data consisted of total annual expenditures, including buddies compensation, program coordination, and administrative support.

3. Results

3.1. Participation

The overview displayed in Table 1 highlights valuable metrics from the ULiège experience. For all metrics that are not self-explanatory (such as Faculty and Academic year), a clear definition, the calculation formula, and a brief contextualization are provided.

- Colum 1 "FACULTY": seven faculties implemented a PEPPS scheme all academic year during the considered period.
- Colum 2 "ACADEMIC YEAR": as can be seen, the seven faculties joined the program at different times.
- Colum 3 "POTENTIAL PARTICIPANTS": the number of students informed about PEPPS and invited to participate (even though participation to the scheme was voluntary).
- Colum 4 "ACTUAL UNIQUE PARTICIPANTS": the number of unique actual participants defined as students who names appeared at least once in the attendance reports.
- Colum 5 "% PARTICIPATION": the ratio of unique participants to potential participants (C4/C3). The percentage indicates the proportion of enrolled students who attended PEPPS at least once.
- Colum 6 "NUMBER OF PARTICIPATIONS": the total number of attendances recorded from the available attendance reports.
- Colum 7 "AVERAGE NUMBER OF MEETINGS PER UNIQUE PARTICIPANT": the ratio C6/C4 provides insight into the structure of participation, indicating whether a small number of participants attended many sessions or a larger number of students attended sporadically.
- Colum 8 "NUMBER OF QUESTIONNAIRES": the number of exit surveys received, broken down into students who participated to at least one

meeting (P) and from students who did not attend any meeting (NP). This column is relevant primarily for Perception data (AOI 2).

- Colum 9 "NUMBER OF BUDDIES": the number of buddies was determined by the number of students enrolled (following the ration of 1 leader for every 15-20 students). Slight flexibility was allowed based on whether the program was offered only or freshmen or also opened to repeating students. Please note that several methods of recruitment were used depending on the faculty: some proceeded by interest manifestation from students, others hired as many buddies as they could, etc. This point will be discussed in the upcoming Discussion section.
- Colum 10 "DILIGENT BUDDIES": completing attendance reports is a contractual obligation for buddies as part of their 35-hour contract with the university. The time allocated for creating these attendance lists is included in the leaders' workload. This column counts the number of buddies who submitted attendance reports, also showing, when compared to C9, that some buddies did not return any attendance list and therefore failed to comply despite the obligation and reminders.
- Colum 11 "THEORETICAL NUMBER OF MEETINGS / THEORETICAL CONTACT HOURS": buddies were expected to organize five meetings per year for academic year 2019-2020, and seven for all other years. This column (C9*5 or C9*7) represents the theoretical number of meetings that should have been organized. each of the five or seven meetings organized by buddies was supposed to last one hour. Since each of the meetings organized by buddies was supposed to last one hour, this column also represents the theoretical contact hours, although it may not always reflect the actual length of the meetings.

- Colum 12 "ACTUAL NUMBER OF MEETINGS / ESTIMATED CONTACT HOURS": the actual number of meetings organized by PEPPS buddies based on the attendance reports submitted. This can only be calculated for diligent buddies (C10). Moreover, each of the meetings organized by buddies was supposed to last one hour. This column therefore also represents the estimated contact hours, although it may not always reflect the actual length of the meetings.
- Colum 13 "NUMBER OF THEORETICAL PARTICIPATIONS": the number of participations if all potential benefactors attend all meetings (C3*5 or C3*7 meetings organized).
- Colum 14 % "% ACTUAL MEETINGS ATTENDANCE: the percentage of effective participation, calculated as the number of participations (C6) divided by the number of theoretical participation (C13).
- Colum 15 "AVERAGE NUMBER OF STUDENTS PER MEETING": the number of participations divided by the number of actual meetings (C6/C12).
- Column 16 "MONEY SPENT ON BUDDIES' SALARY": the Number of buddies multiplied by 15 or 20 hours and 10€ (C9*15*10 or C9*20*10) in euros (€).

Please note that the academic year 2020-2021 was affected by the COVID-19 pandemic and the resulting lockdowns from 02/11/2020 to 13/12/2020 (Belga, 2021). PEPPS schemes were maintained but transitioned to an online format.

Table 2 - Participation data for PEPPS buddies and participants in 7 faculties from 2019 to 2022.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Faculty	Academic year	Potential participants	Actual unique participants	% participation	N participations	Average meetings per unique participant	N questionnaires (N/NP)	N buddies	Diligent buddies	N theoretical meetings / Theoretical contact hours	N actual meetings / Estimated contact hours	N theoretical participations	% Actual meetings attendance	Average number of participants per meeting	Money spent on leaders' salary
Architecture	19-20	251	78	31.1	95	1.2	8 (7/1)	12	12	60	16	1255	7.6	5.9	1800
	20-21	283	53	18.7	102	1.9	66 (23/43)	12	7	84	40	1981	5.1	2.6	1400
Law	19-20	601	84	14	312	3.7	71 (37/34)	15	15	75	63	3005	10.4	5	2250
	20-21	582	317	54.5	987	3.1	47 (45/2)	24	23	168	140	4074	24.2	7.1	4600
	21-22	738	269	36.4	797	3	98 (77/21)	43	30	301	181	5166	15.4	4.4	6000
Medicine	19-20	1054	343	32.5	733	2.1	160 (90/80)	67	58	335	238	5270	13.9	3.1	8700
	20-22	1062	398	37.5	1370	3.4	199 (117/82)	61	48	427	348	7434	18.4	3.9	9600
	21-22	1267	374	29.5	982	2.6	147 (87/60)	55	41	385	240	8869	11.1	4.1	8200
Philosophy	19-20	731	176	24.1	986	5.6	69 (49/20)	41	37	205	166	3655	27	5.9	5550
	20-21	604	194	32.1	823	4.2	80 (65/15)	47	46	329	282	4228	19.5	2.9	9200
	21-22	665	164	24.7	550	3.4	86 (56/30)	39	33	273	165	4655	11.8	3.3	6600
Sciences	19-20	413	12	2.9	38	3.2	12 (6/6)	5	5	25	18	2065	1.8	2.1	750
	20-21	446	12	2.7	31	2.6	5 (5/0)	2	2	14	10	3122	1	3.1	400
	21-22	497	52	10.5	94	1.8	13 (5/8)	5	4	35	16	3479	2.7	5.9	800
Social Sciences	20-21	126	80	63.5	321	4	13 (13/0)	8	7	56	40	882	36.4	8	1400
	21-22	123	82	66.7	261	3.2	22 (18/4)	6	6	42	37	861	30.3	7.1	1200
Veterinary	19-20	275	70	25.5	225	3.2	92 (51/41)	7	7	35	33	1375	16.4	6.8	1050
	20-21	306	149	48.7	582	3.9	56 (47/9)	14	14	98	95	2142	27.2	6.1	2800
	21-22	388	147	37.9	409	2.8	39 (32/7)	13	12	91	69	2716	15.1	5.9	2400
Total		10918	5219	47.8	9698	1.9	1283 (820/463)	476	407	3038	2197	66234	14.6	4.4	74700

Note: As observed from Table 1, the faculty of Architecture withdrew from the program after academic year 2021-2022 while the faculty of Social Sciences joined the program in academic year 2020-2021.

Table 2 shows the repartition of students per meeting based on the attendance reports completed by buddies. Only five meetings were planned for the academic year 2019-202, a “welcome meeting” (Table 2, WM) and an “exit meeting” (Table 2, EM) were introduced the following year, which explains the absence of data for these two sessions in 2019-2020. For the sake of completeness, data related to these additional meetings are reported in the table but not included in subsequent analyses to ensure, across academic years, comparability of the five core meetings that were common to all cohorts. Finally, it should be noted that the faculty of Architecture submitted only one list for the first and second meeting of 2019-2020.

Table 2 - Repartition of PEPPS students based on recorded participation.

Faculty	Academic year	WM	M1	M2	M3	M4	M5	EM	Total
Architecture	19-20	.	54	.	30	11	0	.	95
	20-21	13	5	12	13	27	13	19	102
Law	19-20	.	102	65	57	39	49	.	312
	20-21	223	135	137	123	145	118	106	987
	21-22	193	121	170	97	105	63	48	797
Medicine	19-20	.	284	203	138	78	30	.	733
	20-22	301	245	205	186	153	105	175	1370
	21-22	286	192	138	110	80	93	83	982
Philosophy	19-20	.	275	198	208	148	157	.	986
	20-21	148	153	117	110	103	96	96	823
	21-22	162	73	73	62	70	49	61	550
Sciences	19-20	.	13	7	11	7	0	.	38
	20-21	7	8	5	4	6	0	1	31
	21-22	46	0	22	0	15	6	5	94
Social Sciences	20-21	67	44	51	44	42	45	28	321
	21-22	76	34	36	22	32	37	24	261
Veterinary	19-20	.	61	59	44	41	20	.	225
	20-21	110	96	81	88	79	65	63	582
	21-22	142	70	54	37	37	43	26	409
Total		1774	1965	1633	1384	1218	989	735	9698

Table 3 shows the repartition of students who answered the following questions: “ How many meetings did I attend? ” for PEPPS. Moreover, since

this question was not mandatory, only the answers of students who had answered it are reported here.

Table 3 - Repartition of PEPPS students based on self-proclaimed participation.

Faculty	Year	0	1	2	3	4	5	6	7	Total >0
Architecture	19-20	1	1	2	1	1	2	0	0	7
	20-21	43	9	3	4	1	2	1	0	20
Law	19-20	34	3	4	9	9	12	0	0	37
	20-21	2	2	2	2	7	8	12	12	45
	21-22	21	7	6	14	13	6	15	16	77
Medicine	19-20	80	34	18	14	9	9	0	0	84
	20-21	82	11	16	19	19	13	6	33	117
	21-22	60	24	9	17	12	4	6	15	87
Philosophy	19-20	20	1	5	11	12	18	0	0	47
	20-21	15	4	3	7	9	9	10	22	64
	21-22	30	0	9	3	7	13	6	15	53
Sciences	19-20	6	0	2	0	2	3	0	0	7
	20-21	0	0	0	0	0	0	4	0	4
	21-22	8	1	0	2	2	0	0	0	5
Social Sciences	20-21	0	1	0	0	0	1	2	8	12
	21-22	4	1	0	0	4	2	5	6	18
Veterinary	19-20	41	3	2	14	12	20	0	0	51
	20-21	9	1	3	8	5	5	12	13	47
	21-22	7	5	3	2	1	11	6	4	32
Total		463	108	87	127	125	138	85	144	814

3.2. Perception

3.2.1. Reasons to participate

Table 4 displays the main reasons that motivated students to participate to the PEPPS program through the question “Here is what motivated me to participate”. Together, 820 respondents who participated to at least one meeting express a total of 982 reasons to participate, which means that each respondent producent on average 1.2 reasons. The inductive analysis reveals eight themes, with a large majority of citations relating to a better understanding of the course(s) materials (theme 1, 40.32% of all expressed elements), followed by socialization (theme 2, 21.28%). The third theme relates to the fact that the buddies of the groups are still students (13.34%), and emotional support follows closely (theme 4, 12.73%). The four additional

themes (5 to 8) are: “Resources, Integration”, “Ambiance”, “Curiosity”, and “Mandatory”. PEPPS meetings do not focus on a specific course and have more global themes used as guidelines for the meetings. Since it is less centered around a course, it makes sense that students mention the fact that they use these meetings to get a better understanding of how the university works as a whole where to look for resources, how to actively participate to the academic life, etc. (theme 5, 8.55%). Then, “Ambiance” (theme 6, 1.73%) refers to the positive unformal atmosphere present during the meetings; while “Curiosity” (theme 7, 1.73%) refers to their will to experience the program at least once to see what it consists of. The last theme (8, 0.31%) relates to the mandatory nature of the program. It is mentioned only by students from the faculty of Social Sciences only where a strong engagement of the official contact person there might have led a small number of students to interpret participation as compulsory.

Table 4 - Frequency of motivational theme mentioned by PEPPS participants from each faculty.

Themes	Architecture	Law	Medicine	Veterinary	Philosophy	Sciences	Social Sciences	Total
1.Learn, understand, ask questions	3*	83	101	67	107*	9	26	396
2.Socializing	3	38	53*	56*	44	3	12	209
3.Student buddies	3	19	45	27	30	1	6	131
4.Emotional support	1	22	29*	35*	33	2	3	125
5.Resources, integration	0	18	20*	9	30*	2	5	84
6.Ambiance	0	2	3*	2	6*	1	3	17
7.Curiosity	1	5	4	2	3	0	2	17
8.Mandatory	0	0	0	0	0	0	3	3
Total	11	187	255	198	253	18	60	982

Note: Statistically significant differences ($p < 0.05$) in response frequencies for each theme between faculties using a chi-square test are marked by *.

Another point to investigate relates to the potential difference between faculties in terms of themes ranking. When a chi-square test is performed on PEPPS students’ data, we obtain $X^2(42) = 95.36$, $p < .001$, $V_{Cramer} = 0.13$ thus

indicating a significant difference between the groups. More specifically, Bonferroni-Holm corrected post-hoc pairwise comparisons were conducted to identify which group differences contributed to the overall effect.

- Learn, Understand, Ask Questions: $X^2(6) = 39.97$, $p < .001$. Faculty of Philosophy mentions this theme more than other faculties, while faculty of Architecture mentions this theme less than other faculties.
- Socializing: $X^2(6) = 28.08$, $p < .001$. Faculty of Veterinary Medicine mentions this theme more than other faculties, while faculty of Medicine mentions this theme less than other faculties.
- Student Buddies: $X^2(6) = 6.52$, $p = .037$. No significant difference.
- Emotional Support: $X^2(6) = 24.39$, $p < .001$. Faculty of Veterinary Medicine mentions this theme more than other faculties, while faculty of Medicine mentions this theme less than other faculties.
- Resources, Integration: $X^2(6) = 19.97$, $p = .003$. Faculty of Philosophy mentions this theme more than other faculties, while faculty of Medicine mentions this theme less than other faculties.
- Ambiance: $X^2(6) = 14.5$, $p = .025$. Faculty of Philosophy mentions this theme more than other faculties, while faculty of Medicine mentions this theme less than other faculties.
- Curiosity: $X^2(6) = 4.87$, $p = .56$. No significant difference.

3.2.2. Reasons not to participate

Table 5 shows the nine main reasons mentioned by students of the PEPPS programs as to why they decided to withdraw from the schemes with the question “This is/are the reason(s) why I did not get involved in the scheme”. Out of the 315 units of meaning mentioned by the 294 students who did not participate, the two main themes cited are the perception of uselessness they feel from the program (theme 1, 29.21%) and a lack of time (theme 2, 26.03%).

The third and fourth themes are a lack of interest from students (theme 3, 17.46%) and a lack of information regarding the existence of the schemes (theme 4, 17.14%). Then, on a more marginal note (5.71%), students mention the lack of responsiveness to their email by buddies (theme 5) as a negative element. They also mentioned their stress or timidity to participate to such meetings (theme 6, 2.22% - *e.g.* "*I do not feel at ease speaking in large groups*", Veterinary student), and the fact that they had already participated to the scheme and did not appreciate it enough to continue (theme 7, 1.59% - *e.g.* "*Didn't work out for me*", Philosophy student). The two last themes mentioned only once throughout all seven faculties point at negative feedback received from their peers regarding the program (theme 8) and a linguistic barrier that would prevent them from participating to the program (theme 9). These two themes are marginal (0.32% each) but mentioned here for completeness.

Table 5 - Frequency of reasons for non-participation mentioned by PEPPS students from each faculty.

Themes	Architecture	Law	Medicine	Veterinary	Philosophy	Sciences	Social Sciences	Total
1.Useless	1	9	49	23	8	2	0	92
2.Lack of time	12	14	27	15	11	3	0	82
3.No interest	6	7	24	9	8	1	0	55
4.Didn't know	11	6	19	10	5	2	1	54
5.Absent buddy	0	2	7	4	4	1	0	18
6.Stress or timidity	0	1	1	4	1	0	0	7
7.Already tried	0	0	1	1	3	0	0	5
8.Negative feedback	0	1	0	0	0	0	0	1
9.Other language	0	0	1	0	0	0	0	1
Total	30	40	129	66	40	9	1	315

Note: Chi-square analyses were not conducted because several cells in the table contain frequencies below 5, violating the assumptions required for χ^2 testing (Cochran, 1954).

3.2.3. Suggestions from students

Table 6 shows six themes emerging from 194 suggestions made by 204 students (who participated at least once) to the question "For me to participate in more meetings it would have been necessary to…". Statistical tests for faculties discrepancies were not possible here due to the lack of category representation for several faculties. The number one theme mentioned is the need for a better schedule (35.05% - *e.g.* "*If people had the time to attend, more people would show up*", Medicine student). This relates to the top motive for non-participating displayed in Table 5 above. Students mention the need for more meetings in second position (26.29% - *e.g.* "*The meetings were fun, I would have loved to have more*", Medicine student) and for a better organization as third theme (19.59%). The mention of virtual meetings (theme 4, 11.34%) was specific to COVID impacted semesters where alternatives had to be created in emergency. Students seem to dislike this approach and would rather attend a real meeting than a virtual one. Lastly, students mention their wish for more information (theme 5, 4.64%) regarding the scheme and more participants (theme 6, 3.09% - *e.g.* "*Having more people attending would make the meeting livelier*", Philosophy student).

Table 6 - Suggestions for more participation mentioned by PEPPS students from each faculty.

	Architecture	Law	Medicine	Veterinary	Philosophy	Sciences	Social Sciences	Total
1.Bette schedule	5	8	32	14	7	2	0	68
2.More meetings	2	6	39	1	3	0	0	51
3.Better organization	2	2	19	8	7	0	0	38
4.No visio conference	2	7	9	2	2	0	0	22
5.More information	1	1	5	1	1	0	0	9
6.More participants	1	0	3	0	2	0	0	6
Total	13	24	107	26	22	2	0	194

Note: Chi-square analyses were not conducted because several cells in the table contain frequencies below 5, violating the assumptions required for χ^2 testing (Cochran, 1954).

3.2.4. Performance perception

Table 7 displays the views of 624 students on the statement, "PEPPS will significantly contribute to my success in the exam session." Overall, 267 respondents (42.8 %) agreed or strongly agreed.

Table 7: Frequency of students' perception of the significant contribution PEPPS will have in helping them pass the exam session from each faculty.

	Architecture	Law	Medicine	Veterinary	Philosophy	Sciences	Social Sciences	Total
Strongly agree	2	16	20	17	24	0	3	82
Agree	7	32	55	31	51	3	6	185
Neither disagree nor agree	9	39	93	35	31	5	11	223
Disagree	2	7	28	13	6	2	2	60
Strongly disagree	1	14	35	8	12	0	4	74
Total	21	108	231	104	124	10	26	624

Note: Chi-square analyses were not conducted because several cells in the table contain frequencies below 5, violating the assumptions required for χ^2 testing (Cochran, 1954).

3.3. Performance

Table 8 displays the results for t-tests performed on specific courses for 4 faculties in 2020-2021 (course description in Appendix 1). RADIUS only provided the grand mean for each cohort, and not supplementary information such as standard deviation or the total *n*. Moreover, no data was available for the faculties of architecture, philosophy, and social sciences. These tests reveal significance for 3 iterations only: the two classes of law and one in veterinary medicine. All others fail to attest for a significant impact of PEPPS on academic performance. Another element to highlight is the small size of several samples ($n < 100$). One could argue that the only reliable tests are therefore those applied to the faculties of medicine (general orientation, dentistry, and biomedical sciences) and sciences. These two faculties do not display any significant results in favor of the program.

The discrepancy between the number of "PEPPS students" in Table 8 and the "Actual unique participants" in Table 1 (Column 4) arises because some registered PEPPS students did not sit the final exam (having withdrawn from the course, changed options, or similar) and were therefore excluded from the academic-performance analysis.

Table 8 - Number of students, mean grades, standard deviation, t-tests on academic performance for PEPPS students and size effect. See Appendix 1 for courses details.

Faculty Option	PEPPS			Non-PEPPS	*t*	*p*	Cohen's *d*
	n	*M*	*STD*	*M*			
Law (a)	32	10.72	.58	8.5	3.81	<.001**	0.67
Law (b)	17	13.94	.82	11.3	3.20	.006*	0.78
Medicine (c)	167	9.68	.16	9.7	-0.07	.94	<.001
Medicine (d)	155	10.64	.28	10.4	0.87	.39	0.07
Pharmacology (e)	158	7.64	.25	7.7	-0.24	.81	-0.02
Pharmacology (f)	157	7.30	.39	7.2	0.26	.79	0.02
Dentistry (c)	21	9.48	.73	9.3	0.25	.80	0.05
Dentistry (d)	20	9.52	.79	9.4	0.15	.88	0.03
Kinesiology (g)	32	5.23	.63	4.9	0.53	.60	0.09
Kinesiology (h)	31	9.08	.82	8.4	0.83	.41	0.15
Motricity (g)	87	4.77	.42	5	-0.54	.59	-0.06
Motricity (h)	83	8.01	.51	8.4	-0.78	.44	-0.09
Biomedical (i)	222	7.50	.19	7.4	0.55	.58	0.04
Biomedical (j)	230	6.35	.25	6.3	0.20	.84	0.01
Veterinary (k)	65	10.00	.41	8.8	2.89	.005*	.36
Veterinary (l)	65	9.32	.42	8.6	1.72	.09	0.21
Veterinary (m)	66	9.71	.50	9	1.43	.16	0.18
Veterinary (n)	62	7.73	.34	7.4	0.95	.34	0.12
Sciences (o)	130	3.71	.36	3.6	0.30	.76	0.03
Sciences (p)	116	7.45	.42	7.3	0.36	.72	0.03

Note: Statistical significance is indicated by $p < .05$ (*), and by $p < .001$ (**).

3.4. Price expenditures

Over the past three years, and among the seven faculties involved, the total number of buddies adds up to 476 (Table 1, Column 9). Buddies are formally

employed by the university on 15-hour (2019-2020) or 20-hour (all other years) contracts and earn 10€ per hour. Their wages constitute the program's principal expense (Table 1, Column 16), as it amounts for a total of 74.700€ for all studied periods and faculties. Please note that this sum only related to the buddies' salary, not the other expenses related to the scheme's implementation within the Institution.

3.5. Faculties storylines

Across the seven participating faculties, the PEPPS scheme followed distinct trajectories that reflect local cultures, constraints, and perceived added value.

Architecture joined PEPPS early but only for two years, with participation rates dropping from about one third of students attending at least once (31.1%) in 2019-2020 to less than one fifth (18.7%) in 2020-2021. Average exposure remained low (around one to two meetings per participant), and very small groups per meeting were recorded, particularly in the second year. Combined with patchy attendance reporting (one list covering several meetings in 2019-2020) and modest survey returns; this pattern suggests that the program never fully embedded itself in the local culture before being discontinued.

In Law, PEPPS gradually evolved from a small pilot to a more substantial scheme. Participation rose sharply from 14% in 2019-2020 to over half the cohort (54.5%) in 2020-2021, before stabilising at a still substantial 36.4% in 2021-2022. Students typically attended three to four meetings, and group size per session was among the highest in the dataset. Law is also one of the few faculties where performance analyses show significant positive effects for PEPPS participants on academic performance (Table 8), which, combined with strong participation and rich qualitative feedback, points to a relatively clear learning value for this faculty.

Medicine consistently mobilised large cohorts, with around a third of students attending PEPPS at least once in each year and substantial absolute numbers of participations. However, average exposure per participant remained modest (two to three meetings), and the performance analyses did not reveal any reliable advantage for PEPPS students on the targeted high-risk courses. Perception data indicate predominantly academic motives ("Learn, understand, ask questions"), but also relatively lower emphasis on social and emotional dimensions compared with other faculties. Overall, PEPPS appears recognised and used, but primarily in an academically oriented, light-touch manner. This interpretation is supported by perception data (Table 4), which emphasise exam preparation and asking questions, while social and emotional motives remained comparatively less prominent.

In Philosophy, participation rates hovered around one quarter to one third of the cohort, but participants tended to be highly engaged: they reported the highest average number of meetings attended and relatively large group sizes in the first years. Qualitative data show that Philosophy students are particularly likely to cite learning, access to resources and integration into university life, as well as ambiance, as key reasons for attending. This faculty thus exemplifies a more intensive, community-oriented use of PEPPS, where the scheme serves both as an academic navigation aid and as a space for collective adjustment to university expectations.

The faculty of Sciences illustrates a more fragile implementation: participation rates were very low in the first two years (around 3%) and only reached about 10% in 2021-2022. Group sizes per meeting stayed small and survey data remain sparse, limiting firm conclusions. The available responses suggest that, when students do attend, their motives are mostly about learning (Table 4), but

the scheme does not yet appear to have achieved visibility or critical mass comparable to other faculties.

Social Sciences joined the program later (from 2020-2021) but with immediately high apparent reach: around two thirds of the cohort are recorded as having participated at least once in both available years. Students report recognisable academic and social benefits, and many stress that timetable alignment would further improve their ability to attend more regularly. PEPPS here functions less as an optional service and more as a structured, co-curricular component of the first-year experience.

In Veterinary Medicine, PEPPS shows a trajectory of expansion and consolidation. Participation almost doubled between 2019-2020 (25.5%) and 2020-2021 (48.7%), before stabilising at around 38% in 2021-2022, with participants attending on average three to four meetings. Veterinary students are over-represented among those citing socialising and emotional support as key motives, and the performance analyses reveal one of the few significant positive effects of PEPPS on exam outcomes. This combination of moderate-to-high participation, repeated exposure, strong relational motives, and occasional performance gains suggests that PEPPS has found a particularly resonant niche in this faculty.

4. Discussion

The present discussion is organised around the four dimensions structuring the evaluation of PEPPS: participation, perception, performance, and price. For each of these dimensions, the results are first interpreted within the PEPPS scheme itself, then examined through a dual comparative lens: locally, in relation to SI-PASS at the University of Liège, and more broadly, in light of international peer-learning literature where relevant. This makes it possible to distinguish what appears specific to PEPPS, what reflects more general dynamics of peer-led support, and what remains tied to local implementation conditions.

Overall, the data collected over the past three academic years suggest that PEPPS occupies a distinctive position within the ULiège support ecosystem. It is a lighter, broader, and more transition-oriented scheme than SI-PASS. Its main strengths appear to lie in its accessibility, its relational climate, and its capacity to combine institutional reassurance with social support. At the same time, its broad scope and limited intensity complicate the detection of direct performance effects, which reinforces the importance of discussing each of the four “P” dimensions both on their own terms and in comparative perspective.

4.1. Participation

Participation in PEPPS appears meaningful but uneven. At one end of the spectrum, Social Sciences displayed participation rates above 60% in both years of implementation; at the other, Sciences remained below 11%, with two years under 3%. Disciplinary variation in engagement is commonly observed in peer-support schemes, as fields differ in assessment culture, perceived difficult, and student expectations (Ashwin, 2003b; Hammond et al., 2010). All other faculties fall between 18.7% and 54.4%, with a global mean of

47.8%, or 14% when the two extreme faculties are removed. The faculty of Architecture withdrew from the scheme after the second year, a decision likely influenced less by participation rates than by internal organisational factors, including coordination issues and limited advocacy for the program within the faculty.

Placed in local comparative perspective, this first observation does not fundamentally differ from the other peer-led program, but the comparison needs to be made explicit. At ULiège, SI-PASS also shows substantial local variation in participation, with an overall participation rate of 52.1%, compared with 47.8% for PEPPS. A chi-square test comparing the proportion of students who attended at least one session in the two schemes was statistically significant, $\chi^2(1) = 20.64$, $p < .001$; with SI-PASS displaying a slightly higher global participation rate than PEPPS. However, the associated effect size was very small ($\varphi = .038$), indicating that the difference, although statistically detectable, remains limited in substantive terms. This comparison should nevertheless be interpreted cautiously, as the two schemes differ in structure, intensity, and local implementation conditions. These structural differences remain important for interpretation. SI-PASS is more intensive, more frequent, and more explicitly embedded in a course-specific structure. PEPPS, by contrast, is lighter, less frequent, and broader in focus. The fact that PEPPS nonetheless reaches nearly half of its target population suggests that even a low-intensity, transition-oriented format can mobilize a meaningful audience. Participation in PEPPS should therefore not be read as weak simply because meetings are smaller or less frequent than in SI-PASS; rather, it reflects a different support logic whose visibility and uptake depend more strongly on local implementation conditions.

A broader comparison remains informative, but it should come only after this local positioning. Unlike SI-PASS, for which trans-institutional data exist, most notably in the Status Report for European SI/PASS/PAL Programmes (Malm et al., 2024), PEPPS has no equivalent international dataset. While related initiatives such as peer mentoring or buddy programs have been described in the literature, differences in structure, objectives, and reporting practices make direct comparison difficult. As Dawson et al. (2014, p. 634) note, peer-learning initiatives outside SI-PASS often suffer from weak or inconsistent reporting structures, which hampers evidence accumulation and limits cross-institutional comparison. The SRE figures should therefore not be used as direct benchmarks for PEPPS, but rather as broad points of reference that help situate the program within the wider landscape of peer-led support.

In that broader perspective, the PEPPS participation rate remains interesting. Malm et al. (2024, pp. 6-8) report that across European SI-PASS schemes, approximately 51% of eligible students attend at least one session. However, the comparison must be treated cautiously, because the underlying denominators are not fully equivalent. In SI-PASS, “eligible students” refers to all students enrolled in the targeted courses, whereas in PEPPS the population considered depends on local implementation procedures, which varied across faculties. In some cases, participation followed an explicit expression of interest, while in other students were more directly integrated into groups. The two metrics are therefore not strictly comparable. Still, the comparison remains informative at the level of order of magnitude: in several local configurations, PEPPS appears capable of generating a non-negligible level of initial engagement. The proportion of students attending at least once (47.8%) thus remains a useful indicator of initial uptake, even if it cannot be interpreted in exactly the same way as the SI-PASS figure.

The same logic applies to session size. The SRE reports an average of 11 students per SI-PASS session, whereas the average PEPPS meeting gathers 4.4 (Table 2, C15) students and ULiège's SI-PASS sessions 3.5 (study 1, Table 1, C15). These figures immediately show that the local SI-PASS and PEPPS implementations differ not only from the broader European SI-PASS landscape, but also from one another. This difference should not be read normatively, as if larger necessarily meant better. Part of it likely reflects structural differences between the two schemes: SI-PASS is course-bound, recurrent, and attached to specific teaching sequences, whereas PEPPS is more occasional, not tied to a single course, and designed around broader transition-related themes. However, structural characteristics alone are unlikely to explain the whole gap. Session size may also depend on local communication practices, the degree of faculty support, and the extent to which the program is made visible and intelligible to students. In that sense, session size is not only a program characteristic, but also a local implementation outcome. More broadly, this numerical gap illustrates how both structural and contextual differences between peer-support schemes complicate direct comparisons and reinforce the importance of interpreting participation indicators within their specific institutional and pedagogical contexts.

Within-year dynamics (Table 2) reinforce this interpretation. The first PEPPS meeting usually attracts the highest number of students, followed by a decline, except in the second iteration of Architecture. This pattern is compatible with a form of exploratory attendance: students initially try the scheme, then decide whether it seems sufficiently relevant to justify continued participation. Such behaviour is common in voluntary support programs, where students allocate their time selectively according to perceived usefulness (Gershenfeld, 2014; Hammond et al., 2010). A more intriguing result is the minor rebound observed around the fourth or fifth meeting in some cohorts. If this increase is indeed

linked to moments when academic pressure intensifies, then it cannot be interpreted simply as a transition-related effect. Rather, it suggests that students may also be turning to PEPPS for more academically oriented reasons than the program's official rationale would lead one to expect. This raises an important interpretive issue: either some students misunderstand the primary purpose of the scheme, or the local implementation of PEPPS partly drifts toward academically supportive functions when the semester progresses. At this stage, the data do not allow these two possibilities to be disentangled. The comparison with SI-PASS is useful precisely because the logic is different and should be stated explicitly. In SI-PASS, a rise in attendance near assessments would be fully coherent with the program's design, since sessions are attached to a specific difficult course and are explicitly meant to support academic mastery. In PEPPS, by contrast, such a rebound is less self-evident, because the scheme is theoretically centred on transition, orientation, and social integration rather than on direct course support. If attendance nevertheless increases at moments of academic pressure, this may indicate that students appropriate the program partly as a broader academic support space. This does not invalidate the scheme, but it does suggest that the practical meaning of PEPPS may be more hybrid than its formal definition implies.

Finally, the comparison between the number of buddies hired (Table 1, C9) and the number of potential participants (Table 1, C3) points to distinct local recruitment logics. Some faculties, such as Law, appear to rely more on an opt-in model, in which students must first express interest before groups are constituted and buddies are hired accordingly. Medicine, by contrast, operates closer to an opt-out logic, with students being assigned to groups more systematically from the outset. This difference is not trivial, because it may partly shape participation itself. Medicine, where students are integrated into groups by default, consistently shows high numbers of potential participants

(Table 2, C3), suggesting that opt-out arrangements may facilitate initial engagement. By contrast, opt-in models may leave participation more exposed to local fluctuations in communication, self-selection, and student initiative. Given the limited number of faculties and the presence of possible confounds, this observation remains exploratory, but it provides one of the most interesting local insights of the study: participation is not only a matter of student motivation, but also of organisational design.

4.2. Perception

If participation indicates who enters the scheme, perception helps clarify why students attend and what they believe they gain from it. One of the most striking findings is that the dominant motive relates to better understanding course material. This is noteworthy because PEPPS is not designed as a course-focused support scheme, but rather as a transition- and integration-oriented initiative. One might therefore have expected social integration to dominate, with academic understanding as a secondary benefit. Instead, the reverse pattern emerges, suggesting that students partly appropriate PEPPS as a form of academically oriented support. In this sense, the scheme appears more hybrid in practice than its formal definition would suggest, particularly in contrast with SI-PASS, where academic support is an explicit core objective. Importantly, the nature of the "better understanding" reported in PEPPS differs qualitatively from that observed in SI-PASS. In SI-PASS, understanding is typically linked to specific course content, structured problem-solving, and repeated engagement with clearly defined material. In PEPPS, by contrast, it appears broader and less course-bound, reflecting a form of global academic orientation: understanding expectations, navigating university structures, interpreting teachers' requirements, and developing general study strategies across courses. This distinction suggests that similar labels ("understanding",

"learning") may refer to fundamentally different underlying processes depending on the design of the peer-led scheme.

The second major perceptual axis is social. Students frequently mention ambiance, emotional support, and the reassuring presence of buddies who are themselves students. This dimension is much more closely aligned with the formal aims of PEPPS. The point is therefore not that PEPPS was designed from the outset as a dual academic-social scheme. Rather, the data suggest that a socially oriented programme may, in practice, also generate more academic effects than expected, not in relation to one specific course, but more broadly across students' courses. The comparison with SI-PASS makes this tension clearer. In SI-PASS, the order of motives is coherent with the programme's aims: academic integration comes first, while social benefit appears more as a secondary gain. In PEPPS, one might have expected the reverse order. Yet understanding still comes first, with social motives second. This does not erase the specificity of PEPPS, but it suggests that the scheme may, in practice, partly overlap with academically supportive functions despite its transition-oriented rationale. At the same time, the social themes remain central to what is specific about PEPPS. Belonging, peer approachability, and informal support are well known facilitators of first-year engagement and help-seeking (Colvin & Ashman, 2010; Terrion & Leonard, 2007; Thomas, 2012; Tinto, 2017). In the present case, these elements appear not only as social benefits in themselves, but also as conditions that may support students' broader sense of academic orientation.

A local comparison with SI-PASS sharpens the interpretation. In principle, the two schemes are built around different expectations: SI-PASS is designed for academic integration around a specific difficult course, whereas PEPPS is designed for transition, integration, and the sharing of first-year experience.

One would therefore expect SI-PASS to be motivated primarily by course-related concerns, and PEPPS more clearly by social and relational ones. The empirical picture is less clear-cut. SI-PASS largely fits its academic rationale, but PEPPS appears more hybrid in practice, since students also use it to better understand their studies and not only to feel socially supported. The comparison therefore suggests not only complementarity between the two schemes, but also partial overlap. They remain institutionally distinct, yet may converge around some shared student needs, which raises the possibility of blurred expectations and practical competition between them.

This is also visible in the more fine-grained categories emerging from students' answers. "Ambiance," "Student Buddies," and "Emotional Support" all align quite closely with the formal rationale of PEPPS as a transition-oriented, reassuring, near-peer scheme. Unlike the prominence of *understanding*, which is more unexpected, these themes are not surprising in themselves. Their importance nevertheless helps make sense of the overall pattern: the academic uses of PEPPS may arise partly through its social function, insofar as relational proximity, reassurance, and informal atmosphere can lower inhibition, facilitate help-seeking, and make academic expectations more intelligible. This is consistent with work on near-peer support and peer mentoring, which shows that more experienced students can provide a form of accessible guidance that supports both adjustment and engagement in first-year contexts (Collings et al., 2014; Evans & Cuffe, 2009).

Faculty-level contrasts further enrich this picture. Although the data remain limited in some cases, Law, Sciences, and Medicine appear to foreground more performance-oriented motives, whereas Veterinary Medicine and Social Sciences place more emphasis on the social and relational value of the scheme. These differences may reflect broader variations in disciplinary cultures, with

some fields encouraging a stronger focus on performance, mastery, and academic efficiency, and others giving greater salience to relational, collaborative, or orientational dimensions of student experience (Becher & Trowler, 2008; Pintrich, 2003). Rather than interpreting this as noise, it may be more appropriate to see it as evidence that the same scheme is appropriated differently depending on local student cultures, expectations, and needs. The Faculty of Philosophy, for instance, stands out less for performance motives than for themes linked to academic and institutional orientation.

The question of non-participation points in the same direction. The two dominant reasons given are lack of time and perceived limited usefulness (Table 5). Here again, the local comparison with SI-PASS is instructive. Because SI-PASS is visibly attached to one difficult course, its academic value may be easier for students to identify immediately. PEPPS, by contrast, asks students to invest time in a broader support format whose payoff may be more diffuse. Similar findings appear in studies of optional support programs, where perceived relevance strongly predicts engagement (Ashwin, 2003b; Elen & Lowyck, 1998). This likely helps explain why some students struggle to see its relevance, even while others explicitly ask for more meetings. Importantly, these two views cannot be linked at the individual level in the present analysis, so this apparent contradiction should not be overinterpreted. It remains possible that different subgroups are expressing different relationships to the scheme. What matters here is that PEPPS generates a more ambivalent perception profile than a narrowly course-focused support programme: it is appreciated by many, but its usefulness is also more interpretively demanding for students.

4.3. Performance

Performance is the dimension on which PEPPS differs most clearly from SI-PASS, and it is also the dimension for which comparison is most analytically useful. By design, PEPPS does not target one specific course. It addresses a wider set transitional issue, which immediately complicates any attempt to trace its effect to a single exam result. The strategy adopted in this study, namely selecting particularly difficult first-year courses as possible sites of visible effect, was therefore a reasonable heuristic rather than a definitive solution. Out of the 20 iterations tested, only 3 yielded statistically significant results (Table 8), and even these should be interpreted with caution, given the small number of PEPPS students involved in each analysis (always under 70).

The local comparison with SI-PASS is particularly informative here. At ULiège, SI-PASS is course-embedded, more frequent, and explicitly designed to support repeated engagement with difficult content over time. PEPPS is not. It follows that grade effects should be more directly observable in SI-PASS than in PEPPS. This contrast does not suggest that PEPPS fails; rather, it suggests that the two schemes should not be judged against the same performance expectations. The absence of strong academic effects in PEPPS is thus not only an empirical result, but also a clue regarding the nature of the scheme itself.

This interpretation also fits the broader literature. As Ashwin (2003b) and Topping (2005) suggest, peer-learning initiatives may produce outcomes that are not immediately reducible to grade differences, especially when they support broader forms of academic adjustment, confidence, or strategic orientation. At the same time, more directly measurable performance gains tend to be easier to identify when peer-learning is closely aligned with a particular course, includes regular exposure, and activates structured cognitive

engagement around concrete learning material (Arendale, 2014; Dawson et al., 2014). From this perspective, the weak or inconsistent performance signal in PEPPS is less surprising than it might first appear.

The year 2020-2021 further illustrates this difficulty, as no statistically significant effect was detected in the analyses conducted for that period. More fundamentally, this result is coherent with the design of PEPPS itself. Because the scheme is not attached to a specific course and offers only a limited number of meetings addressing broader first-year issues, its effects on academic performance are structurally more difficult to capture than those of course-embedded support programs such as SI-PASS. Under such conditions, performance indicators may remain informative, but they cannot serve as the sole or primary criterion of value.

4.4. Price expenditures

The fourth dimension, price, gives the article one of its most distinctive contributions, because cost reporting remains relatively rare in the peer-learning literature. The present study was explicitly designed to provide triangulated information on participation, perception, performance, and price. This multidimensional approach is particularly important since current literature increasingly encourages researchers to evaluate the efficiency and cost-effectiveness of such programs (Kraft, 2020; Levin & Belfield, 2015), a trend that is particularly salient in French-speaking Belgium where ARES (Research and Superior Education Academy) now requests not only evidence of impact but explicit links between outcomes and associated costs.

Here again, the local comparison with SI-PASS should begin with directly comparable figures. In the present dataset, buddies' and leaders' salaries amount to €74,700 for PEPPS and €81,900 for SI-PASS. When these totals are

related to the number of recorded participations, the average direct salary cost per participation is €7.70 for PEPPS and €7.91 for SI-PASS. This common metric offers a clearer basis for comparison than absolute expenditure alone and shows that, despite their different formats and intended functions, the two schemes generate a remarkably similar direct salary cost per participation. These figures remain partial, however, as they exclude overhead costs such as supervision, faculty liaison, and administrative coordination. In this respect, the comparison with Dekker et al. (2023) remains useful. Their estimate of €154 per student is not directly equivalent to the present calculation, but it highlights how unusual transparent monetary reporting still is in the field. Even partial estimates, when expressed explicitly in euros, contribute to a more mature comparative evidence base.

A broader interpretive point remains important. If PEPPS produces only weak direct grade effects but contributes to belonging, reassurance, orientation, or sustained engagement, then its cost should not be judged against academic performance alone. Its value may also lie in outcomes related to first-year adjustment, engagement, and persistence (Thomas, 2012; Tinto, 2017). From that perspective, the price dimension completes the comparison with SI-PASS: the two schemes address partly different functions within the same institutional ecosystem.

4.5. Limitations

A first limitation concerns the difficulty of interpreting the relationship between PEPPS participation and academic performance. Because the scheme is broad in scope and not tied to the repeated study of one specific course, any effect on grades is likely to be more diffuse and less directly traceable than in SI-PASS. This difficulty is well known in the literature on generic first-year transition schemes, where broad support formats often generate effects that are

real but harder to capture through course marks alone (Kift et al., 2010; Thomas, 2012). More importantly, the present study does not allow a sufficiently fine-grained analysis of how PEPPS actually relates to students' courses in practice. This remains an important issue for future research. It would be useful to examine more closely whether PEPPS drifts, in some cases, toward practical "strategic learning", toward discussion of assignments and concrete academic tasks, or whether its academic effects remain more indirect, for example through reassurance, better understanding of pedagogical expectations, clearer interpretation of what teachers require, or the extension of study strategies across courses. Clarifying these mechanisms would help explain how a theoretically transition-oriented scheme may still produce academically relevant effects without being course-bound in the same way as SI-PASS.

A second limitation relates to sample size. As participation is voluntary, predicting uptake is intrinsically difficult, a recurring issue in peer-led initiatives internationally (Topping, 2005). Small and uneven cohorts limit statistical power and reduce the interpretability of quantitative comparisons. Whether participation would stabilise or increase over time remains uncertain; longitudinal work shows that newly implemented support programs often undergo a multi-year "settling period" before achieving stable engagement (Kahu & Nelson, 2018). The local and contextual nature of PEPPS also raises questions of generalisability: results observed at the University of Liège over a three-year period cannot be assumed to apply to other institutions or cohorts.

A final limitation concerns the voluntary nature of the scheme. Compulsory participation would undeniably resolve the small sample issue and may enhance organisational consistency, but research suggests that mandatory attendance can undermine the ethos and effectiveness of peer-learning by

reducing autonomy, a key motivational driver in student engagement (Bryson, 2016; Ryan & Deci, 2017). Voluntariness was also essential in allowing us to analyse *why* students chose to attend or not, insights that would have been inaccessible under a compulsory model. Even if future iterations moved toward a more required structure, the current phase of voluntary participation remains crucial for understanding motivational patterns and identifying levers for improved design.

4.6. Perspectives

The present study covers only three academic years and, as shown in the results section, no faculty displays consistently significant effects across iterations. This limited temporal window naturally restricts the robustness and generalisability of the findings. A first direction for future research is therefore the continuation of longitudinal monitoring, both at the University of Liège and across other institutions implementing comparable peer-led schemes. Although no directly equivalent international dataset exists for PEPPS, it would also be valuable to explore whether partial comparisons could be developed with peer mentoring or buddy programs that share some of its transition-oriented characteristics. Long-term datasets are particularly important in peer-support research, as effects may only become more stable or interpretable after several cycles of institutionalisation (Colvin, 2007; Topping, 2005).

A second avenue concerns the extension of comparative evidence beyond the present local case. Rather than focusing again on the problem of small cohorts, future work could aim to strengthen the comparative basis on which PEPPS is interpreted, whether through replication in other faculties, through multi-site collaborations, or through partial alignment with existing peer mentoring and buddy-program evaluations. Such work would make it possible to clarify

which findings appear specific to the ULiège implementation and which may reflect broader dynamics of transition-oriented peer support.

More broadly, one of the main lessons of this study is precisely the value of structured comparison itself. Discussing participation, perception, performance, and price separately, but systematically through both a local and a broader lens, makes it possible to characterise PEPPS more precisely than a single outcome approach would have allowed. Future research on PEPPS-like schemes would benefit from adopting similar multidimensional frameworks, so that peer-led transition programs can be compared not only in terms of grades, but also in terms of their support logic, their relational profile, and their institutional cost-efficiency.

Moreover, this study highlights the pressing need for internationally comparable datasets on peer-led transition programs. Existing literature continually calls for greater methodological transparency and cross-institutional sharing to better understand the mechanisms underpinning peer support and student transition (Bryson, 2014; Thomas, 2012). Such efforts would not only advance knowledge but could also reinforce student engagement: strong evidence of impact is known to increase both institutional endorsement and student participation in support initiatives (Kuh et al., 2006). In this sense, expanding the empirical base on PEPPS-like programs has the potential to benefit both research and practice, ultimately enriching the broader field of peer-led learning.

Finally, a broader interpretive implication of these findings concerns the evolution of the PEPPS program itself. As originally designed, PEPPS was conceived as a transition-oriented scheme, with clearly defined themes and objectives centred on social integration, orientation, and adjustment to

university life. However, the present field data suggest that students consistently appropriate the program in ways that extend beyond these initial intentions, particularly by using it as a space to support their understanding of academic expectations and learning processes. From an ergonomics perspective, this gap between prescribed design and actual use is not unexpected. It reflects a classic distinction between the “task” as designed and the “activity” as performed (Guérin & Deniellou, 2006; Leplat, 1997). In this case, students actively reshape the function of PEPPS according to their needs, thereby revealing latent expectations that were not explicitly integrated into the program’s initial design. This observation opens an interesting perspective for future development. Rather than viewing this shift as a deviation, it could be interpreted as a form of implicit participatory feedback. PEPPS could thus evolve toward a more hybrid model, explicitly integrating elements related to academic understanding and learning, while preserving its core function of social integration. Such an evolution would ideally rely on a participatory design approach, involving not only students, but also program coordinators, faculty members, and institutional stakeholders. This would allow the scheme to be redefined in a more systemic way, ensuring alignment between its intended objectives, its actual uses, and the broader institutional ecosystem in which it operates.

5. Conclusion

The results obtained after the analysis of the data collected for the PEPPS program over the past three years (from September 2019 to June 2022) in seven faculties from the University of Liège indicate that the most frequently cited motivational elements regarding students' attendance relate to their will to learn and understand more, and their need for socialization. On the other hand, the most frequently cited reasons for not attending are a lack of time and a perceived uselessness of the scheme. For more attendance, students suggest organizing meetings that match their timetables and more organization from both faculties and buddies. No significant result was found regarding the scheme's impact on academic performance. Further studies need to be carried on proving if these results are generalizable to other universities in various contexts. To our knowledge, this article provides one of the first multi-faculty, multi-year participation datasets for a program other than SI-PASS but including it in a comparative perspective. As such, it contributes rare empirical contrast to the peer-learning literature and underlines the importance of documenting structurally diverse programs to enrich the field's comparative insights.

6. Appendices

1. Courses description

Law

a. SPOL1103-1: Histoire politique belge (Pr. G. Grandjean)
   https://www.programs.uliege.be/cocoon/20232024/cours/SPOL1103-1.html
b. PHIL1102-1: Introduction à la philosophie du droit (Pr. E. Delruelle)
   https://www.programs.uliege.be/cocoon/20232024/cours/PHIL1102-1.html

Medicine and Dentistry

c. BIOL2026-2: Biologie générale préparatoire aux sciences médicales, dentaires et pharmaceutiques (Pr. O. Peulen)
   https://www.programs.uliege.be/cocoon/20232024/cours/BIOL2026-2.html
d. PHYS3018-1: Bases physiques des sciences médicales, y compris les bases physiques de l'imagerie médicale (Pr. M. Hoebeke)
   https://www.programs.uliege.be/cocoon/20232024/cours/PHYS3018-1.html

Pharmacology

e. BIOL0847: Biologie générale préparatoire aux sciences biomédicales, Partim 1 (Pr. O. Peulen)
   https://www.programs.uliege.be/cocoon/20232024/cours/BIOL0847-2.html
f. PHYS0972: Bases physiques et mathématiques des sciences pharmaceutiques (Pr. G. Lumay)
   https://www.programs.uliege.be/cocoon/20232024/cours/PHYS0972-1.html

Kinesiology and Motricity

g. PHYS0511-4: Physique appliquée aux sciences du mouvement, Physique appliquée (Prof. L. Dreesen)
   https://www.programs.uliege.be/cocoon/20232024/cours/PHYS0511-4.html
h. BIOL0849-1: Biologie générale préparatrice aux sciences de la motricité, Partim 1 (Pr. D. Cataldo)
   https://www.programs.uliege.be/cocoon/20232024/cours/BIOL0849-1.html

Biomedical

i. BIOL0847-2: Biologie générale préparatoire aux sciences biomédicales, Partim 1 (Pr. O. Peulen)
   https://www.programs.uliege.be/cocoon/20232024/cours/BIOL0847-2.html
j. PHYS3038-1: Bases physiques des sciences biomédicales (Pr. M. Hoebeke)
   https://www.programs.uliege.be/cocoon/20232024/cours/PHYS3038-1.html

Veterinary Medicine

k. VETE0432: Mathématique et bases statistiques (Prof. F. Farnir)
   https://www.programs.uliege.be/cocoon/20232024/cours/VETE0432-4.html
l. PHYS3130: Physique I (Pr. D. Strivay)
   https://www.programs.uliege.be/cocoon/20232024/cours/PHYS3130-1.html
m. PHYS1960: Physique II (Prof. D. Strivay)
   https://www.programs.uliege.be/cocoon/20232024/cours/PHYS1960-1.html
n. CHIM9275: Chimie générale (Pr. J.-F. Focant)
   https://www.programs.uliege.be/cocoon/20232024/cours/CHIM9275-1.html

Sciences

o. MATH2007-1: Mathématiques générales I (Prof. F. Bastin)
   https://www.programs.uliege.be/cocoon/20232024/cours/MATH2007-1.html
p. CHIM0737-1: Chimie (Pr. R. Cloots)
   https://www.programs.uliege.be/cocoon/20232024/cours/CHIM0737-1.html

Transition

Study 3 strengthens the methodological progression of the dissertation by introducing a randomized controlled trial (RCT) designed to assess the causal effect of assignment to SI-PASS on student performance in a high-risk statistics course. This experimental approach responds to repeated calls in the peer-learning literature for stronger designs capable of distinguishing program effects from self-selection and other confounding factors (Dekker et al., 2023).

By relying on random assignment to SI-PASS or control conditions and analysing the data through multilevel regression modelling, the study provides a more rigorous test of SI-PASS effectiveness than observational comparisons alone. Rather than assuming that higher performance among attendees necessarily reflects program impact, this design makes it possible to examine whether access to the scheme produces measurable gains under controlled conditions, thereby addressing methodological concerns highlighted in recent reviews (Bengesai et al., 2023).

The inclusion of variables such as student motivation, adjustment, and engagement further supports a more nuanced interpretation of the results. Study 3 therefore constitutes a central methodological step in the dissertation: it does not merely test whether SI-PASS "works", but helps clarify under what conditions program availability, student participation, and academic outcomes can meaningfully be linked.

Study 3

Effects of SI-PASS on a high-risk course - A randomized controlled trial

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"Many studies used quasi-experimental study designs, and some authors suggest that studying SI using experimental designs will enhance the results in this area." (Dawson et al., 2014, p. 632)

Abstract

BACKGROUND*: SI-PASS is a structured academic support program employing successful later-year students to facilitate peer-learning sessions attached to high-risk courses, specifically here statistics for psychology at ULiège. The research translates as: How much does this method improve academic performance and impact socio-affective perceptions in first-year students?*

AIMS*: This study compares academic performance and socio-affective variables of first-year students in the experimental condition and the control condition.*

SAMPLE*: Participants were 245 freshmen for the experimental trial, and 985 for the quasi-experimental trial.*

METHODS*: Participants were assigned to either participate to the SI-PASS scheme or not during the first semester following a randomized controlled trial with stratified random assignment method. Then, the whole cohort enlisted for the course was analyzed to validate supplementary hypotheses.*

RESULTS*: The first step of the study reveals no difference between both groups on academic performance, unless the level of attendance is considered; nor does it identify any significant impact on socio-affective variables. The second step consisted in the comparison of the experimental group and the group of students who chose not to volunteer for SI-PASS and resulted in significant improvement in academic performance in favor of SI-PASS.*

CONCLUSIONS*: This delivered significant results in favor of the program but only when attendance is considered, thus offering empirical evidence that a genuine experimental design is likely to mitigate the effects found in a tradition of quasi-experimental designs. These results are valuable for the SI-PASS community, where randomized trials are still scarce, and for higher education institutions seeking evidence-based assistance.*

1. Introduction

Research shows that the transition from secondary school to university is a critical stage in educational journeys (Mayhew et al., 2016; Kovač, 2015; Johnston, 2010). This shift implies significant academic adjustments (Van Rooij et al., 2018; Wasylkiw, 2015; Aspelmeier et al. 2012) or adaptations (De Clercq et al., 2023) to various essential requirements (Trautwein & Bosse, 2017): students must acclimate to new teaching and learning methods (Noël & Parmentier, 1998), effectively manage a range of resources (Tampakis & Vitoratos, 2009) and services (Lowe & Wright, 2023), and build connections with peers to promote a sense of belonging within the academic community (Brooman & Darwent, 2014; Thomas, 2012). As failure and dropout rates remain very high - up to 60% of a student cohort - in French-speaking Belgium (Brunet et al., 2021) -, supporting academic performance and success remains a major priority for higher education institutions (Van der Zanden et al., 2018; Vanthournout et al., 2012; Upcraft, 2004), as student attrition carries direct psychological, organizational, and financial consequences (Jacquemart et al., 2023; Galand et al., 2020). Among the available forms of academic support (Delnoij et al., 2020; Feldman, 2005), SI-PASS (Supplemental Instruction Peer Assisted Study Sessions) stands out as one of the most widespread programs, with a well-established presence in over 30 countries (Malm et al., 2024).

1.1. Practice of SI-PASS

SI-PASS is a peer assisted learning program in which trained and supervised second-year students (usually called *leaders*) facilitate freshmen's one-hour weekly discussions on the content attached to a "high-risk course" (Martin & Arendale, 1992). The role of the leader is not to teach the group but to organize the interactions so that the students get used to learning together. SI-PASS uses a supplemental and non-remedial approach to learning by providing students

with additional opportunities to engage with course material and to develop disciplinary study skills and strategies (Strømmen-Bakhtiar et al., 2021).

1.2. Research on SI-PASS effects on performance

In 2022, SI-PASS celebrated its 50th anniversary since its inception at the University of Missouri-Kansas. Throughout the years, much research on peer-learning brought to the program an aura of efficacy regarding academic success. This overarching positive trend is noticeable in two comprehensive studies:

Dawson et al.'s systematic review (2014) covers the period 2001-2010. Among the 29 studies included, some aim to measure the effectiveness of the SI-PASS on three dimensions of the academic success:

- Final course grades (sixteen studies): sixteen studies used this dependent variable to compare students who were engaged in the program and those who were not.
- Course completion (five studies): while no precise count of studies that included this variable is specified, the authors do clarify that some of them resort to a dichotomous variable (pass/fail) for the high-risk course as a primary measurement.
- Assessment tasks (three studies): three studies focused on the identification of improvements in assessments other than the final marks.

Bengesai et al.'s meta-analysis (2023) covers the period 2010-2021 with a wider scope. They report that among the 1645 studies on peer tutoring found in the considered period, 21 studies were specifically focused on the SI-PASS program, collectively demonstrating, through a comparative analysis of participant against non-participant groups in quasi-experimental designs, a moderate impact of the program of $g_{Hedges} = +.40$ [.30-.50] on achievement.

Besides this positive perspective on the effectiveness of the SI-PASS program, both reviews highlight significant methodological flaws. They report inadequate control of the measured variables and emphasize the need for more robust experimental designs. Dawson et al. argue that, despite the listed positive effects, “ none is supported by a gold standard study involving random assignment to groups and sufficient detail about methodology, participants, and the SI intervention in practice ” (2014, p. 635). Similarly, Bengesai et al. express caution about the existing research, “ Despite the optimism surrounding peer learning in recent years and the increase in the number of studies, very few control studies have evaluated its effect on academic performance in the past decade ” (2023, pp. 12-13).

Between 2001 and 2010, Dawson et al. (2014) identify only one study with a proper controlled design: in 2009, Parkinson (2009) created an experimental and a control group based on voluntary participation. However, the contribution was based on a relatively small sample (n = 63) and the SI-PASS meetings described were not connected to a “high-risk” specific course but to the whole program of study for a degree in Biotechnology. Even if these studies report positive results, Dawson et al. (2014) highlight the difficulty of verifying their results due to lacks in the methodological information provided. Only seven studies allow to compute effect size. These effects ranged from d = .29 to d = .60. Note that these quasi-experimental studies do not account for the self-selection bias. The only experimental study cited (Parkinson, 2009) provides partial methodological information, both on the numbers of participants and on the criteria for assigning them to the experimentation. Finally, Dawson et al. (2014), point out the conflicts of interest of many authors of the studies carried out.

To be complete, Paloyo et al. (2016) conducted a study at an Australian university that assessed an SI-PASS program, a study that was neither included by Bengesai et al. (2023) nor by Dawson et al. (2014): a randomly selected subgroup of students, enrolled in fourteen first-year courses, over three semesters, was encouraged to attend SI-PASS sessions through an incentive (here, a chance to enter a draw and win a gift certificate of AUD 5000). The study found that students who attended the sessions had increased final grades and were more likely to pass the course than students who did not attend the sessions. This design, however, cannot be compared to the present study which sticks to the common SI-PASS principle of fully voluntary participation.

To ensure thorough coverage, the authors inspected literature produced from 2021 (the endpoint of Bengesai et al.'s review) to August 2023. This effort left unchanged Bengesai et al.'s conclusion that "very few control studies have evaluated the effect of SI-PASS on academic performance during this past decade" (2023, p. 13), with one noticeable exception: Dekker et al. (2023) who, through a sound controlled randomized trial, obtain significantly higher grades in favor of SI-PASS participants. While the methodology is similar to the present study, differences arise in the following aspects: a) focusing on a specific course, calculations were conducted across a mix of 10 courses, b) the research was conducted in an institution that would not be categorized as a "university" in Belgium, but as "vocationally-oriented" higher education, c) participants were offered seven meetings of 100 minutes, in contrast to twelve meetings of 60 minutes, and d) the average age of subjects was 20.57 years, as opposed to 18.76 in the present study.

1.3. Research on SI-PASS effects on socio-affective dimensions

Dawson et al.'s systematic review (2014) identifies five studies demonstrating the beneficial influence of the SI-PASS program on students' well-being and

sense of belonging/connectedness to the university. By providing additional support and guidance, the scheme helps alleviate stress and anxiety, thereby improving the overall well-being for students (Abegglen & Morris, 2015). In Martin & Arendale (1992) or Bronstein (2008), students engaging in peer-led sessions expressed decreased anxiety and increased confidence in their academic skills. These studies also revealed the program's heightened effectiveness among students at risk of dropout or those with a history of low academic achievement before enrollment (Hafer, 2001; Stansbury, 2001). Furthermore, Dobbie & Joyce (2009) proposed that students' increased comfort in asking questions freely during SI-PASS sessions contributes to these positive outcomes.

SI-PASS can also help promote a sense of community and connection among students, as these sessions are typically held in a group setting which provides students with the opportunity to interact with peers and build relationships with other students taking the same course. This sense of community can help enhance social integration, which is important for student well-being (Hayes & Fulton, 2019). This aspect is underscored in Verpoorten et al. (2021) with a notable 70% of students reporting SI-PASS meetings as positive experiences for socialization. Regarding students' engagement with the discipline, a study by Hockings (2009) showed that students who participated in peer-learning programs reported feeling more engaged and motivated in the course. The study also found that the program was particularly effective for students who were struggling with the course material or who had low levels of motivation prior to enrolling in the course. By providing additional support and guidance, peer-assisted learning can help to improve student engagement and motivation, which can have a positive impact on overall well-being (Hager, 2018). However, in contrast to the aforementioned observational studies, the randomized controlled trial conducted by Dekker et al. (2023) did not unveil

significant differences between groups concerning well-being and the sense of belonging scores.

1.4. Geographical and disciplinary gaps in SI-PASS research

The need for more research in diverse geographical regions, where SI-PASS is introduced, pertains both in Dawson et al.'s state-of-the-art for the studied period ("The majority of studies using entry scores were conducted in an American context", 2014, p. 623) and, for the subsequent timeframe, in Bengesai et al. (*"[…] most of the studies were conducted in the USA […]",* 2023, p. 13). Again, Dekker et al. (2023) represents a noticeable exception as it takes place in the Netherlands.

Disciplines and content domains also call for refined research on SI-PASS. Regarding statistics for psychology (the high-risk course selected for this study), the research landscape appears rather depleted. Only one research on SI-PASS in the context of a psychology course has ever been documented (Guarcello et al., 2017). Two quasi-experimental studies specifically focused on statistics were conducted, but for a statistical class in a business school (Szal et al., 2017) and for a chemistry class (Miller et al., 2004). Two of the three experimental studies involving randomly assigned students were carried out, for one, within the disciplines of chemistry and mathematics (Parkinson, 2009), and, for the other, in an education faculty with no included course related to psychology or statistics (Dekker et al., 2023). The third one (Paloyo et al., 2016) mentions three courses in statistics for business and one in statistics for psychology. However, as the data combines fourteen courses, no specific metrics for this course is available.

1.5. Hypotheses

The distinctive contribution of this study is threefold: a randomized controlled trial targeting a course of statistics for psychology in a Belgian context. Four hypotheses were tested.

1.5.1. Hypothesis 1: Effects on academic performance.

Hypothesis 1a: Freshmen from the experimental group will perform significantly better at the final exam than those from the control group. Hypothesis 1a was tested controlling for students' motivation, since participants from both groups volunteered for the SI-PASS scheme. Hypothesis 1b: Students from the experimental group will also outperform students who opted not to participate (freshmen in the same cohort who did not volunteer for the experiment). The combination of these two predictions helps determine if experimental and quasi-experimental methods will produce convergent or contrasting outcomes.

1.5.2. Hypothesis 2: Effects of the quality of implementation.

Hypothesis 2a: Students from the experimental group who attended a minimum of four meetings are expected to demonstrate significantly better performance compared to those with lower attendance. Early concerns, as noted by McCarthy et al. (1997), highlight the limitations of binary variables for attendance (*e.g.*, attending or not attending), suggesting the adoption of a discrete variable approach. Following this recommendation, Cheng & Walters (2009) reported that attending all meetings in their setting corresponds to a ten-fold increase in the odds of academic success. Previous quasi-experimental studies conducted at ULiège indicated a potential effectiveness threshold of six or seven participations. However, since these studies were kept internal, Hypothesis 2a chooses to adopt the figure presented in a published paper by Gattis (2002) which asserts that individuals who attended four or more SI-

PASS meetings performed better than those who opted not to attend. Beyond this tentative cut point of four meetings, hypothesis 2a also operates a correlational analysis between discrete attendance levels and final exam results. To consider the nested nature of the measures, an additional multilevel analysis was conducted to explore possible influence of group ownership in relation to a Hypothesis 2b, which posits that exam performance varies across different SI-PASS groups. This analysis aims to understand how group dynamics or leader-dependent aspects influence outcomes.

1.5.3. Hypothesis 3: Effects on socio-affective dimensions.

Students from the experimental group will perceive a significant improvement in their psychosocial well-being and academic adjustment. Along with the five studies mentioned in Dawson et al.'s systematic review (2014), the study inspects these effects through "socio-affective" variables. It allows to simultaneously deal with general well-being (positive/negative affects and somatization) and students' academic adjustment, including belonging/connectedness to the university.

1.5.4. Hypothesis 4: Effects on academic engagement.

Hypothesis 4a: Students attending SI-PASS sessions will use more intensively than the control group the online exercises recommended by the teacher. This hypothesis is introduced to get an insight about the place of a SI-PASS scheme in the larger learning "ecology" (Barron, 2004; Normak et al., 2012; Siemens, 2003) of a course and to explore patterns of engagement (Cole & Spence, 2012; Howard et al., 2019; Meehan & McCallig, 2015) with two different learning aids.

Hypothesis 4b: Similar to Hypothesis 1b, an extra comparison is performed between SI-PASS participants and those who also signed up for the course but

opted not to participate in the scheme. Likewise, it allows to see whether the experimental and the quasi-experimental methodologies yield similar or divergent results.

2. Methodology

2.1. Intervention

ULiège has a four-year experience in implementing regular SI-PASS schemes across four faculties (Verpoorten et al., 2021; Verpoorten & Jérôme, 2022). The groups of voluntary students are supervised by 2nd or 3rd year students (SI-PASS leaders), who undergo an initial six-hour training, receive a handbook outlining expected roles, activities, and mindset, and get reflective exercises and debriefings as in-service training, To secure a fair level of adherence to the SI-PASS specifics, two certified program supervisors conduct site visits to each leader during the semester, using an observation grid (Appendix 1) grounded in recommendations and quality standards from American and European SI-PASS centers. Analysis of these field observations over the years reveals minimal variability, indicating a good understanding and application of the instructions by the leaders. To further support compliance, one individual and two collective debriefings take place within the semester. Those monitoring actions allow assuming a reliable level of implementation fidelity (James Madison University, 2023), aligning with the fundamental tenets of the SI-PASS approach. Exit surveys, collected from both leaders and participants, corroborate overall compliance to the unique structured form of peer learning that SI-PASS embodies.

2.2. Targeted high-risk course

At the Faculty of Psychology, the course of "Descriptive and inferential psychostatistics is known by students as a "killer course" with a high rate of failure. The lecturer is aware of this and has, over the years, in addition to the two-hour lecture per week, created a supplemental aid for students: weekly online exercises were offered, featuring questions akin to those anticipated in the final exam. A total of 96 exercises were distributed across twelve chapters. Immediate automatic feedback was provided to students, helping to identify

and correct mistakes. Students had the freedom to attempt these online exercises at their convenience. Despite those efforts, the lecturer noticed that a significant number of students still appeared underprepared (in terms of "time on task") for the final exam. This is the reason why he welcomed a SI-PASS scheme in his course, without canceling the online exercises. Hypothesis 4 explores the complementarity/competition of this aid with SI-PASS sessions.

2.3. Schedule and participants

The experiment (Ethical Approval 2122-098) began on the welcome day of the academic year 2022-2023, introducing freshmen from the Faculty of Psychology to the SI-PASS program and the details of the upcoming experiment. All students interested in taking part in the study were informed that they would be allocated either to the experimental group (EG) which would benefit from the scheme during the first semester or to the control group (CG) which would participate to the program during the second semester. Much understanding was expressed by the students for two reasons: on the one hand, as future psychologists, they understood the value of a rigorous experiment and were keen on taking part in it as participants. On the other hand, students assigned to the control group were warranted a priority for participating in the SI-PASS scheme taking place in the next semester in a different course. Doing so alleviated a common criticism addressed to randomized trials, that is depriving a group of a possibly beneficial pedagogical intervention. Everything being clear, the candidates took the pre-test (Appendix 2) before being randomly assigned to the EG or CG. Students from the EG were also randomly assigned to one of the thirteen groups headed by one of the thirteen hired leaders. As with all SI-PASS programs at ULiège, the groups were designed to be stable: students assigned to a specific leader were not allowed to switch groups during the semester. This policy aims to promote a sense of identification among group members, including the leader,

and to cultivate mutual trust and consistent working habits deemed to develop a sense of belonging. The fixed groups convened twelve meetings throughout the semester, adhering to a recommended schedule where each course session was followed by a meeting later that week to discuss the course content.

2.4. Research design

The research implements a randomized controlled trial (RCT) with a stratified random assignment and a waiting list control group (Slavin, 2007) based on a convenience sample of students interested in participating in the intervention. The randomization of volunteers addresses the primary criticism raised by McCarthy et al. (1997) and reiterated by Dawson et al. (2014, p. 611) regarding motivation and the danger of self-selection bias in experiments: "More than a decade after McCarthy et al.'s (1997) critique of the literature, there is still limited research that controls for motivation, as distinct from prior academic achievement, when evaluating the effectiveness of supplemental instruction". In this case, both experimental and control group included students wishing to participate in the intervention. Additionally, in line with Dawson et al.'s (2014) recommendation to include students from diverse backgrounds, the study considered the following variables linked to students' profiles during stratified randomization to form equivalent pairs of students: gender, socio-economic status, and logical reasoning abilities. Students were not tested after the second semester because the targeted course was different from the course chosen in the first semester, both in terms of its subject matter (*e.g.* it did not deal with statistical analyses) and its nature (*e.g.* it did not systematically involve exercises and practical work) Such comparison would not have made much sense.

The dependent variables are the grade obtained by students at the final exam (Hypotheses 1 and 2), students' perceptions on academic adjustment and well-

being (Hypothesis 3), and the advantage that students took off the other aid (online exercises) offered in the course during the semester (Hypothesis 4). The independent variable is the exposure to a SI-PASS scheme offered in the high-risk course of statistics for psychology. A sensitivity analysis in G*Power indicated that with a power of .80, a sample size of 245 (120 in control group and 125 in treatment group) would detect group differences with an effect size of Cohen's d = .36 (t-test, difference between independent group means, two-tailed test and an alpha of .05). With the current sample size of 184 students (92 in control group and 92 in treatment group) after attrition, the detectable effect size increases to .42.

2.5. Data sources

2.5.1. Sociodemographic data

The pretest collected self-reported data on gender, age, and profession of both parents. Socio-economic status (SES) was inferred from the highest occupation of either the mother or father, using the one-digit ISCO-08 code (International Labour Office, 2012) and converted into four categories.

2.5.2. Socio-affective data: SACQ

The pretest encompassed an adjusted French-translated version (Carayon & Gilles, 2005) of the "Student Adaptation to College Questionnaire" (SACQ, Dahmus et al. 1992), intended to measure possible influences of SI-PASS in the areas of social well-being and academic adjustment. Considering possible concerns related to a potential North American-centric bias, all item formulations were double-checked by linguistic and education experts. The final questionnaire (Appendix 3) was structured as follows:

- Academic Adjustment: evaluates the student's ability to face academic standards.
- Application: perception of efforts put into academic work.

- Performance: perception of academic achievements.
- Environment: satisfaction towards academic environment (this dimension is only present in the post-test because its items made no sense at the very start of a first year at university).
- Social Adjustment: evaluates the student's ability to face social standards.
- Attachment: perceived level of engagement towards the academic institution.
- Personal-emotional adjustment: this dimension was replaced by three dimensions from the Multidimensional and Systemic Survey on Climate and Well-being at School (MSSCWS) - upper secondary students (Francotte et al., 2023), namely positive affects/negative affects, climate, and somatization. This substitution was necessary since this SACQ sub-scale probes into the respondent's personal experience at the university, which would have been incongruent given that the pre-test was conducted on their official first day at university.

2.5.3. Logical thinking: TOLT

Since the intervention was implemented within a statistics course, controlling students' logical skills and proficiency in probabilities, two predictors of students' performance in statistics (Jaing et al., 2010; Vázquez & de Anglat, 2017) was the most relevant measure one could take. The "Test of Logical Thinking" (TOLT, Tobin & Capie, 1981) was administered, after personal contact with the authors, as a section of the baseline pretest. The ten-items questionnaire was designed to gauge formal reasoning ability within a limited completion time. Internal consistency analyses (*KR-10* = 0.87) attests for the good reliability of the TOLT test.

2.5.4. Participation data

Throughout the semester, each SI-PASS leader was tasked with maintaining a detailed record of student participation. This documentation served to monitor attendance, tally the total number of sessions attended by each student, and pinpoint the specific meetings they participated in. This data collection was essential for analyzing and testing Hypothesis 2. Students' involvement in the weekly online exercises was monitored through the institutional Learning Management System. Basic learning analytics allowed for the calculation of individual students' participation rate (the number of exercises each attempted to solve).

2.5.5. Final exam grades

The final exam grades (scores from 0 to 20), provided by the course lecturer, were used to measure the students' achievement in the targeted course. The Cronbach's reliability coefficient for the 9-items exam is α = .84, thus indicating good internal consistency.

2.5.6. Post-test on socio-affective data

The post-test is identical to the pre-test, excluding only demographic items and the TOLT test. The comparison of pre- and post-test for the French version of the SACQ (Carayon & Gilles, 2005) yielded satisfactory internal consistency scores (Appendix 4), confirming the good psychometrical properties of this slightly adapted instrument. Similar analyses were applied to the MSSCWS scale dimensions producing consistent Cronbach alphas (Appendix 5).

2.6. Data processing

All statistical procedures were executed with a double-blind approach, as both researchers did not know which conditions was experimental and decided to analyze data on their own before comparison. Minor disparities noted between

the two independent researchers (in terms of rounding of found value to the hundredth) were attributable to the statistical tools employed (SAS 9.4 and Jamovi 2.3.21 with packages ‘JMV’, ‘Descriptives’, ‘corrMatrix’, ‘ttestIS’, ‘contTables’) and to the management of attrition.

3. Results

3.1. Analytical sample

On the welcome day (September 14th), 245 students expressed interest in being part of the SI-PASS scheme attached to the targeted high-risk course and took the pretest (Appendix 9). Among those, 184 passed the final exam (92 in each group). For Hypothesis 1 analyses, all the students who took the final exam, even those who did not take the post-test on socio-affective variables as well (26 in the control group and 15 in the experimental group) were kept to maximize power. The post-test on socio-affective variables was filled in by 160 students (86 in the experimental group, 74 in the control group). For Hypothesis 3, only the subjects with complete datasets on socio-affective variables were kept. This loss of participants impacted in a non-significant way the groups equivalence established at baseline (Table 1 & 2). The large proportion of women in the sample reflects a common reality in Belgian psychology faculties. Correlation tables can be found in appendices 6 and 7, confirmatory factor analyses for the two scales in pre-test and post-test can be found in appendix 8. Results of the confirmatory factor analysis performed on the pre-test display a X^2 (1106) = 2163.6, $p < .001$, CFI = .634, TLI = .61, SRMR = .096, RMSE = .078; and on the post-test a X^2 (1297) = 2494, $p < .001$, CFI = .678, TLI = .658, SRMR = .097, RMSE = .078.

Table 1 - Groups baseline equivalence on sociodemographic variables used for the stratified randomization.

Characteristic	*n*	Control group Sample % or *M (SD)*	Treatment group Sample % or *M (SD)*	Test	*p*
Gender	182	7.69 %	12.09 %	$X^2(2, 182) = 1.30$	.52
Age	184	19.25 (4.18)	18.36 (1.13)	t(104)* = 1.97	.05
SES	184	1.87 (1.02)	1.99 (1.02)	t(182) = 0.43	.43
TOLT (Score)	184	8.85 (3.89)	9.27 (4.20)	t(182) = 0.48	.48
TOLT (Success rate)	184	55.43 %	57.61 %	$X^2(1, 184) = 0.09$	.77

Note. The percentages indicated for the gender variable represent the percentage of boys in our sample; the percentages indicated for the TOLT (Success Rate) variable represent the percentage of success in our sample; * Welch's approximation was preferred to the classic Student's *t*-test to take unequal variances into account.

Table 2 - Groups baseline equivalence on socio-affective variables.

Dimension	*n*	Control group *M (SD)*	Treatment group *M (SD)*	*t*	*p*
Performance	156	16.5 (3.35)	16.0 (3.13)	$t(154) = 0.99$	.33
Environment	NA	NA	NA	NA	NA
Social Adjustment	154	19.0 (4.72)	20.3 (4.63)	$t(152) = 1.77$	.08
Application	157	29.3 (3.57)	29.2 (3.65)	$t(155) = 0.23$	.82
Attachment	158	19.0 (5.72)	18.0 (5.72)	$t(156) = 1.01$	.31
Affects	157	20.2 (4.43)	20.1 (4.64)	$t(155) = 0.15$	.88
Climate	158	18.6 (5.09)	18.0 (4.22)	$t(156) = 0.82$	.41
Somatization	156	23.3 (5.14)	22.6 (5.54)	$t(154) = 0.82$	.41

Note. NA = not applicable and relates to the sub-dimension that was only measured at post-test. Maximum *n* was used here to best represent participants' data.

3.2.1. Hypothesis 1 - Academic performance

To test Hypothesis 1a, a *t*-test was performed between the experimental and the control group. Results show that the model is nonsignificant ($t(182) = -0.18$, $p = .86$), with a higher mean in favor of the experimental group ($M = 6.48$, $SD = 4.36$). As mentioned in the methodology section, the minimal detectable effect size in this study is .42. Our effect size is Hedges' $g = .03$. These results do now allow the rejection of the null hypothesis. When contrasting the academic performance of the experimental group with that of

all students enrolled in the course (Hypothesis 1b) who took the exam, but who did not volunteer for the scheme, the *t*-test, this time, displays a significant result: ($t(696) = 3.15$, $p = .002$). Effect size is Hedges' $g = .26$.

Taking the mark at the exam as dependent variable, a further multiple linear regression was performed, using the following variables as predictors: experimental group, SES category, TOLT score. Results show that the general model is statistically significant ($F(3,180) = 20.87$, $p < .001$) with an $R^2 = .26$. However, when taken apart, only the TOLT score reaches statistical significance ($F(1) = 63.15$, $p < .001$). The other two predictors, namely the experimental group and the socioeconomic status score fail to reach statistical significance (Table 3).

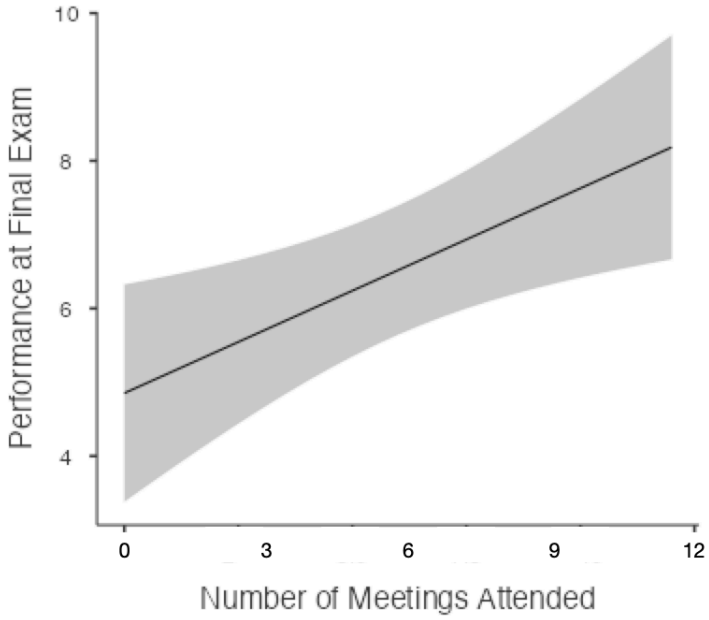
Table 3 - Linear Regression of the independent variables Group (SI-PASS vs. Control), Socio-Economic Status (SES) and logical thinking (TOLT) on the dependent variable "performance at the final exam".

Predictor	Estimate	*SD*	*t*	*p*
Intercept	1.44	1.07	1.36	.18
Intervention (SI-PASS 2 - Control 1)	0.11	0.59	0.19	.85
SES	0.07	0.3	0.25	.81
TOLT	0.57	0.08	7.55	< .001

3.2.2. Hypothesis 2a - Attendance level

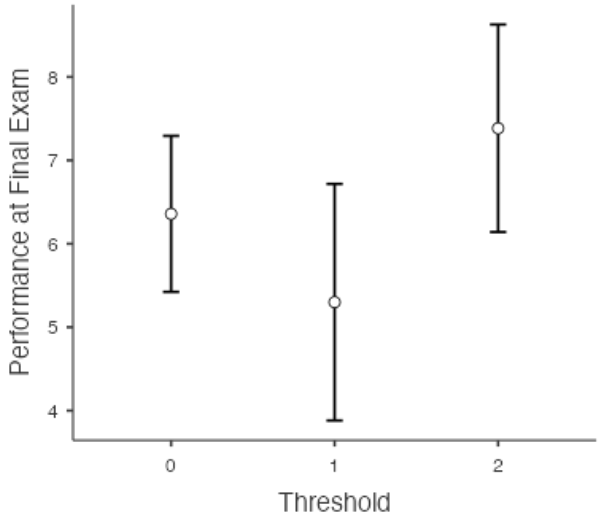
The linear regression calculated on participation in SI-PASS meetings exhibits a positive correlation ($r(90) = .28$, $p = .007$) between students' attendance at SI-PASS meetings and their exam performance (Figure 1).

Figure 1 - Correlation between performance at final exams and number of attended meetings within the experimental group.



Linear contrasts performed between all levels of attendance show that students must have attended at least 5 meetings to see their academic performance significantly improve ($t(90) = 2.33$, $p = .022$) with a mean difference of 2.08 on a 20-point scale. Figure 2 displays the mean differences between the control group (0; $n = 92$), those who attended fewer than 5 meetings (1; $n = 40$, $M = 5.3$, $SD = 3.82$), and those who attended at least 5 (2; $n = 52$, $M = 7.38$, $SD = 0.63$).

Figure 2 - Mean (95 IC95%) Differences between control group (0), experimental group <5 meetings (1), and experimental group ≥5 (2) in attendance to SI-PASS meetings.



3.3.2. Hypothesis 2b - Group ownership

The multilevel analysis does not detect any differences when group ownership is considered, as reflected in the dotplot (Figure 3) where each individual grade is given as a dot and the group mean grade as a diamond. Table 4 presents results of multilevel analyses conducted. It shows that there are no between group (leader) variance and that the only independent variable that influences students' exam results is the score these same students obtained on the TOLT, the logic test used as a pre-test. Analyses were performed on R (version 4.3.1) using the lme4 package (Bolker, 2024) and following the recommendations of Finch et al. (2019).

Figure 3 - Dotplot of students' performance at the final exam in relation to their leader.

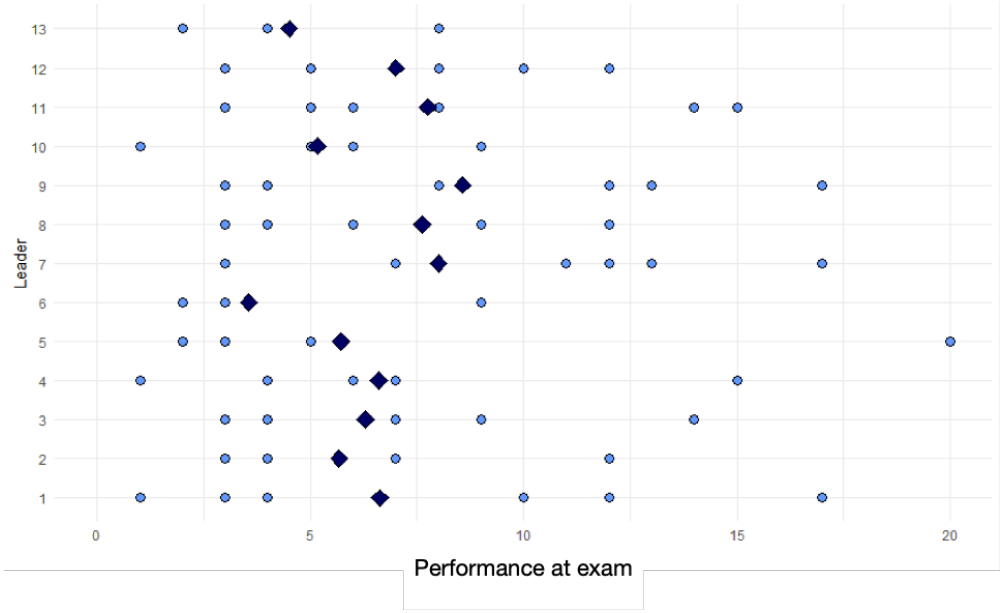


Table 4 - Two-level regression analyses of treated effects of performance at exam.

Effect	Parameter	Performance at exam			
		Model 1	Model 2	Model 3	Model 4
Fixed effects					
Intercept	γ_{00}	6.42 (0.34)	6.24 (1.07)	1.38 (1.11)	1.56 (1.31)
Intervention (=1)	γ_{01}		0.12 (0.68)	-0.12 (0.59)	-0.11 (0.59)
Tolt	γ_{02}			0.58*** (0.07)	0.57*** (0.08)
HISEI	γ_{03}				-0.07 (0.30)
Random effects					
Leader variance	e_{0ij}	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Student variance	μ_{0j}	20.97 (4.58)	21.08 (4.59)	15.73 (3.97)	15.82 (3.98)
Total variance	$e_{0ij} + \mu_{0j}$	20.97	21.08	15.73	15.82
Goodness of fit					
AIC		1087.1	1096.7	1036	1038.2
BIC		1089.0	1101.9	1052	1057.4
Deviance		1081.1	1081.0	1026.2	1026.2
Model of reference			Model1	Model1	Model 1
$\chi 2$ fit improvement (Df)			0.03 (1)	54.85 (2)	54.91 (3)
p-value			.86	< .001	< .001

Note. Standard errors are presented in parentheses. All p values in this table are two-tailed.

3.4. Hypothesis 3 - Socio-affective dimensions

Table 5 displays the effect sizes of all dimensions in the post-test when comparing the two groups. No *p* value reaches significance level, thus failing to reject the null hypothesis.

Table 5 - Comparison of control and experimental groups in post-test on socio-affective variables.

Dimension	*n*	Control *M (SD)*	Treatment group *M (SD)*	*t*	*p*
Performance	159	16.3 (3.52)	15.6 (3.36)	$t(157) = 1.12$	.27
Environment	160	15.04 (2.37)	14.44 (3.06)	$t(158) = 1.37$	.17
Social Adjustment	157	21.46 (4.78)	21.69 (4.54)	$t(155) = -0.31$	.76
Application	159	16.22 (5.85)	16.51 (5.06)	$t(157) = -0.34$	.74
Attachment	160	27.46 (5.13)	27.48 (4.94)	$t(158) = -0.02$	.98
Affects	155	22.31 (4.60)	21.75 (4.61)	$t(153) = 0.75$	.45
Climate	151	16.79 (4.54)	16.64 (4.69)	$t(149) = 0.2$	.84
Somatization	153	23.66 (4.58)	22.80 (5.76)	$t(151) = 1.01$	.32

Note. Maximum n was used here to best represent participants' data.

3.5. Hypothesis 4 - Patterns of engagement

No statistical difference was found in engagement with the online exercises (number of online exercises completed, irrespective of the accuracy of the answers) between the groups ($t(182) = 0.48$, $p = .63$). Yet, a correlation matrix calculated for SI-PASS students only reveal a significant relationship between their attendance at meetings and their interaction with online exercises ($r(90) = .33$, $p = .001$) (the more students attend meetings, the more they engage with online exercises, and/or the more students engage in online exercises, the more they attend meetings). Students attending more meetings also engage more frequently with online exercises (Table 6). As expected, there's a robust and significant correlation between students' interaction with online exercises and their exam performance ($r(184) = .75$, $p < .001$).

Table 6 - Means of online exercises done according to meeting attendance.

Meetings Attendance	*n*	*M*	*SD*
0	15	9.8	10.9
1	9	18.45	19.23
2	7	23.95	23.44
3	3	25.13	19.58
4	6	19.08	15.25
5	3	28.25	10.58
6	6	11.86	19.16
7	2	34.62	31.24
8	5	35.35	15.58
9	8	39.63	28.1
10	9	19.6	13.8
11	12	35.47	25.1
12	7	25.61	15.05

An exploratory analysis, comparing students who participated in the program to all other students enrolled in the targeted course, was conducted for this hypothesis similarly to the first one. This time, the *t*-test between SI-PASS students ($n = 184$, $M = 24.31$, $SD = 19.97$) and all other students ($n = 801$, $M = 10.76$, $SD = 17.54$) turns out to be significant ($t(983) = 9.2$, $p < .001$, $d = .72$). Results with these two groups are again different from the ones obtained within the randomized controlled trial.

4. Discussion

Research on SI-PASS effects lacks studies employing randomized trial experiments. The present study developed such an experimental design deemed to get more valid results than most of the prevailing quasi-experimental studies. Results related to each hypothesis are now discussed.

4.1. Hypothesis 1 - Academic performance

In contrast to the predominantly quasi-experimental methodological paradigm of the field (Armentor, 2019; Fayowski & MacMillan, 2008; Moore & LeDee, 2006), a rigorously designed randomized experimental plan failed to demonstrate higher performance among students participating in SI-PASS. The first hypothesis cannot be confirmed. However, when reverting to a quasi-experimental approach-comparing SI-PASS participants with students who took the exam without prior engagement in the peer-learning scheme (*e.g.*, all enrolled students excluding those in the control group), a significant performance disparity appears. This result aligns with Cheung & Slavin (2016) observation that quasi-experimental studies tend to report larger effect sizes than randomized experiments, raising broader concerns about the influence of research design on the evaluation of educational programs. When looking for a possible explanation, the role of intrinsic motivation in academic success could be invoked as one potential confounder. While all participants in the randomized trial were volunteers, the “all-comers” group likely included a higher proportion of students with uncertain commitment, potentially more prone to underperformance, thereby accentuating the contrast with the experimental group and leading to significant differences. These findings invite to caution when interpreting results from quasi-experimental studies within SI-PASS research. They also highlight the need for careful consideration, especially in the context of leader training and scheme promotion: tempting taglines making simplistic links between SI-PASS and

academic success might be deceptive, unless nuance is added to the discussions.

4.2. Hypothesis 2 - Attendance threshold and group ownership

Results regarding the second hypothesis come as a nuance to the lack of effect recorded for the first one, by revealing a cut point (five participations) from where effects can be significantly traced in the exam grade (Figure 2). Strictly speaking, the second hypothesis, which had located this inflection point at four participations, following Gattis' proposal (2002), is not confirmed. However, its rationale subsists. The transformative power of SI-PASS is neither automatic nor instantaneous. As already noticed by McCarthy et al. (1997), the binary dyad "participated" *versus* "did not participate" misses the point that a certain level of engagement is needed to produce effects. This observation is further substantiated by Figure 1, which portrays a trend demonstrating that although lower levels of engagement fail to attain statistical significance, students who exhibit heightened commitment to attending SI-PASS meetings tend to perform better in the exam. The implications are immediate: any endeavors aimed at improving the support to students should not involve altering the SI-PASS scheme itself but directed towards encouraging students to elevate their level of participation in the weekly sessions.

The current body of literature does not conclusively fix the exact number of SI-PASS sessions students must attend to significantly benefit from the program. Dancer et al. (2015) tend to relate the optimal number of meetings needed to contribute to academic success to factors such as gender, local *vs.* international student status, etc. In any case, the optimal attendance level likely varies across different contexts. This context-dependent variation is illustrated by evidence from the only other randomized controlled trial so far, which contrasts with the findings of the present study. Dekker et al. (2023) noted a

substantial impact on performance after > four 100-minute sessions for about 35.7% of participating students, in contrast to the five 60-minute sessions required in this study. Determining an ideal number of sessions for substantial improvement thus remains an open question for future research. This inquiry is complex, as it involves exploring nuanced aspects of the learning process. For instance, it remains conceivable that even minimal participation in SI-PASS sessions, if oriented towards strategic learning - a deviation from the true spirit of SI-PASS - could result in improved exam grades. In contrast, the effects that take longer to manifest might be associated with deeper understanding (Phan, 2009). An intriguing angle is explored by Malm et al. (2021a) in this respect. They investigate the surface/deep nature of SI-PASS through descriptive verbs used by participants, offering insights into the qualitative aspects of the program. Rigorous multidimensional documentation of various SI-PASS implementations could shed light on the impact of different intervening factors. With their meta-analysis of 28 peer-led learning research studies conducted from 1993 to 2017, Zha et al. (2019) offer an interesting example of such refined investigation as their work deliberately focuses on specific considerations: effects of the leader's training, task type, and session duration. In the same vein, a recent qualitative study by Dekker et al. (2025) focused on the understanding of perceived efficiency of SI-PASS on fourteen students. Three elements emerged from the interviews, namely: the use of effective study techniques, collaborative learning, and pedagogical climate. Besides these contextual parameters, refining the profiles of the students for whom this specific support can be beneficial also opens the door to personalizing support programs, a critical aspect of enhancing educational outcomes.

4.3. Hypothesis 3 - Socio-affective dimensions

Previous studies (Abegglen & Morris, 2015) have emphasized that one of the effects of the program relates to the social ties students build from weekly interactions with their peers. However, the dimensions tested in this research using both the SACQ and MSSCWS questionnaires revealed no significant difference between the control and experimental groups, consistent with the findings of Dekker et al. (2023). This outcome does not validate the third hypothesis. Should this be surprising or disappointing? Not necessarily. When summoning the classical conditions for a successful first year as historically established by Tinto (*e.g.* academic integration and social integration), SI-PASS is right from the start oriented towards the former, with socialization gains as welcomed by-products or fringe benefits which naturally emanate from the assembly of unfamiliar students during weekly sessions and the inherent SI-PASS approach encouraging discussion and interaction. Expecting too much of socialization outcomes from a program primarily centered on mastering disciplinary academic content and mindset could overlook the fact that other peer-support initiatives, such as buddy or mentoring programs specifically tailored to enhance social integration (Larose & al., 2011), are more fittingly employed for such a purpose.

4.4. Hypothesis 4 - Profiles

Generally, SI-PASS schemes are part of a broader array of support mechanisms available for a course, potentially functioning in either complementarity or competition. What is the place of the SI-PASS program in such a learning ecology? Results show that there is no significant difference between both groups in terms of engagement with the online exercises. However, SI-PASS students who show the greatest levels of participation in meetings are also those who engage the most with online exercises. From these findings, one could think that those who display motivation for one course support tend to

display it across other supports (Meehan & McCallig, 2015), pointing towards a congruence in the behavioral pattern displayed. In contrast, when a quasi-experimental approach is used to compare students who participated in SI-PASS to those who took the exam without showing initial interest in the peer-learning scheme (*e.g.* not the control group), a significant difference emerges between the groups. Further research is needed to explore this phenomenon and attest for the existence of intrinsic motivation in the consistent use of academic aids made available to students (Van Nuland et al. 2010). This internal disposition is proposed as a plausible explanation, though it should be noted that "motivation" is a broad term encompassing various constructs such as self-efficacy, attribution, goal orientation, and task value (Roozen et al., 2024; Trevino & De Freitas, 2014; Vu et al., 2024), which this study was not designed to disentangle. Moreover, while motivation has been extensively studied in educational contexts (Galand & Bourgeois, 2006; Lieury & Fenouillet, 2013; Viau, 2009), its influence has been questioned. For instance, the meta-analysis conducted by Credé et al. (2010) suggests that class attendance is a stronger and more reliable predictor of academic success, with only a weak to moderate relationship with student motivation (p. 281, 287). While motivation is discussed here not directly in relation to grades, but as the underlying factor driving two forms of observable (non-)engagement in the course (SI-PASS attendance and online exercises), it would be worthwhile to incorporate class attendance (Leclercq & Glowacki, 2005) into future research on SI-PASS. This is especially relevant considering that at the University of Liège, it is part of the leaders' official duties to encourage students to attend classes before joining their SI-PASS group, ensuring they fully benefit from such collaborative gatherings. Unfortunately, data on class attendance was not collected in the present study. In their extensive literature review of student support actions, Delnoij et al. (2020), while acknowledging peer mentoring as

a promising intervention to resolve the problem of non-completion, highlight, on the motivation side, the "contradictory results" (p. 7) regarding the link between motivational factors and retention in (online) higher education, which underscores the need for more precise research on this aspect in the context of SI-PASS schemes. This call for further investigation is echoed in the recent review by Vu et al. (2024), which focuses on the "motivation/achievement" reciprocity and concludes that essential factors in this dynamic may not yet have been fully captured, motivation being one potential confounder.

4.5. Limitations and further work

The primary limitation concerns the sample size. Although it isn't exceedingly small, it inherently stems from a finite student population associated with a relatively modest-sized faculty. This would not be a serious problem if other studies had found large effects. However, as indicated by the sensitivity analysis, the sample size of the present study only allows to detect medium effect sizes (d = .42) with an adequate power of .80 and is therefore barely acceptable for the average effect found in quasi-experiments (g = .4). The achieved power to detect similar effect as the one found in Dekker et al.'s RCT study was significantly lower (the achieved power to detect an effect size of d = .26 was exactly .42 with the current sample size), such that the results of the present study cannot rule out real effect sizes in the range of those observed in Dekker et al.'s study. It is also worth noting that the Intra-class Correlation Coefficient (ICC) was zero, which fortunately maintained the study's statistical power. Had the ICC been greater than zero, the power would have been significantly reduced. Taken together, this experiment's constraints might also indicate that the real effect size could be closer to the g = 0.26 (or even lower, depending on attendance) found than the moderate g = 0.4 usually found in quasi-experimental designs. Consequently, the study doesn't fully overcome the warnings raised by McCarthy et al. (1997), Ashwin (2003b), or Kochenour

et al. (1997) regarding the “anecdotal” and “small or non-representative” sample sizes frequently seen in SI-PASS research. Recent developments in the field of educational measurement suggest that in the realm of education, many interventions might yield effects, but at a very modest magnitude (Hill et al., 2008; Kraft, 2020). Thus, test sensitivity becomes even more crucial than ever before. A second limitation relates to the composition of the sample. The higher representation of female participants can be attributed to the demographic distribution within the Faculty of Psychology. This gender skew might also tangentially echo findings from Peterfreund et al. (2008) and Hodges et al. (2001a, 2001b), suggesting that more females tend to enroll in SI-PASS programs. Consequently, the generalizability of results to faculties with dissimilar gender distributions can be hampered. A third limitation touches upon the second factor of the SACQ scale, Academic Adjustment (Environment), which could only be assessed in the post-test phase. It might have been beneficial to establish a pre-test for this aspect, perhaps through inquiries about students' anticipation regarding the upcoming semester. Another limitation concerns previous education: students’ GPA could not be obtained, and proxies were used instead. The last limitation is related to engagement with the course markers. The current study uses two of them: attendance to SI-PASS sessions and diligence for doing the online exercises. The attendance to the lectures would have been a natural and critical indicator of engagement as well. Unfortunately, this presence is never tracked at ULiège.

Future investigations should focus on more detailed observations regarding the content, structure, interactions within SI-PASS meetings. These extra insights would trigger the development of new measures and comparability options of schemes’ quality against performances and profiles. Furthermore, exploring the dynamics of competition and complementarities among various learning support mechanisms in high-risk courses warrants thorough examination. In

their article, Dekker et al. (2023) also introduce an interesting section “Costs-effectiveness of the intervention”, presenting various assessments of the program. This goes beyond the typical focus on efficacy to include a consideration for efficiency. In lending support to this line of inquiry, which extends beyond SI-PASS to encompass all support programs and educational public policies, a rough calculation is offered for comparative purposes. In the present study, the cost per student, accounting solely for leaders' payment, is 99€ per term, with additional expenses for training, supervision, monitoring, reporting, and administrative services yet to be factored in. One last element that needs further investigation relates to intrinsic motivation. For both the first and the fourth hypotheses, when a supplementary analysis is performed with the so-called all-comers, statistical significance is reached. As the effect sizes for mean group differences are clearly higher in the supplementary analyses, this drastic change does not seem attributable to the sample sizes. A mediator variable, such as motivation, probably explain these significant differences between groups when tested in a quasi-experimental design. When two groups of motivated students are compared, there is no difference in terms of academic performance or engagement with supplementary material (or, more precisely, for a significant difference to emerge, it needs to be driven by “super-motivated” students, here the ones attending more than 5 sessions). However, once a comparison is made between the motivated students who attended the scheme and the rest of the cohort who did not display initial interest, these two differences become statistically significant. The place of motivation ought to be studied in more detail on further work to truly understand its role in academic achievement for peer-learning students (Fredricks et al., 2004).

5. Conclusion

Literature on SI-PASS now includes two full-fledged randomized trials: Dekker et al.'s (2023) and the present study. While Dekker et al. (2023) confirm the positive effect on average grades, consistent with many previous quasi-experimental investigations, the present research cannot account for the positive effect previously found. Both studies identify a critical threshold in attendance. It is reasonable to assume that thresholds and results in general vary based on targeted courses, attendee profiles (for instance the mean age is different between the two randomized controlled trials) and dynamics that unfold within SI-PASS sessions in terms of interactions and mastery learning. Further qualitative, observational, and controlled research is welcome to delve deeper into these aspects. Such explorations are essential for refining the understanding of SI-PASS, as well as other forms of academic support, and for putting into perspective their efficacy, efficiency, and personalization.

6. Appendices

1. Observation grid

Leader name
Meeting number
Number of students attending
Total meeting duration

Opening of the meeting (15 min.):

		Adher. Y/N	**Quality 1-5**	**Respons. 1-5**
1.1	The leader communicates the agenda of the session to the students (SI-PASS principle)			
1.2	The leader completes the agenda according to the needs expressed by the students (SI-PASS principle)			
1.3	The digital environment is conducive to exchanges between connected people (leader and students)			

Comments (points 1.1 to 3):

Learning Environment:

		Adher. Y/N	**Quality 1-5**	**Respons. 1-5**
2.1	The leader behaves as a peer in order to create an informal and relaxed learning climate for the students			
2.2	The leader encourages all students to participate (SI-PASS principle)			
2.3	The leader equitably distributes time between students and/or subgroups of students (SI-PASS principle)			
2.4	The leader avoids monopolizing speaking time (SI-PASS principle)			
2.5	The leader refrains from any comments regarding the judgment and ensures that the students do the same			
2.6	The leader uses encouraging words whenever warranted			

Comments (points 2.1 to 6):

Learning Facilitation:

		Adher. Y/N	Quality 1-5	Respons. 1-5
3.1	The leader avoids transmitting or exposing the material as a teacher would (SI-PASS principle)			
3.2	The leader redirects student questions to the group as much as possible (SI-PASS principle)			
3.3	The leader regularly uses reflective pauses to allow students to process information in depth (SI-PASS principle)			
3.4	The leader strives to check the students' understanding (invitations to reformulate, to offer examples/analogies/applications, etc.) (SI-PASS principle)			
3.5	The leader chooses activities that promote knowledge application, problem solving and/or critical thinking			
3.6	The leader refers students to the course materials as much as possible (manuals, course notes, exam sheets, etc.)			
3.7	The leader suggests study strategies adapted to the subject			
3.8	The leader recognizes, if necessary, his mistakes or the limits of his knowledge			
3.9	The leader respects the planned timing for the session: - 20 mins. discussion in pairs or small groups - 15 mins. feedback and discussion together			

Comments (points 3.1 to 10):

End of the meeting (5-10 min.):

		Adher. Y/N	Quality 1-5	Respons. 1-5
4.1	The leader allows time to close the session			
4.2	The leader encourages students to participate in future sessions			
4.3	The leader encourages students to participate in the lesson			

Comments (points 4.1 to 3):

Recommendations for the leader:

Students Engagement:

		1-5
5.1	Students are focused during the session	
5.2	Students collaborate/interact with each other	
5.3	Students do their best to solve the exercises	
5.4	Students actively participate in discussions	
5.5	Students ask relevant questions	
5.6	The students persevere in the effort	

Comments (points 5.1 to 6):

General comments:

2. Test administration script

1. *Launch*

Hello, my name is XXX and I am here to give you a questionnaire to participate in this year's SI-PASS program. Please turn off your cell phones and other electronic devices.

You are going to participate in a study on SI-PASS schemes within the University of Liège. This peer-learning program is used in other countries, including the United States, Canada, the United Kingdom, Sweden, etc. The questionnaire that we invite you to complete will allow you to be fairly distributed among the groups necessary for the smooth running of the study.

This study is important because it will give us insight into how you acclimate to the university environment as first-year students. This is a significant change that requires adapting to a new way of operating than the one you experienced in secondary school. As your responses will help to influence how first years are received, we ask that you respond as honestly as possible.

To ensure that you all receive the same instructions, I will read them to you:

If paper version By now, you should have the questionnaire and a pen or pencil on your desk. If you're missing anything, raise your hand and tell me, I'll give it to you.

If online version By now, you should be able to answer the questions provided to you online. If you have any difficulty logging in, raise your hand and let me know, I will provide you with a paper version of the questionnaire.

You have one hour to complete the entire questionnaire. If you have a question, please raise your hand so I can answer it.

2. *Finish*

I will now collect the questionnaires and the pencils or pens that I lent you. Please remain seated and calm until I have collected everything and before turning your cell phones and other electronic devices back on.

Thank you for participating in this study, you will receive an email from us in a few days to assign you a study group.

Thank you and welcome back to the university!

3. *Feedback (online)*

Dear respondent,

The objective of this questionnaire is to collect your experience of the SI-PASS meetings which took place in Q1 of this 2021-2022 academic year, even if you did not, or barely, participated in them. Your opinion will be used to evaluate the system and, if possible, to improve it. The questionnaire should take you between 30 and 40 minutes. Thank you very much for your responses.

Your participation in this survey is voluntary, and we thank you for the time you agree to devote to it.

The SI-PASS coordination team.

3. SACQ and Climate questionnaires

My life at university

		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
a)	I think I did the right thing by applying to university.	☐	☐	☐	☐	☐
b)	I keep up to date with my academic work.	☐	☐	☐	☐	☐
c)	I met a lot of people and made quite a few friends at university.	☐	☐	☐	☐	☐
d)	I know why I am at university and what I expect from it.	☐	☐	☐	☐	☐
e)	I'm afraid that university will be too hard for me.	☐	☐	☐	☐	☐
f)	I think I will do well during my exam session.	☐	☐	☐	☐	☐
g)	I think I have a sufficient level to get by at university.	☐	☐	☐	☐	☐
h)	I am satisfied with my decision to go to university.	☐	☐	☐	☐	☐
i)	I am happy to be at the University of Liège.	☐	☐	☐	☐	☐
j)	I don't work as hard as I should.	☐	☐	☐	☐	☐
k)	My academic goals and objectives are well defined.	☐	☐	☐	☐	☐
l)	I am smart enough to succeed in university.	☐	☐	☐	☐	☐
m)	I am very efficient in using my study time.	☐	☐	☐	☐	☐
n)	I haven't been very motivated to work.	☐	☐	☐	☐	☐
o)	Lately I have had doubts about the value of a university education.	☐	☐	☐	☐	☐
p)	I would have preferred to go to another university.	☐	☐	☐	☐	☐
q)	I am a very sociable person, which facilitated my integration into the university.	☐	☐	☐	☐	☐
r)	I have trouble concentrating when I study.	☐	☐	☐	☐	☐

s) I feel uncomfortable around others at university.	☐	☐	☐	☐	☐
t) I feel alone at university.	☐	☐	☐	☐	☐
u) I often have trouble getting to work.	☐	☐	☐	☐	☐
v) I think I am very different from other students at university, and it bothers me.	☐	☐	☐	☐	☐
w) I have some good friends and acquaintances at university with whom I can talk about my difficulties.	☐	☐	☐	☐	☐
x) I consider myself well prepared for university work.	☐	☐	☐	☐	☐
y) I started the new academic year with confidence.	☐	☐	☐	☐	☐
z) I am satisfied with the quality or density of courses available at the university.	☐	☐	☐	☐	☐
aa) I am satisfied with the number and variety of courses available at the university.	☐	☐	☐	☐	☐
bb) I am satisfied with the courses of this semester.	☐	☐	☐	☐	☐
cc) I am satisfied with the teachers I had in class.	☐	☐	☐	☐	☐

Well-being

1. Lately, when I think about my studies…	Never	Rarely	Sometimes	Often	Very often
a) I feel happy.	☐	☐	☐	☐	☐
b) I feel angry.	☐	☐	☐	☐	☐
c) I feel anxious, stressed.	☐	☐	☐	☐	☐
d) I feel embarrassed, uncomfortable.	☐	☐	☐	☐	☐
e) I feel sad, desperate.	☐	☐	☐	☐	☐
f) I feel captivated, interested.	☐	☐	☐	☐	☐
g) I feel confident, optimistic.	☐	☐	☐	☐	☐
h) I am bored.	☐	☐	☐	☐	☐

2.		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
a)	I feel safe at university.	☐	☐	☐	☐	☐
b)	I am afraid of some university students.	☐	☐	☐	☐	☐
c)	I feel stressed about coming to university.	☐	☐	☐	☐	☐
d)	I am afraid of being harassed on the way to university.	☐	☐	☐	☐	☐
e)	I am afraid of some other people at the university.	☐	☐	☐	☐	☐
f)	I am happy to be at this university.	☐	☐	☐	☐	☐
g)	I feel at home at this university.	☐	☐	☐	☐	☐
h)	I would like to change university.	☐	☐	☐	☐	☐
i)	In this university, I am just a number.					

3.	Lately, it happens to me…	Never	Rarely	Sometimes	Often	Very often
a)	to feel bad about myself.	☐	☐	☐	☐	☐
b)	to feel without energy, poorly rested.	☐	☐	☐	☐	☐
c)	to have dark thoughts, to think about unpleasant things.	☐	☐	☐	☐	☐
d)	to have difficulty concentrating.	☐	☐	☐	☐	☐
e)	to cry easily.	☐	☐	☐	☐	☐
f)	to have difficulty falling asleep.	☐	☐	☐	☐	☐
g)	to have a headache or stomachache.	☐	☐	☐	☐	☐

4. SACQ internal consistency analysis

SACQ	*N* items	Cronbach's Alpha	*M*	*S.D.*
PRE-TEST				
Academic Adjustment (Performance)	5	0.76	3.28	0.65
Academic Adjustment (Environment)	.	.	.	.
Social Adjustment	6	0.69	3.25	0.75
Academic Adjustment (Application)	6	0.88	3.01	0.97
Attachment	7	0.73	4.12	0.55
POST TEST				
Academic Adjustment (Performance)	5	0.72	3.18	0.68
Academic Adjustment (Environment)	4	0.76	3.68	0.69
Social Adjustment	6	0.76	3.59	0.77
Academic Adjustment (Application)	6	0.88	2.73	0.9
Attachment	7	0.83	3.92	0.71

5. MSSCWS internal consistency analysis

MSSCWS	*N* items	Cronbach's Alpha	*M*	*S.D.*
PRE-TEST				
Negative Affects	8	0.72	2.53	0.58
Climate	6	0.72	1.67	0.5
Somatization	7	0.77	3.17	0.76
POST TEST				
Negative Affects	8	0.71	2.75	0.57
Climate	6	0.71	1.63	0.51
Somatization	7	0.78	3.31	0.75

6 & 7. Correlation matrix for experimental (left) group and control (right) group

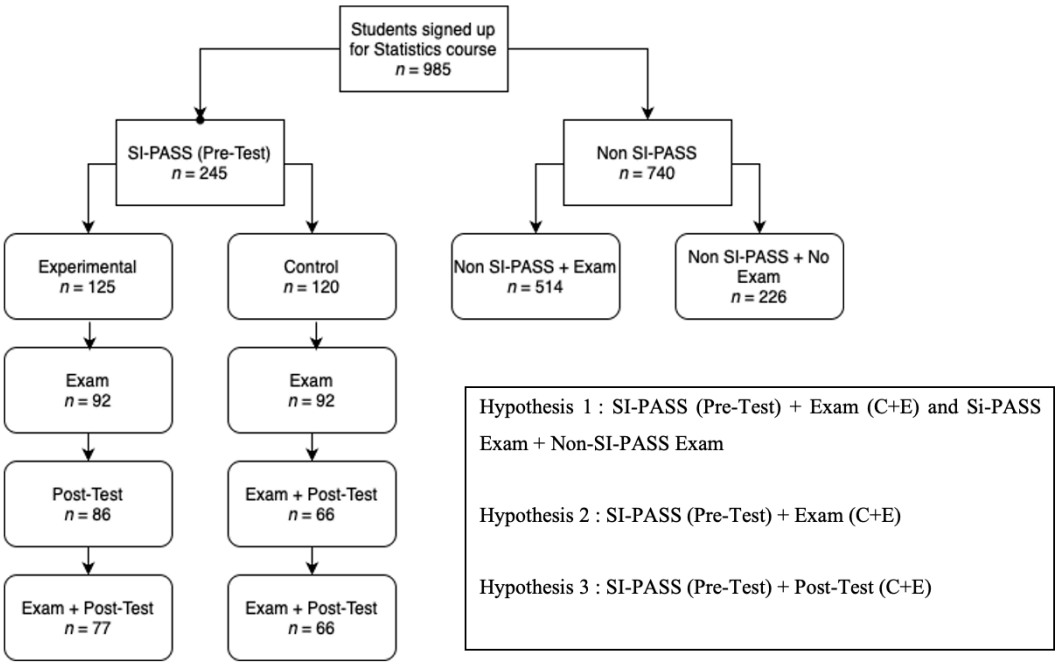
Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Performance (PRE)	—													
2. Social Adjustment (PRE)	.43*	—												
3. Application (PRE)	.12	.23*	—											
4. Attachment (PRE)	.46*	.43*	.26*	—										
5. Affects (PRE)	−.42*	−.55*	−.15	−.50*	—									
6. Climate (PRE)	−.28	−.47*	−.06	−.51*	.41*	—								
7. Somatization (PRE)	−.18	−.38*	−.17	−.21	.37*	.24*	—							
8. Performance (POST)	.61*	.19	−.04	.33	−.22*	−.09	−.08	—						
9. Social Adjustment (POST)	.13	.47*	.13	.17	−.29	−.16	−.31	.15	—					
10. Application (POST)	.34	.22*	.50*	.26*	−.21	.03	−.11	.36*	.13	—				
11. Attachment (POST)	.33	.14	.06	.41*	−.33	−.21	−.01	.57*	.17	.46*	—			
12. Affects (POST)	−.31	−.28	−.03	−.27*	.43*	.12	.41*	−.58*	−.31	−.40*	−.52*	—		
13. Climate (POST)	−.18	−.28*	−.16	−.31	.27*	.46*	.13	−.38*	−.37*	−.21	−.60*	.42*	—	
14. Somatization (POST)	−.22*	−.17	−.05	−.19	.32	.07	.64*	−.26*	−.25*	−.32	−.15	.61*	.11	—

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Performance (PRE)	—													
2. Social Adjustment (PRE)	.33	—												
3. Application (PRE)	.10	−.07	—											
4. Attachment (PRE)	.47*	.27*	.26*	—										
5. Affects (PRE)	−.40*	−.31	−.27*	−.38	—									
6. Climate (PRE)	−.36	−.29*	.04	−.45*	.15	—								
7. Somatization (PRE)	−.18	−.29*	−.32	−.19	.38*	.10	—							
8. Performance (POST)	.63*	.28*	−.02	.31	−.31	−.40*	−.34	—						
9. Social Adjustment (POST)	.09	.43*	.13	.23*	−.32	−.15	−.30	.24*	—					
10. Application (POST)	.25*	.08	.50*	.24*	−.30	−.19	−.25*	.33	.24*	—				
11. Attachment (POST)	.27*	.17	.23	.43*	−.32	−.23	−.29*	.46*	.26*	.36	—			
12. Affects (POST)	−.25*	−.37	−.08	−.14	.34	.16	.28*	−.46*	−.41*	−.37	−.49*	—		
13. Climate (POST)	−.25*	−.30*	−.22	−.42*	.38*	.56*	.30*	−.38	−.33	−.32	−.62*	.48*	—	
14. Somatization (POST)	−.17*	−.16	−.28*	−.07	.19	.01	.64*	−.32	−.37	−.32	−.35	.61*	.29*	—

8. Confirmatory factor analyses (SACQ questionnaire & Climate questionnaire, pre-test and post-test)

Variable	X^2	*df*	*p*	X^2/df	*CFI*	*TLI*	*SRMR*	*RMSE*
Pre-Test	2163.6	1106	<.001	1.956	0.634	0.61	0.096	0.078
Post-Test	2494	1297	<.001	1.923	0.678	0.658	0.097	0.076

9. Sample size flowchart



Transition

Study 4 serves as a necessary complement to study 3. The previous investigation did not provide significant evidence of improved academic performance among students assigned to the SI-PASS condition. This raises an important question: do these results indicate limitations inherent to the SI-PASS model itself, or do they partly reflect how the program was implemented and enacted at ULiège? By shifting the focus from performance outcomes to the processes unfolding within sessions, study 4 offers a process-oriented lens on what students report doing during peer-led meetings, thereby helping to contextualize the absence of significant effects observed in study 3.

This study therefore deepens the dissertation's analysis by examining cognitive engagement during peer-led sessions. Its first component replicates prior research by Malm (2021a), who investigated cognitive processes through students' self-reported use of action verbs in SI-PASS sessions. This replication provides a comparative baseline and situates the local findings in relation to existing SI-PASS research.

Building on this replicated foundation, the study extends the analytical framework by using the SOLO taxonomy (Biggs & Tang, 2011), a well-established model for analysing cognitive engagement and depth of learning. This framework allows for a more structured and theoretically grounded interpretation of the learning

Study 4

Does SI-PASS promote deep learning? - A replication and extension of a study on action verbs

N. Puttaert, L. Leduc, A.-S. Nyssen, D. Verpoorten

"Thus, while self-report and observational data alone can each increase our understanding of student motivation and learning processes, pursuing both in tandem more effectively captures the give-and-take among students, how these experiences evolve over time, and the personal meanings they can afford." (Vriesema & McCaslin, 2020, p. 126)

Abstract

In this study, participants in SI-PASS (Supplemental Instruction - Peer Assisted Study Sessions) and another ULiège peer-led scheme (PEPPS) were asked to select 5 action verbs from the 45 provided by the SOLO (Structure of Observed Learning Outcomes) taxonomy to describe the activities they engaged in during sessions. These responses were compared to a similar survey from a Swedish university to assess their generalizability, and to video recordings of actual sessions to determine their reliability against in-situ observations. The results reveal convergence with the replicated Swedish study, and discrepancies between the self-reported activities and the recorded sessions. The discussion highlights the implications of these findings for understanding the depth of learning encouraged by SI-PASS and the reliability of self-reported data in educational research.

1. Introduction

The first year at university is widely recognized as a critical period (Kift, 2015; Vadeboncoeur et al., 2015). Compared to the high-school experience, a drastic increase of freedom contrasts with the decrease of teacher availability but goes along the same exponential line as the quantity of material to absorb and the amount of individual work to perform. When poorly managed, such challenges can lead to disengagement, academic failure, and potential drop-out. To mitigate these risks, institutions implement various support services of differing types and intensities. Among these, peer tutoring programs have long been highlighted (Topping, 1996) for their potential to support two elements of first-year success, as coined by Tinto: academic and social integration (Byl, 2019; Pavlovic & Jeno, 2024). The University of Liège is actively engaged in this process. Since 2019, it has been implementing two large-scale and distinct peer-tutoring programs. The first one, SI-PASS, is the primary focus of this investigation; while the second one, PEPPS, a local creation, is also briefly presented in the Methodology section since it will be used as a comparator or counterpoint to the results.

1.1. SI-PASS schemes

The SI-PASS program targets specific courses known to be difficult to pass (Appendix 1). It applies principles defined in the 1970s by Deanna Martin at the University of Missouri-Kansas City (European Centre for SI-PASS, 2018). A key element of this program is the collaborative group sessions guided by a trained "leader", an older student who successfully passed the difficult course and was trained to facilitates SI-PASS meetings. The verb 'to guide' ("*The SI-leader guides students to engage with the material in ways that strengthen their learning*", Martin & Hurley, 2005, p. 309) emphasizes a key difference between SI-PASS and other peer-learning schemes, as SI-PASS does not center on pure content delivery, but rather on significative discussion between

students on the course material. The leader is not considered as a substitute for the class teacher, but rather as a facilitating element in the group interactions (Martin & Arendale, 1992). During the semester, students meet once per week after each new lecture to work together on the material covered by the course. Evidence over the past decades suggests that SI-PASS not only enhances academic performance (Adebola et al., 2020; Hoiland et al., 2020) but also strengthens student confidence (Bronstein, 2008), critical thinking skills (Malm et al., 2022a), and promotes a sense of community (Abegglen et Morris, 2015). The scheme implemented at the University of Lund, against which Liège's is compared in terms of action verbs, also operates a standard SI-PASS program. This is especially true given that the program is overseen by this university, the reference SI-PASS center, responsible for providing training to all other European universities.

1.2. Deep and surface learning activities

The first duty of a SI-PASS leader is not to teach but to help meaningful conversations about the course material flourish. The program operates on the assumption that learning occurs through discussions encouraging intellectual processes akin to what pedagogical literature calls *deep learning.* According to Biggs (1987), students can engage with and process information according to three distinct approaches. Deep learning involves actively seeking to understand the underlying meaning and significance of the material, making connections to prior knowledge, and developing a critical perspective. Students who adopt a deep learning approach are intrinsically motivated, aim to extract the essence of the subject, and are willing to spend more time and effort to master the content. In contrast, surface learning is characterized by a more passive, rote memorization of facts and details without a deeper understanding of the subject matter. Students using a surface approach tend to focus on meeting the minimum requirements to pass assessments, rather than

truly engaging with the material. Strategic learning falls between these two extremes, where students aim to optimize their study methods and time management to achieve the best possible academic performance, even if it does not necessarily reflect a deep understanding of the content. Strategic learners are often extrinsically motivated, driven by the desire to obtain good grades and qualifications (De Clercq et al., 2022; Entwistle & Ramsden, 2015; Marton & Säljö, 1976; Ramsden, 2003).

Despite an emphasis on promoting deep learning in official documents and handbooks, and more specifically in the definition of the techniques used by leaders (European Centre for SI-PASS, 2018, p. 42), SI-PASS literature contains few empirical studies that explicitly establish this ideal connection (Martin & Hurley, 2005, p. 17; Ody et al., 2009). While studies indicate a positive correlation between SI-PASS attendance and improved academic performance (Dawson et al., 2014), ambiguity remains regarding the nature of this contribution: is enhanced performance driven by deeper understanding through meaningful discussions, or does it result from surface-level learning strategies such as repetitive practice and exam-focused preparation? In other words, are SI-PASS sessions primarily used by students to exchange tips and strategies for passing exams, or do they genuinely promote deep learning as intended?

In general literature on deep learning, there is a recognition that instilling such an approach in practice is challenging (Diseth & Martinsen, 2003; Hasnora et al., 2013; Ning & Downing, 2010; Northcliffe et al., 2003). Students often favor a surface approach (Duff et al., 2004; Gürlen et al., 2013; Richardson et al., 2012;), particularly when instructors adopt a predominantly transmissive teaching style (Kember, 2003) or a strategic approach; or an in-between approach. The latter one relies on a concern for optimum efficiency and

focuses primarily on passing exams rather than internalizing the material. Within the SI-PASS literature itself, Ashwin (2003a) highlights this difficulty. He observed that while students in peer support groups performed better academically, their learning strategies did not necessarily align with deep learning objectives. Instead, these students tended to adopt more strategic, and paying, approaches, such as tailoring their study methods to exam requirements. Ashwin cautioned against equating higher grades among SI-PASS participants with a reinforcement of deep learning, urging further investigation into this issue.

1.3. SOLO taxonomy

The current study operationalizes learning depth through the lens of the Structure of the Observed Learning Outcome (SOLO) taxonomy, a theoretically grounded and widely accepted framework developed by Biggs and Collis (1982). The SOLO taxonomy was designed to systematically categorize the quality and complexity of student learning outcomes. Rather than focusing solely on content knowledge, SOLO captures the structural organization of students' understanding, making it particularly suitable for educational interventions such as peer-led programs where learning is often socially co-constructed and contextually situated.

While Bloom's taxonomy (1974) and its revision by Anderson and Krathwohl (2001) are typically used to formulate learning objectives and design assessments, the SOLO taxonomy developed by Biggs and Collis (1982) serves a different purpose: it classifies the structural complexity of students' responses to learning tasks. In the present SI-PASS context, SOLO is applied to participants' accounts of what occurred during the sessions. The taxonomy is used to evaluate the level of cognitive complexity reflected in students' descriptions of their peer-learning experience.

In practice, each SOLO level is associated with representative action verbs (45 in total) that reflect increasingly complex forms of cognitive processing. The taxonomy consists of five hierarchical levels of understanding: prestructural (where the student misses the point), unistructural (focus on one relevant aspect), multistructural (focus on several relevant aspects, but treated independently), relational (integration of parts into a coherent whole), and extended abstract (generalization to a new domain). In many applied studies, the last two levels are grouped to represent deep learning, while the earlier levels are associated with surface learning, making the SOLO taxonomy particularly suitable for studies examining not only what students know, but how they organize and apply knowledge.

The cognitive grounding of this framework is robust. The SOLO taxonomy builds upon neo-Piagetian theories of cognitive development, especially the notion that learning progresses through increasingly integrated and abstract stages (Biggs & Collis, 1982). The transition from surface to deep learning within the SOLO model mirrors cognitive processes identified in constructivist theories of learning, where meaningful engagement emerges through processes such as assimilation, accommodation, and metacognitive reflection (Bruner, 1961; Novak, 2010). Moreover, the validity of the SOLO taxonomy as an evaluative and interpretive framework has been demonstrated across diverse educational contexts, including science (Bakouli & Jimoyiannis, 2016; Newton & Martin, 2013) and mathematics (Adeniji et al., 2022). Its structure has proven adaptable to both qualitative and quantitative forms of content analysis, and its categories correspond well with the types of cognitive verbs students naturally use to describe their learning activities. This correspondence supports the methodological approach adopted in the present study, where students and leaders self-reported verbs describing their cognitive processes

during sessions. These verbs were subsequently categorized into SOLO levels following established practices (Holm, 2014; Malm et al., 2021a).

Several empirical studies have applied the SOLO taxonomy to analyse learning activities and educational materials. For instance, Brabrand and Dahl (2009) used the taxonomy to analyse 632 course curricula from a Danish faculty of science to examine whether curricula provided information about the expected progression of students' performance. By comparing intended learning outcomes with the action verbs associated with SOLO levels, they concluded that the taxonomy made it possible to infer the level of cognitive complexity required by curriculum texts. Similarly, Lucas and Mladenovic (2009) employed the SOLO taxonomy in a qualitative study of an accounting course to investigate variations in students' understanding. Their results suggested that the taxonomy offers a useful framework for examining the structure of students' explanations and relating them to different levels of knowledge. The taxonomy has also been used extensively in mathematics education. For example, Hattie and Brown (2004) and Pegg and Tall (2010) examined learning processes in mathematics and found that the SOLO framework provides a reliable tool for analysing the relationship between students' expressed reasoning and the structural complexity of their understanding.

In addition to these applications, the SOLO taxonomy has also been used to classify and support the design of cognitive learning activities such as problem-solving or algorithmic reasoning, illustrating its relevance in both theoretical and applied educational contexts. Building on the original framework, Biggs and Tang (2010, 2011, 2015) further integrated the taxonomy into the theory of constructive alignment, highlighting how the structural complexity of students' learning can be supported through the coherent alignment of teaching activities, assessment methods, and intended learning outcomes. Although the

taxonomy was originally developed to classify the quality of students' responses rather than to formulate learning objectives, this integration demonstrates how the framework can inform pedagogical design aimed at fostering progressively deeper levels of understanding.

The taxonomy has also been applied directly in the context of SI-PASS. Holm (2014), for example, combined the SOLO taxonomy with video-based observation methods to investigate learning activities occurring in SI-PASS sessions in five Swedish upper secondary schools. Using fourteen video recordings of SI-PASS groups discussing mathematics problems, the study examined the conditions under which observable learning processes emerged during peer discussions. Taken together, these studies highlight the relevance of the SOLO taxonomy as a tool for investigating the cognitive dimension of peer-learning interactions and support its use for analysing the learning processes occurring during SI-PASS sessions.

Finally, the SOLO taxonomy is not merely a post-hoc tool for coding open responses. It can also be used to evaluate instructional alignment (Biggs, 1996), curricular coherence, and, in the case of the present study, the cognitive demands of peer-led interaction. The verbs used by participants are therefore not arbitrarily categorized but reflect established alignments with cognitive dimensions of learning. For instance, verbs such as *memorize* or *repeat* correspond to unistructural levels, whereas verbs such as *connect*, *apply*, or *evaluate* indicate relational or extended abstract levels. These distinctions are grounded in extensive educational research linking linguistic indicators to cognitive processes (Marzano & Kendall, 2007). Applying the SOLO taxonomy to peer-led sessions is particularly meaningful, as peer-learning environments often promote the co-construction of knowledge, perspective-

taking, and dialogical reasoning; processes associated with higher levels of cognitive engagement (Topping, 2005; Vygotsky, 1978).

1.4. Malm's original study (202a1)

Malm's (2021a) study directly addresses the challenge of learning depth analysis by utilizing the SOLO taxonomy, which categorizes learning into four distinct levels of depth (original "prestructural" level won't be used here). Malm administered the 45 SOLO verbs to SI-PASS participants in linear algebra (n = 67) and calculus (n = 130) courses, asking students which verbs best described the intellectual processes trained during SI-PASS sessions (Malm, 2021a). The self-reported data suggested that SI-PASS activities predominantly promote deep learning, with a prevalence of verbs from the upper levels of the taxonomy.

There is another research that used both the SOLO taxonomy and the video recording methodology, that of Holm (2014) that aimed at investigating SI-PASS learning activities amongst five Swedish upper secondary schools. Her data consisted in fourteen video recordings of the SI-PASS groups to identify conditions leading to observable learning outcomes occurring during student's discussions around mathematics. Results show that SI-PASS leaders facilitate learning outcomes in the discussions, which is linked to higher level learning outcome. The aim there was quite different from ours, since her study was centered around the conditions (observation of leaders' actions) that made learning possible within SI-PASS meetings, not the actual learning processes per say. Besides, the sample consisted in students from a largely different background and who were younger than ours (16-17 years old students).

1.5. Study specificities

The present study replicates Malm's experimental setup (2021a) for three reasons. First, Malm acknowledged limitations in his research, including the narrow range of courses and the exclusive focus on mathematics within a single university. This study expands the scope by including additional courses and universities. While retaining mathematics, it introduces variation with a course in psychology and two courses in physics.

Second, this replication aims to contribute to the development of more consistent methodologies for assessing SI-PASS effects, providing the broader SI-PASS community with reliable tools for evaluation, monitoring, and comparison (CSAI, 2018). These efforts seek to enhance the program's accountability and establish reliable reference instruments.

Lastly, this replication serves as a critical foundational step rather than the sole objective. Replicating Malm's study provides a robust comparative baseline, validating initial conditions and allowing subsequent findings to be confidently interpreted. Such replications are advocated as best practices in educational research to ensure reliability and comparability (Makel & Plucker, 2014). The importance of replication in educational research cannot be overstated, as it ensures the findings' robustness, increases generalizability, and contributes to cumulative scientific knowledge (Schmidt, 2009). However, the current study significantly expands Malm's original work by explicitly probing deeper into cognitive processes at play during peer-led interactions, employing both self-reported action verbs by students and leaders and systematic observational methods. This dual-methodological approach allows a more detailed and authentic capture of cognitive engagement, extending beyond self-report data alone; and adds a double cross-check to the consistency of the declarative data. By comparing SI-PASS answers to another very different program of peer

mentoring, one can see if the SOLO taxonomy of deep/surface learning is able to capture the differences between these programs and is therefore a sufficiently discriminating instrument. By checking the corresponding elements between self-reported data (the verbs in questionnaire) and field-observation, what the respondents give as verbs can be cross-validated. This methodological extension enhances both construct validity and ecological validity, making the findings more robust and informative for educational practice (Cook & Campbell, 1979).

1.6. Hypotheses

These elements lead to these three interrelated hypotheses:

1. Hypothesis 1 touches upon generalizability: Action verbs reported by SI-PASS students from ULiège will align with those reported by Swedish SI-PASS students, providing in both locations and indications of deep learning activities according to SOLO taxonomy.
2. Hypothesis 2 touches upon specificity: PEPPS students will report different verbs than SI-PASS students, mirroring the distinct nature of the two schemes. Since SI-PASS meetings are specifically targeted at the mastery of one specific course and PEPPS have five meetings with transversal themes, verbs related to content mastery are expected to appear more often for SI-PASS students. If not, the distinctiveness of the two program or the ability of the solo instrument to discriminate cognitive operations will have to be discussed.
3. Hypothesis 3 touches upon consistency: Self-reported verbs will match the verbs that an external observer will detect in the video recordings of SI-PASS sessions.

In addition to these main hypotheses, exploratory analyses were conducted to examine whether the distribution of cognitive verbs varied according to the

role of the speaker (leaders *versus* participants) and across faculties. The verbs reported by participants were subsequently examined through the SOLO taxonomy to assess how the cognitive processes associated with SI-PASS meetings distribute across different levels of learning depth.

2. Methodology

2.1. Data Sources

Data collection followed approval from the Ethics Committee of the Faculty of Psychology, Speech Therapy, and Education Sciences (protocol 2122-098, amendment approved on 13/10/2023). All data were pseudonymised prior to analysis: names, student IDs, and leader identifiers were removed and replaced with numerical codes.

2.1.1. Hypotheses 1 & 2 - Self-reported verbs from the online questionnaire

The verbs describing the activities set up in SI-PASS schemes (faculties of Applied Sciences, Bioengineering, Psychology and Sciences) and PEPPS schemes (faculties of Applied Sciences, Law, Medicine, Philosophy, Social Sciences, Sciences, and Veterinary Medicine) were collected from an online questionnaire sent to participants and leaders/buddies of the two semesters of academic years 2021-2022 (total expected questionnaires for SI-PASS n = , and for PEPPS n =) and 2022-2023 (total expected questionnaires for SI-PASS n = , and for PEPPS n =). Practically speaking, respondents were asked in Qualtrics:

1. "In the following list, I highlight the five verbs that best describe what participants do during my SI-PASS/PEPPS meetings."
2. "For two out of the five verbs I have picked, I give a short explanation regarding my SI-PASS/PEPPS meetings."
3. "I add a verb to the list if I feel it misses something."

2.1.2. Hypothesis 3 - Recorded SI-PASS sessions

A total of 41 SI-PASS videos has been recorded during the second semester of academic year 2022-2023 within the faculties of Applied Sciences (n = 19), Bioengineering (n = 6), Psychology (n = 6) and Sciences (n = 10). The longest

meeting recorded lasted 87 minutes, while the shortest lasted 29 minutes with an average length of $M = 56.63$, $STD = 11.78$.

2.2. Tools and treatment

2.2.1. Hypotheses 1 & 2 - SOLO taxonomy applied to students' self-recorded verbs through the questionnaire

Malm (2021a) tried to know more about what happens at a cognitive level in SI-PASS sessions by asking a class of linear algebra (n = 67 handed questionnaires out of the n = 114 SI-PASS students) and calculus (n = 130 handed questionnaires out of the n = 227 students) to depict the learning activities taking place during meetings by selecting verbs from the SOLO Taxonomy (Table 1). This approach was used to test hypotheses 1 and 2. The use of this approach based on action verbs has triggered worthwhile theoretical works in pedagogy (Anderson & Krathwohl, 2001; Brabrand & Dahl, 2009; Davies & Mansour, 2022; Leduc, 2013). For instance, research has demonstrated its effectiveness in structuring assessments and evaluating learning outcomes in higher education, facilitating a nuanced understanding of students' conceptual grasp (Boulton-Lewis, 1995).

Table 1 - The SOLO taxonomy relates 45 cognitive verbs to four levels of learning.

Superficial Levels		*Deeper Levels*	
1. *Unistructural*	2. *Multistructural*	3. *Relational*	4. *Extended Abstract*
Identify	Explain	Analyze	Generalize
Define	Solve	Apply	Hypothesize
Name	Describe	Argue	Think
Tell	Solve exercises	Compare	Theorize
Memorize	List	Contrast	Create
Quote	Clarify	Criticize	Synthetize
Do a simple procedure	Examine	Explain the causes	Value
Recognize	Interpret	Relate	Develop
Recall	Extend	Justify	Assess
Repeat	Rework	Predict	Debate
	Prove		Validate
	Classify		
	Combine		
	Revise		

The present study performed a frequency analysis on the verbs to locate SI-PASS activities on the scale. While performing this analysis, the short explanation asked in the questionnaire was also examined to ensure that the verbs chosen matched the complexity level and are, therefore, representative of the correct learning process.

Finally, the additional verbs that students (both participants and leaders/buddies) could add to the list if they wished were analyzed. For this part, no justification was asked even though a handful of respondents put more details into brackets next to the word they added. This addition was quite helpful in understanding what was implied by the student with the use of this word. This step has an equal importance as the previous ones, as it allows for a better understanding of the processes taking place during the students' meetings.

2.2.2. Hypothesis 3 - Recorded verbs

Each video was coded with the Noldus Observer XT tool, according to the SOLO taxonomy. Labels were put on spoken verbs only that were explicitly spoken by the leaders and that either matched one of the SOLO verbs (*e.g. "How have you interpreted this?"* corresponds to Interpret), or not (*e.g. "How do you do that?"* does not correspond to any listed verb). In this case, an analysis of the situation had to be made, especially with questions or instructions missing a specific action verb (*e.g. "Is it…", "What is…", "What happens when…"*, etc.) that imply a (re)action from the audience, nonetheless (specific examples are given below). Therefore, there were two possibilities: either the verb identified could be matched to one of the 45 verbs of the SOLO taxonomy, or its context of appearance had to be understood to decide on the category of the SOLO taxonomy that best matches the verb. The occurrences

are therefore all tangible: there is no interpretation of what the students would be doing.

Initial labelling attempts revealed that being precise in the frequency of each of the 45 action verbs from the SOLO taxonomy was not possible. Indeed, cognitive activities brought about by a generic verb (*e.g.* to have, to be, to do, etc.) could only be inferred from the contextual meaning. Moreover, being more specific in terms of verb inference would be hazardous, as some of the instructions given to the group could match two or more verbs within the same level. A few illustrations of this situation are given by full sentences given by leaders:

- Applied Sciences: *"Can someone give me the development of this theorem?"* This question refers to the Unistructural category (I) in which students can identify specific knowledge but do not necessarily understand it. The idea behind this sentence is not to make students solve a new original equation, but rather remember and rewrite a specific theoretic point from their course. This could therefore be associated with verbs such as Recall, Repeat, Define or Quote.
- Sciences: *"What is the solution to this equation? Give the full development."* This instruction refers to the Multistructural category (II) in which students are asked to use their theoretical knowledge and apply it to simple procedures. The associated verb could therefore be either Solve, Solve exercise, Explain, Develop, or even Describe.
- Bioengineering: *"How would changing this element affect the whole equation?"* This sentence refers to the Relational category (III) in which students are asked to understand relationships between

elements. However, does this instruction specifically refer to the verb Compare (the previous equation and the new), Contrast (the elements that vary), Relate (each element to one another), or even Predict (the change)?

- Psychology: *"What is the core message from this whole chapter? How could you apply it to your daily life?"* This question refers to the Extended Abstract category (IV) in which students are asked to fully understand the course material and go beyond the mere surface of things. Verbs such as Hypothesize, Synthesize, Theorize, Think or even Develop could be matched to it.

3. Results

3.1. Hypothesis 1 - SI-PASS Verbs

3.1.1. Usable sample

Table 2 displays the number of SI-PASS students who answered the question related to verbs in their online questionnaires from academic years 2021-2022 and 2022-2023. A total of n = 541 students ($n_{leaders}$ = 172; $n_{participants}$ = 369) answered this question for a total of n = 942 questionnaires received ($n_{leaders}$ = 197; $n_{participants}$ = 745), thus resulting in a 57.4% answer rate ($\%_{leaders}$ = 87.3; $\%_{participants}$ = 49.5). Out of a total of 2481 singular verbs given, students give a mean of 4.59 verbs ($M_{leaders}$ = 4.52; $M_{participants}$ = 4.62) out of the five asked, so being very diligent with the instruction of 'five verbs'.

Table 2 - Number of students who answered the question concerning the verbs they would choose to describe SI-PASS meetings. The Q column corresponds to the number of questionnaires received; the A column corresponds to the number of students who answered the question concerning action verbs; the column V corresponds to the number of singular verbs collected. % corresponds to the rate of A/Q, and the column M corresponds to the mean of verbs given per student.

Role	Year	Semester	Applied Sciences			Bioengineering			Psychology			Sciences			Total			%	*M*
			Q	A	V	Q	A	V	Q	A	V	Q	A	V	Q	A	V		
Leader	21-22	1	11	11	55	15	15	75	22	21	105	3	3	15	51	50	250	98	5
	21-22	2	15	14	70	9	8	40	7	6	30	12	7	35	43	35	175	81.4	5
	22-23	1	24	20	97	10	7	35	11	11	55	11	9	45	56	47	232	83.9	4.9
	22-23	2	22	19	57	10	8	24	5	5	15	10	8	24	47	40	120	85.1	3
Participant	21-22	1	127	69	345	46	25	120	141	62	310	20	14	70	334	170	845	50.9	4.9
	21-22	2	66	33	165	22	8	40	45	7	35	31	18	90	164	66	330	40.2	5
	22-23	1	50	33	165	25	15	75	0	0	0	26	17	85	101	65	325	64.4	5
	22-23	2	61	30	90	17	10	30	45	13	39	23	15	45	146	68	204	46.6	3
Total			376	229	1044	154	96	439	276	125	589	136	91	409	942	541	2481	57.4	4.59

3.1.2. Top ten verbs

Comparison 1: Verbs

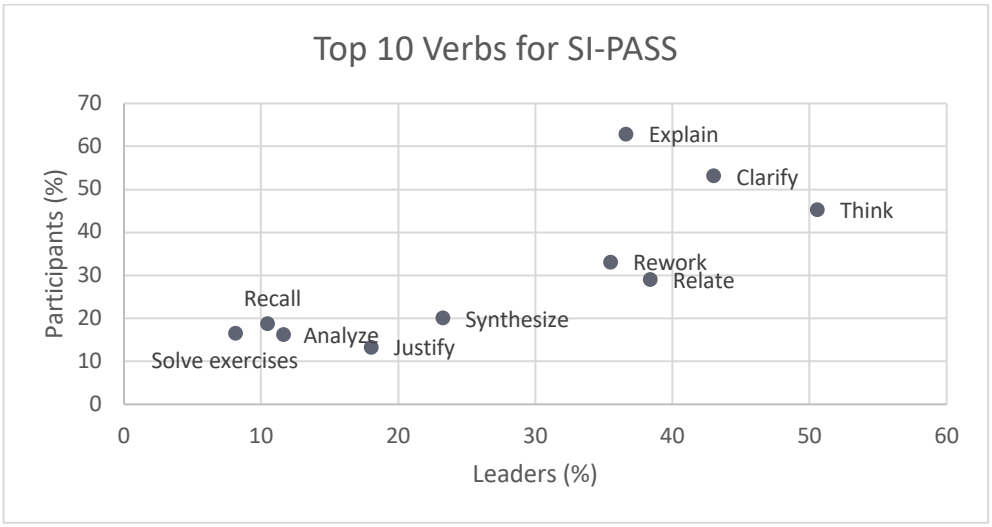
The top three verbs for SI-PASS program (all categories confounded) as displayed in Table 3 and Figure 1 are Explain (Multistructural II), Clarify (Multistructural II), and Think (Extended Abstract IV) in that specific order. These main three verbs account for 33.01%, and the top ten verbs account for 64.96% of the total verbs cited by both leaders and participants. In his 2021 research, Malm found that the top three verbs for the linear algebra class were Explain (Multistructural II), Clarify (Multistructural II) and Analyze (Relational III), followed by Reflect, Solve, Explain causes, Motivate, Argue and Apply; while those cited for the calculus class were Explain (Multistructural II), Solve (Multistructural II) and Clarify (Multistructural II), followed by Reflect, Analyze, Motivate, Argue, Apply and Explain causes. Note that Malm asked for three verbs, while we asked for five.

Table 3 -Top ten verbs cited by students as best describing SI-PASS meetings.

Ten most used action verbs	SOLO	Participant	Leader	Applied Sciences	Bioengineering	Psychology	Sciences
Explain (295 - 54.53%)	II	232 (62.87%)*	63 (36.63%)*	124 (54.15%)	61 (63.54%)	64 (51.2%)	46 (50.55%)
Clarify (270 - 49.91%)	II	196 (53.12%)	74 (43.02%)	112 (48.91%)	50 (52.08%)	63 (50.4%)	45 (49.45%)
Think (254 - 46.95%)	IV	167 (45.26%)	87 (50.58%)	115 (50.22%)	37 (38.54%)	50 (40%)	52 (57.14%)
Rework (183 - 33.83%)	II	122 (33.06%)	61 (35.47%)	69 (30.13%)	37 (38.54%)	47 (37.6%)	30 (32.97%)
Relate (173 - 31.98%)	III	107 (29%)	66 (38.37%)	80 (34.93%)	31 (32.29%)	36 (28.8%)	26 (28.57%)
Synthesize (114 - 21.07%)	IV	74 (20.05%)	40 (23.26%)	33 (14.41%)*	32 (33.33%)*	38 (30.4%)*	11 (12.09%)*
Recall (87 - 16.98%)	I	69 (18.7%)*	18 (10.47%)*	41 (17.9%)	16 (16.67%)	22 (17.6%)	8 (8.79%)
Justify (80 - 14.79%)	III	49 (13.28%)	31 (18.02%)	38 (16.59%)*	9 (9.38%)*	7 (5.6%)*	26 (28.57%)*
Analyze (80 - 14.79%)	III	60 (16.26%)	20 (11.63%)	31 (13.54%)	12 (12.5%)	21 (16.8%)	16 (17.58%)
Solve exercises (75 - 13.86%)	II	61 (16.53%)*	14 (8.14%)*	35 (15.28%)*	4 (4.17%)*	29 (23.2%)*	7 (7.69%)*

Note: % = percentage of answered surveys that marked the verb. Statistically significant differences ($p < 0.05$) in response frequencies for a verb between students and SI leaders using a chi-square test are marked by *.

Figure 1 - Ten most frequently cited verbs used by participants and leaders to describe SI-PASS meetings.



Comparison 2: Faculties

Going one step further into our analyses by making comparisons of the three most chosen verbs by faculty:

- Faculty of Applied Sciences has the verbs Explain (n = 124, 54.15%), Think (n = 115, 50.22%) and Clarify (n = 112, 48.91%).
- Faculty of Bioengineering has the verbs Explain (n = 61, 63.54%), Clarify (n = 50, 52.08%) and Think or Rework (both mentioned n = 37 times, 38.54%).
- Faculty of Psychology has the verbs Explain (n = 64, 51.2%), Clarify (n = 63, 50.4%) and Think (n = 50, 40%).
- Faculty of Sciences has the verbs *Think* (n = 52, 57.14%), Explain (n = 46, 50.55%) and Clarify (n = 45, 49.45%).

Regardless of the faculty, the same three verbs always appear even though they are not always ranked in the same order. The courses used for these comparisons are physics for the faculties of Applied Sciences and Bioengineering, and math/statistics for Psychology and Sciences. Malm performed his analyses on classes of linear algebra and calculus, which are quite similar in their nature to the courses presented here. Visual representations of verbs per faculty can be found in Appendix 2.

Concerning the statistically significant differences between all four faculties, chi-squared tests performed on the sample highlight differences for three verbs: Synthetize ($X^2(3) = 20.56$, $p < .001$), Justify ($X^2(3) = 21.12$, $p < .001$), and Solve exercises ($X^2(3) = 17.21$, $p < .001$). More specifically, students from the faculties of Applied Sciences and Sciences chose the verb Synthetize less often than expected, while students from the faculties of Bioengineering and Psychology chose it more often. The reverse trend appears for Justify, while

the verb Solve exercises is cited more often by students from the faculties of Applied Sciences and Psychology. The illustrative definitions provided for the verb Justify suggest a broadly comparable interpretation of the notion across faculties. However, these examples remain illustrative and do not constitute evidence of a shared understanding, as no systematic qualitative analysis of a larger corpus was conducted:

- Justify - Leader from the faculty of Applied Sciences: *"By delving deeper into the course materials, they justified the use of certain formulas for to certain hypotheses. I regularly asked them to justify their answer, when they made their choice."*
- Justify - Leader from the faculty of Bioengineering: *"I train them to always justify their answers by their knowledge. Not simply give the answer because they have memorized it, they must explain it and justify it."*

Comparison 3: Participants and leaders

When the same method is used to compare participants and leaders, the three most chosen verbs become:

- Participants have the verbs Explain (n = 232, 62.87%), Clarify (n = 196, 53.12%) and Think (n = 167, 45.26%).
- Leaders have the verbs Think (n = 87, 50.58%), Clarify (n = 74, 43.02%) and Relate (n = 66, 38.37%).

From these verbs, it is interesting to notice that contrary to comparison by faculties, leaders do not rank the verb *Explain* in their top three. Instead, they chose Relate.

When the same chi-squared tests are performed on participants and leaders, statistically significant differences also appear for the verbs: Explain ($X^2(1) = 16.05$, $p < .001$), Recall ($X^2(1) = 5.33$, $p = .021$) and Solve exercises ($X^2(1) =$

6.34, $p = .012$). In all three instances, participants selected the verb more than leaders. Could these differences come from a divergence in the definition of these terms from both groups? Here are a few comparisons of the definitions given for the mentioned verbs by both SI-PASS leaders and participants:

- Recall - Leader: *"I ask students to recall elements seen during the last lecture and to write them down on the blackboard to create a plan of the session."*
- Recall - Participant: *"When attending SI-PASS meetings, I recall elements from the course more easily and am able to use it during the meeting."*

Comparison 4: Participants and leaders within faculties

Lastly, when a supplementary degree of detail is studied by comparing both leaders and participants within each faculty (Appendix 2 for complete tables), it can be noted that the following elements display a statistically significant difference:

- Faculty of Applied Sciences: Explain is cited significantly more by participants than leaders ($X^2 = 9.8, p = .002$) ; Solve exercises is cited significantly more by participants than leaders ($X^2 = 4.74, p = .03$).
- Faculty of Sciences : Analyze is cited significantly more by participants than leaders ($X^2 = 4.21, p = .04$).

To further interpret the cognitive meaning of the verbs cited by participants, the reported verbs were subsequently categorized according to the SOLO taxonomy. This allows the analysis to move beyond individual lexical choices and examine the distribution of responses across different levels of learning depth.

3.1.3. Distribution of verbs across SOLO categories

Regarding the SOLO categories, the Multistructural (II) category comes first, followed by either the Extended Abstract (IV), the Relational (III), and finally the Unistructural (I) as displayed in Table 4. The fact that category I (the more superficial) appears at the bottom of the table is quite encouraging regarding the type of learning taking place during SI-PASS meetings. The Multicultural (II) category accounts for nearly half of the chosen verbs, especially for participants. Moreover, both participants and leaders seem to have the same ranking amongst the four SOLO categories, which gives even more coherence and validity to the results. Comparison with Malm's study (2021a) is not possible, as he did not analyzed results by category.

Table 4 - Most often cited SOLO categories by SI-PASS students.

SOLO Categories	Participants	Leaders	Applied Sciences	Bioengineering	Psychology	Sciences
Multistructural II (1104 - 44.50%)	808 (47.42%)	296 (38.1%)	458 (43.87%)	209 (47.61%)	253 (42.95%)	184 (44.99%)
E. Abstract IV (587 - 23.66%)	376 (22.07%)	211 (27.16%)	237 (22.7%)	108 (24.6%)	141 (23.94%)	101 (24.69%)
Relational III (507 - 20.44%)	305 (17.9%)	202 (26%)	236 (22.61%)	71 (16.17%)	106 (18%)	94 (22.98%)
Unistructural I (283 - 11.41%)	215 (12.62%)	68 (8.75%)	113 (10.82%)	51 (11.62%)	89 (15.11%)	30 (7.33%)

Is there a difference between faculties, and between participants and leaders in terms of categories ranking? When performing a chi-squared test to see if such a difference exists between faculties, we obtain $X^2(9) = 24.84$, $p = .003$, $V_{Cramer} = 0.06$ thus indicating a significant difference between the faculties (detailed tables in Appendix 4). More specifically, we see that:

- Faculty of Applied Sciences mentions Relational (III) category verbs more than the other faculties.
- Faculty of Bioengineering mentions Multistructural (II) category verbs more than the other faculties.

- Faculty of Psychology mentions Unistructural (I) category verbs more than the other faculties, and Relational (III) category verbs less than the other faculties.
- Faculty of Sciences mentions Unistructural (I) category verbs less than the other faculties.

When performing the same test between SI-PASS participants and leaders, we obtain $X^2(3) = 40.39$, $p < .001$, $V_{Cramer} = 0.13$ thus indicating a significant difference between the groups (detailed Tables in Appendix 4). More specifically, we see that:

- Leaders mention Relational (III) category verbs more than participants, and Multistructural (II) category verbs less than participants.
- Participants mention Multistructural (II) category verbs more than leaders, and Relational (III) category verbs less than leaders.

3.2. Hypothesis 2 - PEPPS Verbs

3.2.1. Usable sample

Table 5 displays the number of PEPPS students who answered the question related to verbs in their online questionnaires from academic years 2021-2022 and 2022-2023. A total of $n = 465$ students ($n_{buddies} = 201$; $n_{participants} = 264$) answered this question for a total of $n = 813$ questionnaires received ($n_{buddies} = 221$; $n_{participants} = 592$), thus resulting in a 57.2% answer rate ($\%_{buddies} = 91$; $\%_{participants} = 44.6$). Students give a mean of 4.88 verbs ($M_{buddies} = 4.89$; $M_{participants} = 4.88$) out of the five asked. Out of a total of 2270 singular verbs given, students give a mean of 4.88 verbs ($M_{buddies} = 4.88$; $M_{participants} = 4.82$) out of the five asked.

Table 5 - Number of students who answered the question concerning the verbs they would choose to describe PEPPS meetings. The Q column corresponds to the number of questionnaires received; the A column corresponds to the number of students who answered the question concerning action verbs; the column V corresponds to the number of singular verbs collected. % corresponds to the rate of A/Q, and the column M corresponds to the mean of verbs given per student.

Role	Year	Applied Sciences			Law			Medicine			Philosophy			Social Sciences			Sciences			Veterinary Medicine			Total			%	*M*
		Q	A	V	Q	A	V	Q	A	V	Q	A	V	Q	A	V	Q	A	V	Q	A	V	Q	A	V		
Buddy	21-22	0	0	0	31	27	135	44	40	200	33	31	150	8	5	25	5	5	25	12	12	55	133	120	590	90.2	4.92
	22-23	7	5	25	0	0	0	32	31	153	26	25	118	6	6	28	3	3	15	14	11	53	88	81	392	92	4.84
Participant	21-22	0	0	0	99	47	235	147	55	275	87	36	180	22	14	70	13	1	5	39	23	115	407	176	880	43.2	5
	22-23	7	4	20	27	13	58	23	12	58	40	30	141	16	12	57	1	0	0	71	17	74	185	88	408	47.6	4.64
Total		14	9	45	157	87	428	246	138	686	186	122	589	52	37	180	22	9	45	136	63	297	813	465	2270	57.2	4.88

3.2.2. Top ten verbs

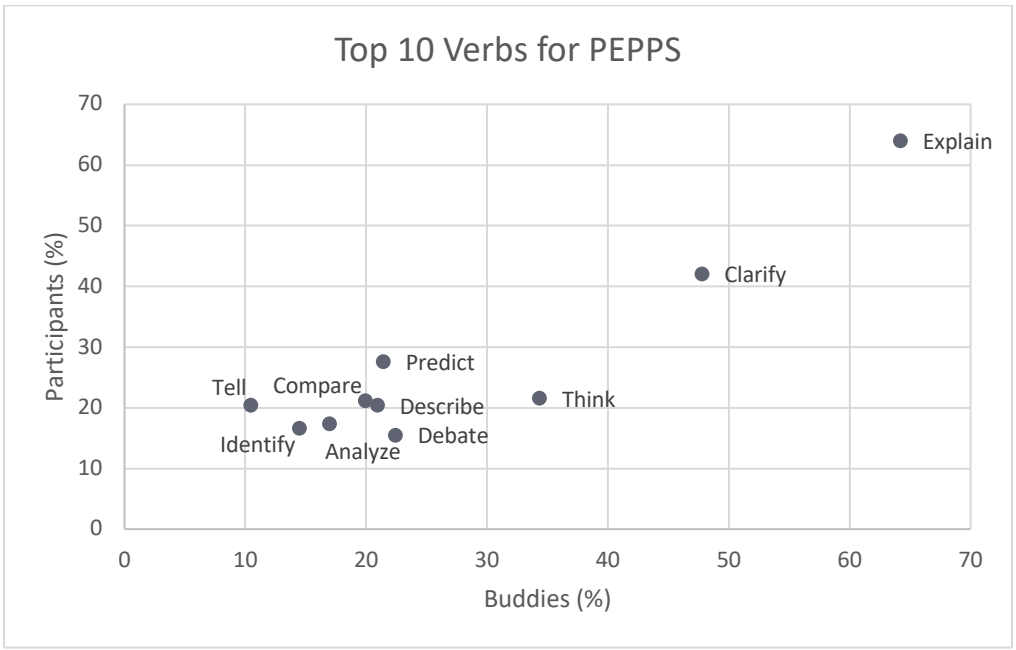
The top three verbs for PEPPS program as displayed in Table 6 and Figure 2 are Explain (Multistructural II), Clarify (Multistructural II), and Think (Extended Abstract IV) in that specific order. The main three verbs account for 27.8%, and the top ten verbs account for 55.2% of the total verbs cited by both buddies and participants. Apart from those, the same pattern exists for both categories, as these verbs appear in the exact same order as in SI-PASS (Table 3), but that the other seven differ significantly as displayed in Figure 3. Predict Compare, Describe, Debate, Tell and Identify do not appear in the top ten SI-PASS verbs. Only Analyze is present in both lists, in eighth position for PEPPS students and ninth for SI-PASS. This major divergence could account for the fundamental conceptual differences in the two programs, as PEPPS does not focus one specific course material like SI-PASS.

Table 6 - Top ten verbs cited by students as best describing PEPPS meetings.

Ten most used action verbs	SO LO	Participants	Buddies	Applied Sciences	Law	Medicine	Philosophy	Social Sciences	Sciences	Veterinary Medicine
Explain	II	169	129	5	63	94	68	22	4	42
(298 - 64.09%)		(64.02%)	(64.18%)	(55.56%)	(72.41%)	(68.12%)	(55.74%)	(59.46%)	(44.44%)	(66.67%)
Clarify	II	111	96	3	36	66	52	12	4	34
(207 - 44.52%)		(42.05%)	(47.76%)	(33.33%)	(41.38%)	(47.83%)	(42.62%)	(32.43%)	(44.44%)	(53.97%)
Think	IV	57	69	4	25	41	32	6	2	16
(126 - 27.1%)		(21.59%)*	(34.33%)*	(44.44%)	(28.74%)	(29.71%)	(26.23%)	(16.22%)	(22.22%)	(25.4%)
Predict	III	73	43	0	23	29	37	10	1	16
(116 - 24.95%)		(27.65%)	(21.39%)	(0%)	(26.44%)	(21.01%)	(30.33%)	(27.03%)	(11.11%)	(25.4%)
Compare	III	56	40	1	17	33	25	9	0	11
(96 - 20.65%)		(21.21%)	(19.9%)	(11.11%)	(19.54%)	(23.91%)	(20.49%)	(24.32%)	(0%)	(17.46%)
Describe	II	54	42	0	20	29	25	6	3	13
(96 - 20.65%)		(20.45%)	(20.9%)	(0%)	(22.99%)	(21.01%)	(20.49%)	(16.22%)	(33.33%)	(20.63%)
Debate	IV	41	45	3	14	20	20	13	3	13
(86 - 18.49%)		(15.53%)	(22.39%)	(33.33%)	(16.09%)	(14.49%)	(16.39%)	(35.14%)	(33.33%)	(20.63%)
Analyze	III	46	34	4	15	24	19	6	2	10
(80 - 17.2%)		(17.42%)	(16.92%)	(44.44%)	(17.24%)	(17.39%)	(15.57%)	(16.22%)	(22.22%)	(15.87%)
Tell	I	54	21	1	20	20	14	7	1	12
(75 - 16.13%)		(20.45%)*	(10.45%)*	(11.11%)	(22.99%)	(14.49%)	(11.48%)	(18.92%)	(11.11%)	(19.05%)
Identify	I	44	29	6	11	19	25	4	2	6
(73 - 15.7%)		(16.67%)	(14.43%)	(66.67%)*	(12.64%)*	(13.77%)*	(20.49%)*	(10.81%)*	(22.22%)*	(9.52%)*

Note: % = percentage of answered surveys that marked the verb. Statistically significant differences ($p < 0.05$) in response frequencies for a verb between students and SI leaders using a chi-square test are marked by *.

Figure 2 - Top ten verbs cited by participants and buddies at best describing PEPPS meetings.



Concerning the statistically significant differences between participants and buddies, chi-squared tests performed on the sample highlight differences for two verbs: Think ($X^2(1) = 6.53$, $p = .011$) and Tell ($X^2(1) = 7.31$, $p = .007$). Buddies selected Think more often than participants, while the opposite pattern is true for Tell. The definitions given by students display a similar understanding of the verbs:

- Think - Buddy: *"One exercise I like consists in asking students to think about the questions that might appear during their exam and see if they understand the course plan."*
- Think - Participant: *"We thought together about the best way possible to solve our issues concerning our understanding of the course material."*

When the same test is performed on faculties, statistically significant differences only appear for the verb Identify ($X^2(6) = 19.83$, $p = .003$). More

specifically, the verb was chosen more often by students from the faculties of Philosophy, Sciences and Applied Sciences than the other four faculties. Again, the definition of the verb Identify indicates that students from different faculties have the same understanding of the notion:

- Identify - Buddy from the faculty of Philosophy: *"I give students text excerpts and ask them to identify the school of thought it might refer to, as it is a good preparation for the upcoming exam."*
- Identify - Participant from the faculty of Medicine: *"We work together on identifying the important elements in each chapter to focus our study on them and not waste too much time on details."*

Visual representations of verbs per faculty can be found in Appendix 2.

3.2.3. SOLO categories

Regarding the SOLO categories, a very similar pattern for both programs can be observed (Tables 4 and 7), except for the Extended Abstract (IV) and Relational (III) categories that switch places with each other. Another slight difference concerns the ranking made by participants or buddies. PEPPS buddies classify verb categories the same way as SI-PASS students while PEPPS participants choose verbs from the third category more often than those from the fourth.

Table 7 - Most often cited SOLO categories by PEPPS students.

SOLO Categories	Participants	Buddies	Applied Sciences	Law	Medicine	Philosophy	Social Sciences	Sciences	Veterinary Medicine
M. II	504	398	13	170	280	230	62	17	130
(902 - 39.74%)	(39.13%)	(40.53%)	(28.89%)	(39.72%)	(40.82%)	(39.05%)	(34.33%)	(37.78%)	(43.77%)
R. III	309	206	11	104	150	136	45	6	63
(512 - 22.56%)	(23.99%)	(20.98%)	(24.44%)	(24.3%)	(21.87%)	(23.09%)	(25%)	(13.33%)	(21.21%)
E. A. IV	260	245	10	86	168	120	47	14	60
(505 - 22.25%)	(20.19%)	(24.95%)	(22.22%)	(20.09%)	(24.49%)	(20.37%)	(26.11%)	(31.11%)	(20.2%)
U. I	215	133	11	68	88	103	26	8	44
(348 - 15.33%)	(16.69%)	(13.54%)	(24.22%)	(15.89%)	(12.83%)	(17.49%)	(14.44%)	(17.78%)	(14.81%)

Is there a difference between faculties, and between participants and buddies in terms of categories ranking? When performing a chi-squared test to see if such a difference exists between faculties, we obtain $X^2(18) = 21.54$, $p = .25$ thus indicating no significant difference between the faculties (detailed tables in Appendix 6).

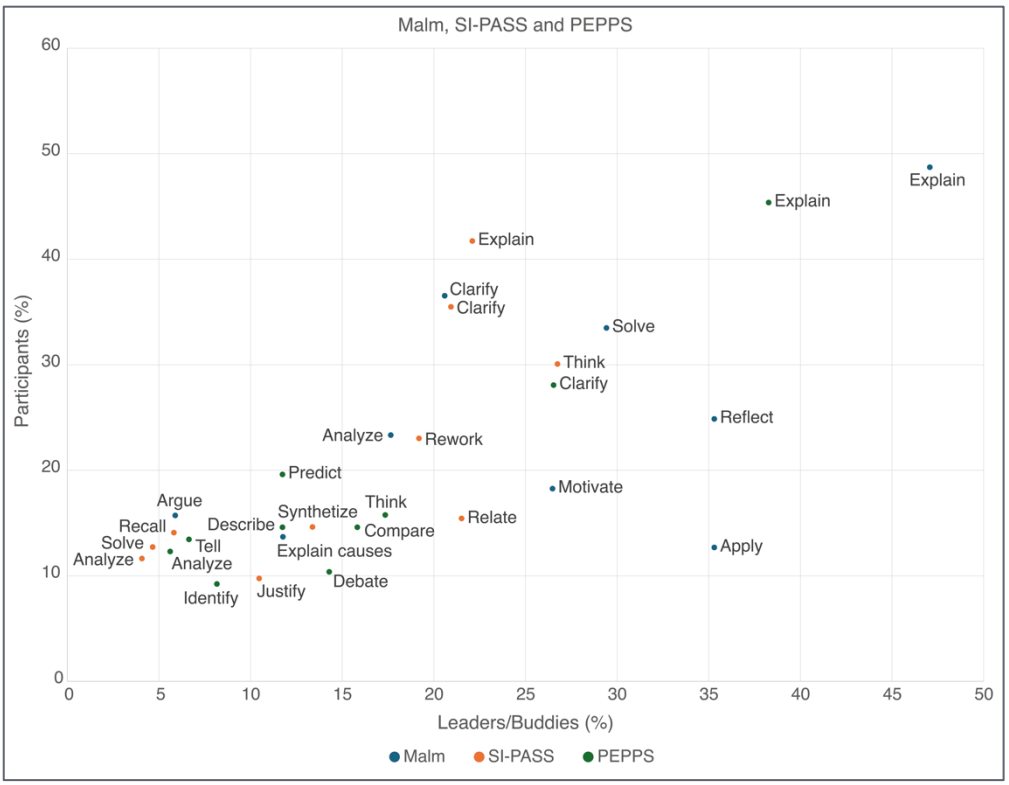
When performing the same test between PEPPS participants and buddies, we obtain $X^2(3) = 11.79$, $p = .008$, $V_{Cramer} = 0.07$ thus indicating a significant difference between the groups (detailed tables in Appendix 6). More specifically, we see that:

- Buddies mention Extended Abstract (IV) category verbs more than participants, and Relational (III) and Unistructural (I) category verbs less than participants.
- Participants mention Relational (III) and Unistructural (I) category verbs more than buddies, and Extended Abstract (IV) category verbs less than buddies.

3.2.4. Comparison Malm's, SI-PASS and PEPPS classifications

Lastly, a visual representation of the top ten action verbs chosen by PEPPS and SI-PASS students from ULiège and SI-PASS students from Lund is presented on Figure 3. The verb *Explain* remains the most cited regardless of the program and whether students are participants or leaders/buddies. Clarify appears to have been chosen in nearly identical proportions for ULiège and Lund SI-PASS students, while PEPPS participants chose it less and buddies more. All proportions kept, these are the two self-reported action verbs that share a similar pattern. Other verbs are either placed completely differently from one another on Figure 3 or are unique to the scheme considered.

Figure 3 - Top ten verbs cited by participants and buddies as best describing PEPPS meetings at ULiège, SI-PASS meetings at ULiège, and SI-PASS meetings in Malm's study (2021a).



3.2.4. Additional verbs

Table 8 presents the additional verbs chosen by PEPPS and SI-PASS students. Out of the total n = 1006 students who answered the question on action verbs in SI-PASS (n = 541) and PEPPS (n = 465), n = 109 (20.15%) SI-PASS students (47 leaders and 62 participants) gave one or more supplementary verbs and n = 131 (28.17%) PEPPS students (68 buddies and 63 participants) did the same. The table only reports verbs that have been cited at least five times altogether.

Table 8 - Additional verbs chosen by PEPPS and SI-PASS students.

Verb	*PEPPS*	*SI-PASS*	*Total*
Support	43	5	48
Exchange	38	9	47
Help (each other)	20	21	41
Listen	20	4	24
Share	14	2	16
Socialize	8	7	15
Understand	5	10	15
Advise	13	1	14
Motivate-Encourage	10	1	11
Organize	7	1	8
Collaborate	1	7	8
Question	3	4	7
Go deeper	1	5	6
Guide	5	0	5
Inform	4	1	5

One of the first elements that can be noticed is the large number of interpersonal verbs such as Support, Help (each other), Socialize, Advise, Motivate-Encourage, Have Fun-Laugh, etc.

3.4. Hypothesis 3 - Recorded Verbs

The final step to this research consisted in investigating the verbs spotted in SI-PASS meetings (either a SOLO action verb or a non-SOLO action verb that was classified in one of the four categories). Results displayed in Table 9 classify all the verbs uttered or inferred during the 41 recorded sessions (n = 2721) and show that the main category used during SI-PASS meetings is the Multistructural (36.94%), followed by the Unistructural (27.15%), the Relational (23.49%) and the Extended Abstract (12.42%). The first two categories account for 64.09% of the total action verbs used and relate to more superficial learning levels; while the last two account for 35.91% of the total action verbs used and refer to deeper levels of learning. The hypothesis which stated that more verbs from categories III and IV were used during SI-PASS meetings is therefore not confirmed. Moreover, percentages from Table 9 highlight a few more elements worth noting such as the stability of the

Unistructural I [25.4-28.5], Relational III [18-25.1], and Extended Abstract IV [10.5-14.7] categories between faculties; while the Multistructural II remains stable for three faculties [34.9-39.1] and displays a peak at 46.1 for the faculty of Psychology. A more detailed table presenting data per video is available in Appendix 7.

Table 9 - Distribution of SOLO categories across faculties based on SI-PASS meetings observations (n, total %, % within each SOLO category and mean verbs per video).

SOLO Categories	*n*	Total %	*M* per video	Faculties	*n*	% within faculty
Unistructural I*	736	**27.15**	17.95	Applied Sciences	1539	100
Applied Sciences	412	15.14	21.68	Unistructural I	412	26.8
Bioengineering	71	2.61	11.83	Multistructural II	549	35.7
Psychology	82	3.01	13.67	Relational III	387	25.1
Sciences	171	6.28	17.10	Extended Abstract IV	191	12.4
Multistructural II*	1009	**36.94**	24.61	Bioengineering	258	100
Applied Sciences	549	20.18	28.89	Unistructural I	71	27.5
Bioengineering	101	3.71	16.83	Multistructural II	101	39.1
Psychology	149	5.48	24.83	Relational III	48	18.6
Sciences	210	7.72	21	Extended Abstract IV	38	14.7
Relational III*	640	**23.49**	15.61	Psychology	323	100
Applied Sciences	387	14.22	20.37	Unistructural I	82	25.4
Bioengineering	48	1.76	8	Multistructural II	149	46.1
Psychology	58	2.13	9.67	Relational III	58	18
Sciences	147	5.4	14.7	Extended Abstract IV	34	10.5
Extended Abstract IV*	336	**12.42**	8.2	Sciences*	601	100
Applied Sciences	191	7.02	10.05	Unistructural I	171	28.5
Bioengineering	38	1.4	6.33	Multistructural II	210	34.9
Psychology	34	1.25	5.67	Relational III	147	24.5
Sciences	73	2.68	7.3	Extended Abstract IV	73	12.1

Note: % = Statistically significant differences ($p < 0.05$) in response frequencies for a verb between faculties using a chi-square test are marked by *. SOLO categories were coded at the session level based on the verbs observed during interactions and were not systematically differentiated between leaders and participants. This observational analysis concerns SI-PASS sessions only and therefore serves as a complementary exploration rather than a direct comparison with the survey analyses presented earlier.

More specifically, once the 2721 verbal occurrences were identified by the program, a second round of analysis needed to be performed to match each verb to the corresponding category. 763 markers corresponded exactly to one of the 45 verbs from the SOLO category. For the remaining 1958 verbs, the

whole context needed to be understood to decide on the category the verb belongs to. The two largest categories contained the verbs "to be" (n = 303) and "to have" (n = 204). Concrete examples of the use of these verbs are to be found in expressions such as *"What is it?"* (n = 152), *"What is…?"* (n = 130), *"What do we have?"* (n = 129). From the 1958 non-SOLO verbs that were not "to be" or "to have", the remaining 1451 verbs were also analyzed in their context of occurrence and a decision was made as to the category they belong to.

Going one step further into the analyses, by performing chi-squared tests (tables in Appendix 8) to examine statistical differences between faculties for each SOLO category:

- There is a statistically significant difference between faculties for the Unistructural category ($X^2(3) = 33.7$, $p < .001$). The Faculty of Applied Sciences mentions verbs from the first category more than other faculties.
- There is a statistically significant difference between faculties for the Multistructural category ($X^2(3) = 34.21$, $p < .001$). The Faculty of Applied Sciences mentions verbs from the first category more than other faculties.
- There is a statistically significant difference between faculties for the Relational category ($X^2(3) = 63.81$, $p < .001$). The Faculty of Applied Sciences mentions verbs from the third category more than other faculties.
- There is a statistically significant difference between faculties for the Extended Abstract category ($X^2(3) = 16.16$, $p = .001$). The Faculty of Applied Sciences mentions verbs from the fourth category more than other faculties.

Even though the higher number of videos from the Faculty of Applied Sciences was considered for our analyses (proportions were included in the chi-squared test), data shows that leaders from this faculty tend to use the four categories more than all others.

4. Discussion

4.1. Hypothesis 1 - SI-PASS Verbs

The first step in this analysis consisted in a replication of the study carried on by Malm in 2021a on Swedish students who followed a class of linear algebra and another of calculus. The main three verbs from the SOLO category were Explain, Clarify and Analyze (in that order) in linear algebra; and Explain, Solve and Clarify for the calculus class. When compared to our results, Explain and Clarify also reach the top-ranking positions, and Think takes the third place as displayed in Figure 1. These results are very similar to Malm's regardless of the faculty. However, one question that still needs to be addressed relates to the choice Malm made of splitting his analysis: could one conclude that his results are more discipline dependent (algebra *vs*. calculus) than specific to SI-PASS as a whole?

One might argue that the verbs selected by the Swedish students are specific to "scientific" faculties and might, therefore, not be generalized to other faculties. With the present study, which also includes the Faculty of Psychology, we see that the ranking remains consistent regardless of the faculty concerned. Besides, the courses used for these comparisons are physics for the faculties of Applied Sciences and Bioengineering, and math/statistics for Psychology and Sciences. Malm performed his analyzes on classes of linear algebra and calculus, which are quite similar in their nature to the courses presented here.

One notable difference comes from the difference between participants and leaders in terms of chosen verbs: while participants rank Explain in their top three, leaders preferred the word Relate. One plausible explanation for this difference might come from the bias of social desirability: leaders might want

to be perceived as perfectly applying SI-PASS guidelines, while students report what they perceive as being the closest to their genuine experience.

Regardless, our conclusion is also similar to Malm's: the main goal of SI-PASS is to work on one difficult course, therefore making explanations and clarifications the central focus of the sessions. But this does not mean that students perform deeper learning activities, as the main two verbs belong to the second SOLO category. The third verb, Think, also seems to fit on the third rank of this list, as participants are encouraged to reflect individually or in small groups on the material they have been taught during lectures. This verb belongs to the highest category and hints towards a deeper understanding of the course material than the two other verbs that belong to the second category.

However, the all-encompassing nature of this verb could also be an indication that some sort of cognitive process is performed on the course materials without knowing exactly what is being performed. For instance, one could think about the various chapters of the course to make links between them, or one could think about the solution of an equation and use all their knowledge to solve it. This simple example illustrates the ambiguity of action verbs from the SOLO taxonomy and question the meaning given to the terms by students. The short definitions asked in the questionnaires to check for good understanding of the word shows that the verb meaning reached consensus through all respondents; but the verb itself remains too vague to pinpoint specific cognitive processes.

4.2. Hypothesis 2 - PEPPS Verbs

The short justification given by both participants and leaders from both programs helped us gain more insight into the meaning attributed to the verbs chosen and displayed a general consensus in their definition. However, in a

very counterintuitive way regarding the nature of the PEPPS program, the top ten verbs chosen were not of a collaborative nature. The verbs Explain, Clarify, Think were the most chosen for both programs, but they do not involve a strict exchange of ideas or contents between participants; rather, they emphasize the "top down" process (not to say teaching) taking place between leaders and students.

When analyzing the categories associated to the verbs, both PEPPS and SI-PASS students and buddies/leaders use five action verbs from the lower categories (I and II) and five from the deeper learning categories. The similar proportions could lead to think that the same depth of learning takes place in both programs. But is that so? The fourth-category verb Debate chosen by PEPPS students is congruent with the fact that those sessions are aimed at various elements of the students' academic life such as creating a good synthesis, planning exams ahead, getting organized for the semester, etc. Therefore, even the verbs Predict and Compare make sense in this context. Another plausible explanation could relate to the generalist nature of the actions verbs. This issue is discussed in the limits of the present study. Regarding the SI-PASS program, the verbs Synthesize and Relate on the deeper meaning make sense regarding the nature of the sessions in which students try their best to remember what was taught and to synthesize it and put elements into relation before they Solve Exercises on lower levels of learning. Again, this is typical of SI-PASS sessions in which students use hard exercises as a basis for the session and to make sure everyone understands everything. This is typical of both Applied Sciences and Sciences faculties for which the selected courses consist almost exclusively of exercises and demonstrations.

- Relate: *"It is when we juggle with several concepts that physics becomes difficult. SI-PASS therefore deals with relationships that are unclear."*
- Justify: *"We often tried to justify moving from one step to another in a demonstration during SI-PASS sessions, which helped me a lot."*

Even though the larger part of the verbs chosen by students and leaders from PEPPS and SI-PASS are from the Multistructural category of the SOLO taxonomy, the justification given in the online questionnaires are undoubtedly related to a deeper learning effort than one might think. Moreover, the second most chosen category is the highest one, indicating that the deepest level of learning activity is taking place during the sessions. The most superficial category is the least cited one. Both PEPPS and SI-PASS programs seem to provide room for deeper learning approaches and a thorough work through lectures material. This is congruent with the findings of Malm (2021a).

4.3. Additional verbs

Regarding these verbs, we can go further into our analysis by proceeding the same way we did for the action verbs. The top three verbs spontaneously cited by participants from both programs are Support, Exchange and Help (each other). From the short explanations given my by students, the Support observed appeared primarily emotional rather than directly focused on learning processes. Although socio-emotional support can contribute indirectly to learning and student engagement (De Clercq et al., 2022; Tinto, 1997), the interactions identified in this category did not explicitly involve cognitive or task-related guidance. Since the PEPPS main goal is to discuss various topics related to students' discovery of a brand-new way of life (whether it is strictly academically related or not), anxious feelings may emerge from discussions, thus inducing other participants to bring emotional support to the anxious ones.

On the other hand, *Exchange*, is the second most cited verb for both programs. This one can be understood either by the fact that students are exchanging regarding formal lectures material, or by the fact that they are casually exchanging about various topics, therefore reinforcing relationships. Similarly, Help (each other) aligns with the core element of both programs: first-year students ought to discuss the lectures' material together and collaborate throughout the meeting. The notion of interaction is hinted here, as it was absent from the SOLO taxonomy list of action verbs. Besides, this is the most cited verb for SI-PASS students, hence reinforcing the 'learning' aspect of this program. But could the all-encompassing nature of this verb be understood as an umbrella term for all elements related to collaborative acts? No short justification was asked from students for this spontaneous addition of a verb, so we can only guess the underlying meaning they allocate it.

As mentioned earlier in this article, only learning action verbs are present in the SOLO taxonomy, therefore only accounting for one dimension of peer-learning study programs. The true richness of these programs lies partly in their multiple facets as to how they allow new students to adapt to their new environment. A large quantity of interpersonal verbs was chosen as additional verbs used to describe these sessions. The SOLO category can only account for learning-related aspects of the programs and therefore lacks both preciseness in the verbs used; and several dimensions which is critical for students to pursue their studies (emotional, relational, adaptative, etc.). The dynamics at play during the peer learning meetings encourages interaction between all students. This only makes sense to see verbs such as Collaborate, Exchange, Guide, Share, Support, etc. since they account for a large part of the interactive processes. Moreover, from observations of sessions and replies to online questionnaires, we know that students choose to attend the meetings also for social reasons, as their recent arrival to the academic world often left

them without friends and relatives. The role of social interactions is closely connected to the central concern of this paper, namely the promotion of deeper learning. Prior research has shown that a facilitative learning environment can significantly support students' retention and understanding of academic material (Akkuzu & Akçay, 2011; Hizer, 2010). A study exploring the link between these two elements ought to be conducted to get a better understanding of all the implications of such programs.

4.4. Hypothesis 3 - Recorded Verbs

The last step to this research consisted in investigating the action verbs spontaneously pronounced by leaders during the meetings. Results displayed in Table 9 show that the main category used during SI-PASS meetings is the Multistructural (36.94%), followed by the Unistructural (27.15%), the Relational (23.49%) and the Extended Abstract (12.42%). The first two categories account for 64.09% of the total action verbs used and relate to more superficial learning levels; while the last two account for 35.91% of the total action verbs used and refer to deeper levels of learning. Fortunately, all categories appear at least once in each recorded video. The hypothesis which stated that more verbs from categories III and IV were used during SI-PASS meetings is therefore not confirmed. These findings are dissimilar to that of Malm (2021a) in his study regarding reported action verbs. He found that SI-PASS sessions tend to refer to verbs depicting deeper levels of learning (categories III and IV), but these results are based on the analysis of self-reported verbs, which differs from the present ecological approach. This hints towards a reflection regarding the perception of the work accomplished by leaders during the meetings and what really takes place naturally. A confrontation with these findings could change the leaders' perception in a positive way and highlight the need for a different approach to the meetings.

This could ensure a better fidelity of implementation of the scheme within our Institution in accordance with the official SI-PASS guidelines.

4.5. Limits and perspectives

Even though this action verbs methodology has not been applied to many studies of peer studying programs, the fact that similar results were found in Malm's study (2021a) gives our results some more credibility. Of course, the replication of this methodology also provided a few differences which can have several explanations. Regarding our case, the data collected only spans the course of four years with many heterogeneities regarding the faculties that joined the programs and the cooperation of both participants and leaders to respond to our questionnaires. A better standardization of the way both programs are delivered through faculties would ensure the reliability of our data; but as previously mentioned, it is nearly impossible to have full control over the way these sessions are being held. Both programs are now running more smoothly in the faculties where they have been implemented since the beginning, therefore acting as a familiar and acknowledged device for first year students. We can only hope for a wider use of both PEPPS and SI-PASS programs at the university over a longer period, again for a matter of data reliability.

As previously mentioned in this section, the all-encompassing nature of the action verbs used in the SOLO taxonomy could also be problematic when it comes to gaining a detailed understanding of the cognitive processes at play during peer-led sessions. Indeed, verbs such as Think or Reflect can have several meanings and encompass many cognitive processes. The guardrail used to limit this bias is the same as Malm (2021a): students had to give a short explanation of the verbs they selected. These definitions, drawn from participants' written responses and examined through a qualitative content

analysis, showed that respondents generally understood the term itself. However, they did not resolve the conceptual difficulty inherent in the notion: namely, identifying the specific processes that "deep learning" actually entails.

This observation also raises the question of a more strategic approach to learning that could potentially take place in these sessions. Indeed, these action verbs and their frequency of apparition do not ensure that pure deep-learning is being performed during peer-led meetings. This hybrid form of learning, which aims at achieving the highest possible grades through efficient time and assessment management (Tait et al., 1998), may also be reflected in the action verbs reported by students. In this sense, verbs describing activities such as revising, summarizing, or practicing may indicate strategies primarily oriented toward assessment performance rather than toward deeper conceptual integration. This approach does not align with SI-PASS spirit and aims but could be used by students as the exam session approaches. Unfortunately, we can only believe students when they say they align with SI-PASS principles to the best of their abilities. Even field observation would be useless, as this might generate social desirability bias and extra preparation of the meeting ahead.

The need to add more interpersonal verbs to the list to give it a more well-rounded quality is visible when examining the additional verbs chosen by students. We noticed from the list that the social aspect of both programs seems to play a predominant part in the whole experience. Action verbs are very useful to understand learning activities to their strictest definition, but they lack the nuance to really give a good general overview of the dynamics at play within those programs.

A major element to remember while analyzing the results lies in the consistent application of SI-PASS principles during the sessions. This aspect is irrelevant

to PEPPS sessions since they are a local creation not framed by any sort of international agreement. The SI-PASS program encourages supervisors to carry on a set of observations during the year. Observing every session throughout the semester would be methodologically desirable but practically demanding, especially given that the program runs simultaneously across several faculties and student groups. Implementing such a design would require substantial observational resources and a large team of trained coders, which typically exceeds the scope of most program evaluation studies. What's more, the inherent nature of the program would have lost its meaning since an external member of the group would have been permanently present during the students' meetings, therefore being counterproductive. To remedy this, complementary online questionnaires are being used throughout the year to ensure that the basic rules of the programs are being respected, and to gain more insight into other dimensions of the program (*aka* what is going on during the sessions? are students enjoying it? etc.).

One significant limit of the live observations made during the second semester of academic year 2022-2023 concerns the timing and uniqueness of the observation. More specifically, these observations occurred towards the end of the semester where students are experiencing higher level of stress associated to the approaching exam session. This might lead to some serious questioning concerning the strategic approach implemented at this stage of the year as already described by several authors (Duff et al., 2004; Richardson et al, 2012; Gürlen et al., 2013). In other words, do leader always manage SI-PASS meetings through activities that primarily support superficial learning, or could this observation be partly related to the moment chosen for data collection? Although the sessions analysed took place relatively early in the semester (when leaders may still be adjusting their facilitation strategies) it would nevertheless remain noteworthy if activities predominantly associated with

surface learning were already prevalent at this stage. Given that SI-PASS is explicitly designed to encourage deeper engagement with course material through collaborative reasoning and problem-solving, such a pattern would raise questions about the degree to which the pedagogical principles of the model are effectively implemented in practice.

Another limit concerning the observation concerns both the language and the spontaneous nature of the observations. It was made most noticeable when analyzing results that French-speaking leaders tend to use informal expressions (*e.g.* What is…? Is it...? etc.) rather than full formed sentences with a specific action verb. This does not mean that a specific aim could not be identified with such sentences, not at all. The general context allowed for the identification of a specific intention and therefore a specific category. The central idea that ought to be further investigated here relates to the dynamics between "what is the overarching goal of the exercise" and "what are the specific hints used to bring participants to the correct answer". In other words, the goal of a specific exercise could be to form new hypotheses (category IV) while the questions asked could related to category II verbs such as *Explain* or *Interpret* when the leader sees that the group is struggling to find the correct answer. Further investigation should be conducted to solve this central question to the use of spontaneous verbs to see if supra categories (*aka* the global aim of the exercise) are not subdivided into intermediary steps (*aka* instructions leading to the correct answer). This might explain the gap between what leaders and participants think they do during SI-PASS meetings and what is actually being observed during these sessions.

Lastly, inter-rater reliability needs to be discussed here. Data analysis with the assistance of one or two supplementary researchers was not possible for this research to contextual reasons (mainly timing and means allowed). This

represents a major bias in data analysis and labelling for the recorded verbs. However, one positive aspect that ought to be highlighted pertains to the fact that there is a consistency in this analysis since all data treatment was always performed by the same researcher with the same lenses. Moreover, this work can be understood as a first attempt at comparing self-reported verbs with spoken ones, thus generating investigation leads to be addressed by follow-up work on the topic. For instance, a systematic analysis and report of full sentences, thus referring to the direct object complement adjacent to the verb, could add to the precision and neutral objectivity of the analysis performed. However, this work should also ideally be carried out by a team of researchers, not one alone.

Despite all its limits, this research accomplished something seldom done in the field of educational psychology, which is the replication of a study on a similar sample. This enabled us to build from common foundations and investigate other branches of the topic: another peer-led program, and another way to evaluate what is being done in these sessions. The approach may be criticized on many aspects, but can still be credited for opening doors to new perspectives on SI-PASS, generating new questions and pointing out new gaps in this field.

5. Conclusion

This study focused mainly on the SI-PASS programs in terms of replication with a previous study (Malm, 2021a), comparison with another peer-lead scheme (PEPPS), and comparison with real-life speech. The comparison with results found by Malm in 2021a on Swedish students for two classes (linear algebra and calculus) succeeds in finding similar results in terms of action verbs: Explain and Clarify are the top two action verbs chosen by students and leaders alike in both programs. In ULiège case, the verb Think is also the third favorite in both programs. The comparison between SI-PASS and PEPPS also succeeds in showing that a large proportion of deeper learning activities are carried on during the sessions even though they differ in their nature. The explanations given by students and leaders regarding their choice of verbs give more information regarding the meaning they allocate to their choices and comforts the thinking that the sessions are aimed at a deeper understanding of the material taught during the lectures rather than a superficial revision whose only purpose is to pass the final exam. Then, the additional verbs chosen by students show that interpersonal processes are also taking place during these students' meetings and should be further investigated. Lastly, from the verbs collected from leaders in the recorded SI-PASS sessions, one can notice that they choose verbs from surface learning levels more often than verbs from deeper learning processes. This finding contradicts the previous one on self-reported verbs and suggests that subsequent research should be carried on to investigate such a gap and explain the underlying reasons for it.

6. Appendices

1.Courses targeted by SI-PASS

Applied Sciences

- First semester: Physique 1 (Pr. H. Caps)
  https://www.programs.uliege.be/cocoon/20232024/cours/PHYS2020-1.html
- Second semester: Physique 2 (Pr. H. Caps)
  https://www.programs.uliege.be/cocoon/20232024/cours/PHYS2021-1.html

Bioengineering

- First semester: Physique générale: Thermodynamique (Pr. B. Longdoz et Pr. G. Lumay)
  https://www.programs.uliege.be/cocoon/20232024/cours/PHYS3024-1.html
- Second semester: Mécanique des particules (Pr. B. Longdoz)
  https://www.programs.uliege.be/cocoon/20232024/cours/PHYS3025-1.html

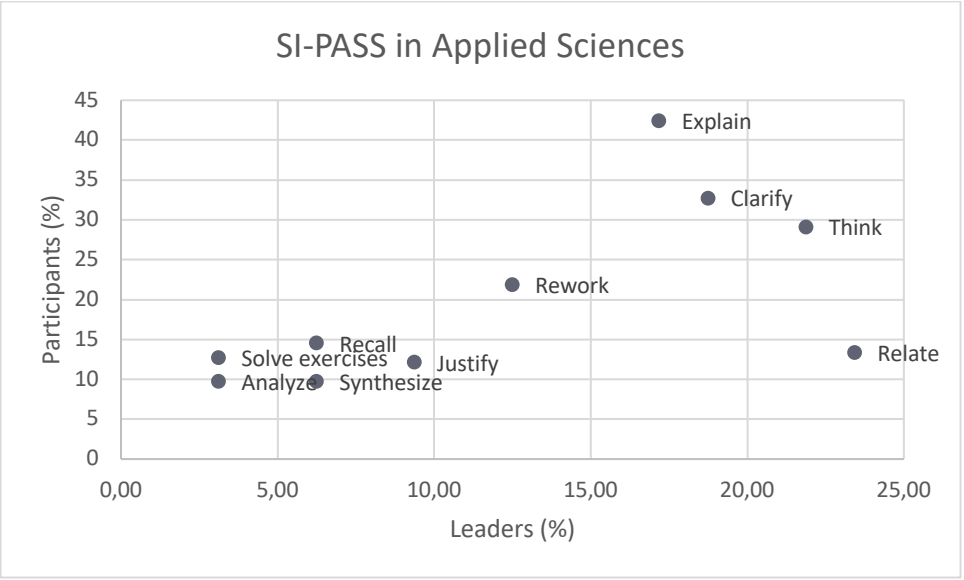
Psychology

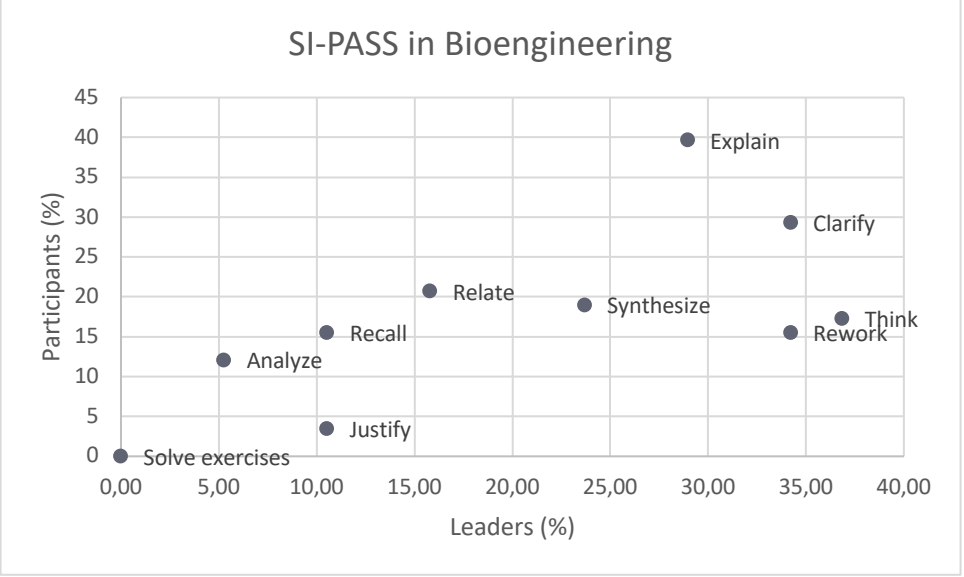
- First semester: Psychostatistique descriptive et inférentielle (Pr. E. Quertemont)
  https://www.programs.uliege.be/cocoon/20232024/cours/PSYC5895-1.html
- Second semester: Physiologie du système nerveux (Pr. P. Kohl)
  https://www.programs.uliege.be/cocoon/20232024/cours/PHYL0646-3.html

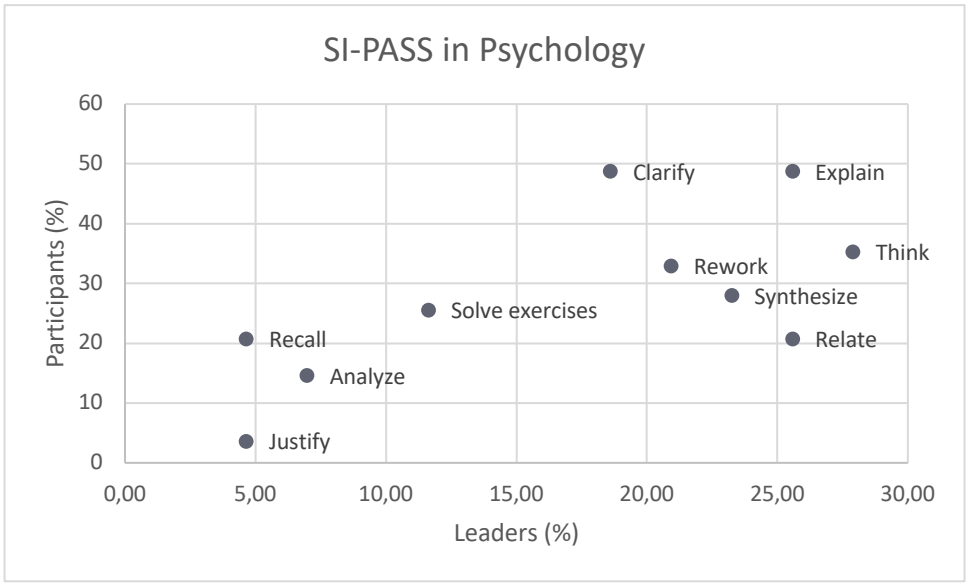
Sciences

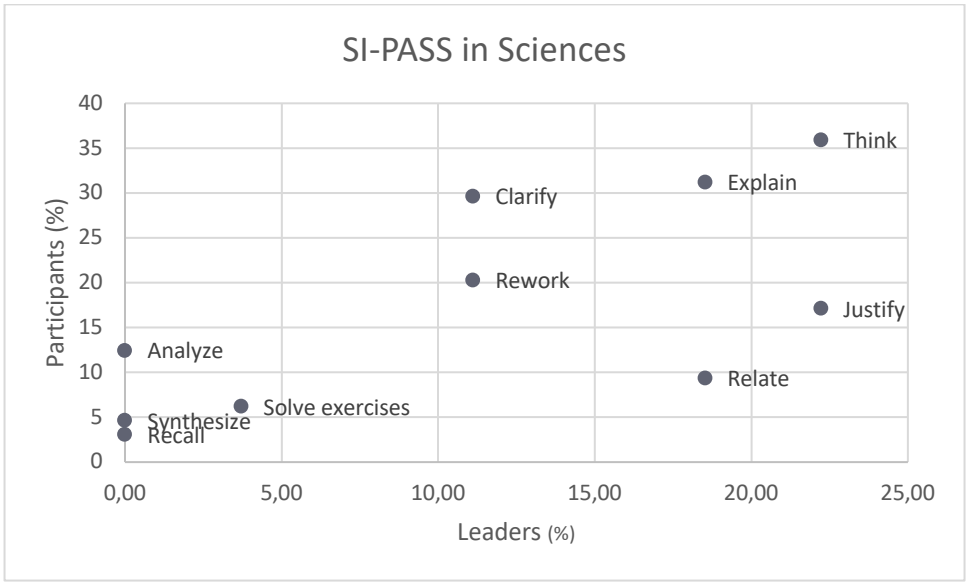
- First semester: Analyse fondamentale, part. 1 (Prof. S. Nicolay)
  https://www.programs.uliege.be/cocoon/20232024/cours/MATH0071-1.html
- Second semester: Analyse fondamentale, part. 2 (Pr. S. Nicolay)
  https://www.programs.uliege.be/cocoon/20232024/cours/MATH0072-1.html

2.Graphic representations of top 10 verbs for SI-PASS faculties






SI-PASS in Psychology
Participants (%)
Leaders (%)
60
50
40
30
20
10
0
0,00
5,00
10,00
15,00
20,00
25,00
30,00
Clarify
Explain
Think
Rework
Synthesize
Solve exercises
Recall
Relate
Analyze
Justify


SI-PASS in Sciences
Participants (%)
Leaders (%)
40
35
30
25
20
15
10
5
0
0,00
5,00
10,00
15,00
20,00
25,00
Think
Explain
Clarify
Rework
Justify
Analyze
Relate
Solve exercises
Synthesize
Recall

3. Top ten verbs cited by students from each faculty describing SI-PASS meetings

Ten most used action verbs	SOL O	Applied Sciences		Bioengineering		Psychology		Sciences	
		Participant	Leader	Participant	Leader	Participant	Leader	Participant	Leader
Explain	II	105	19	43	18	46	18	38	8
(295 - 54.53%)		(63.64%)*	(29.69%)*	(74.14%)	(47.37%)	(56.1%)	(41.86%)	(59.38%)	(29.63%)
Clarify	II	85	27	30	20	46	17	35	10
(270 - 49.91%)		(51.52%)	(42.19%)	(51.72%)	(52.63%)	(56.1%)	(39.53%)	(54.69%)	(37.04%)
Think	IV	78	37	18	19	33	17	38	14
(254 - 46.95%)		(47.27%)	(57.81%)	(31.03%)	(50%)	(40.24%)	(39.53%)	(59.38%)	(51.85%)
Rework	II	54	15	18	19	29	18	21	9
(183 - 33.83%)		(32.73%)	(23.44%)	(31.03%)	(50%)	(35.37%)	(41.86%)	(32.81%)	(33.33%)
Relate	III	52	28	19	12	21	15	15	11
(173 - 31.98%)		(31.52%)	(43.75%)	(32.76%)	(31.58%)	(25.61%)	(34.88%)	(23.44%)	(40.74%)
Synthesize	IV	24	9	19	13	23	15	8	3
(114 - 21.07%)		(14.55%)	(14.06%)	(32.76%)	(34.21%)	(28.05%)	(34.88%)	(12.5%)	(11.11%)
Recall	I	33	8	11	5	18	4	7	1
(87 - 16.98%)		(20%)	(12.5%)	(18.97%)	(13.16%)	(21.95%)	(9.3%)	(10.94%)	(3.7%)
Justify	III	25	13	3	6	4	3	17	9
(80 - 14.79%)		(15.15%)	(20.31%)	(5.17%)	(15.79%)	(4.88%)	(6.98%)	(26.56%)	(33.33%)
Analyze	III	24	7	9	3	12	9	15	1
(80 - 14.79%)		(14.55%)	(10.94%)	(15.52%)	(7.89%)	(14.63%)	(20.93%)	(23.55%)*	(3.7%)*
Solve exercises	II	31	4	2	2	23	6	5	2
(75 - 13.86%)		(18.79%)*	(6.25%)*	(3.45%)	(5.26%)	(28.05%)	(13.95%)	(7.81%)	(7.41%)

Note: % = percentage of answered surveys that marked the verb. Statistically significant differences ($p < 0.05$) in response frequencies for a verb between students and SI leaders using a chi-square test are marked by *.

4.SI-PASS - Contingency Tables of chi-squared test

Proportions - Applied Sciences - Explain

Modality		Vote	Proportion
Participant	Observed	105	0.84677
	Expected	89.363	0.72067
Leader	Observed	19	0.15323
	Expected	34.637	0.27933

Proportions - Sciences - Analyze

Modality		Vote	Proportion
Participant	Observed	15	0.937500
	Expected	11.2522	0.70326
Leader	Observed	1	0.062500
	Expected	4.7478	0.29674

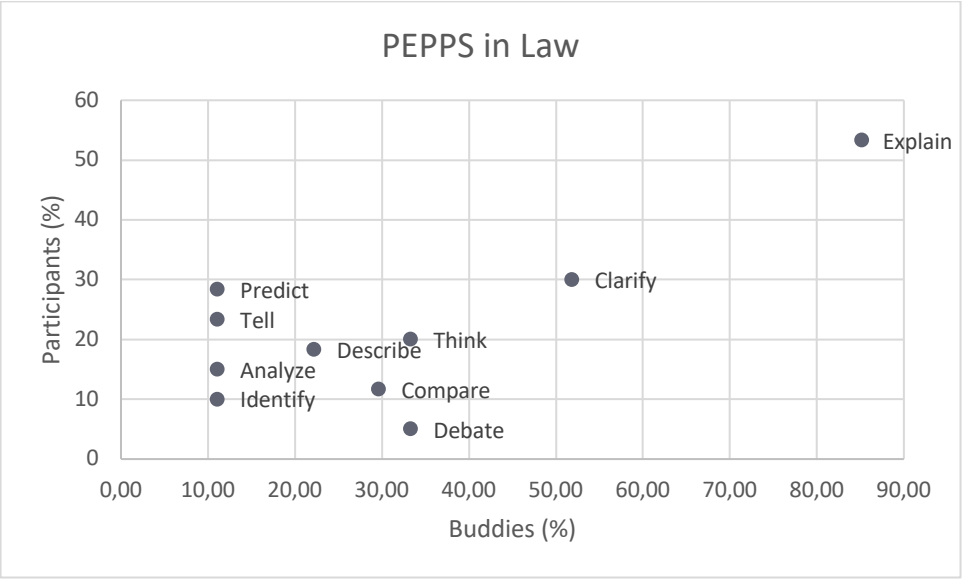
Proportions - Applied Sciences - Solve exercises

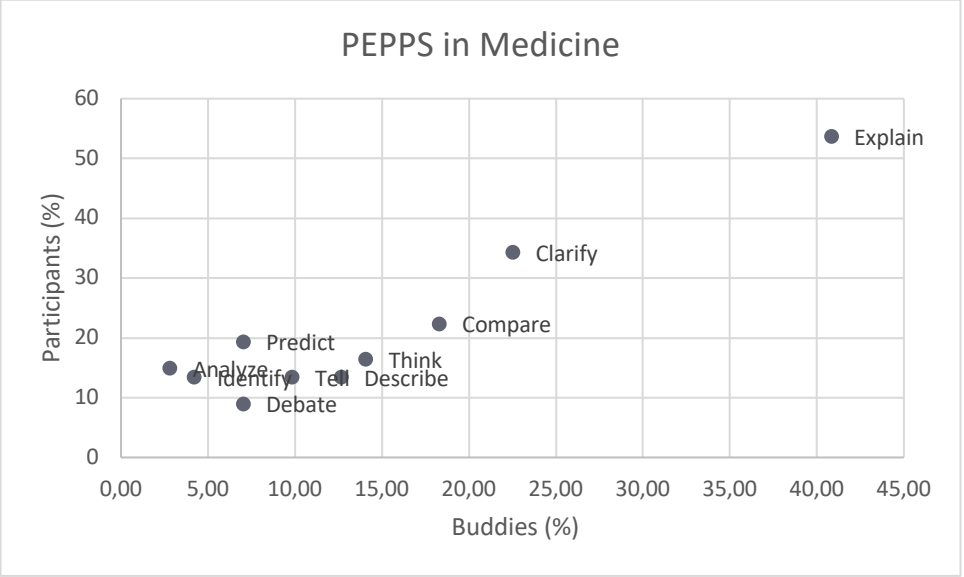
Modality		Vote	Proportion
Participant	Observed	31	0.88571
	Expected	25.2235	0.72067
Leader	Observed	4	0.11429
	Expected	9.7765	0.27933

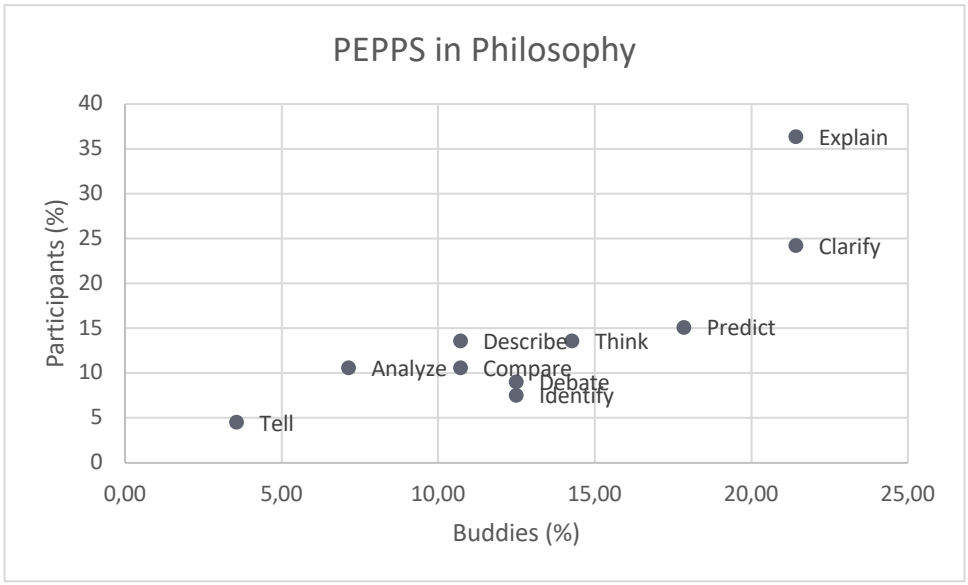
Faculty		SOLO				Total
		IV	III	II	I	
Bioengineering	Observed	108	71	209	51	439
	Expected	103.867	89.711	195.35	50.075	439.00
Psychology	Observed	141	106	253	89	589
	Expected	139.356	120.364	262.09	67.185	589.00
Sciences	Observed	101	94	184	30	409
	Expected	96.769	83.580	182.00	46.653	409.00
Applied Sciences	Observed	237	236	458	113	1044
	Expected	247.008	213.345	464.56	119.086	1044.00
Total	Observed	587	507	1104	283	2481
	Expected	587.000	507.000	1104.00	283.000	2481.00

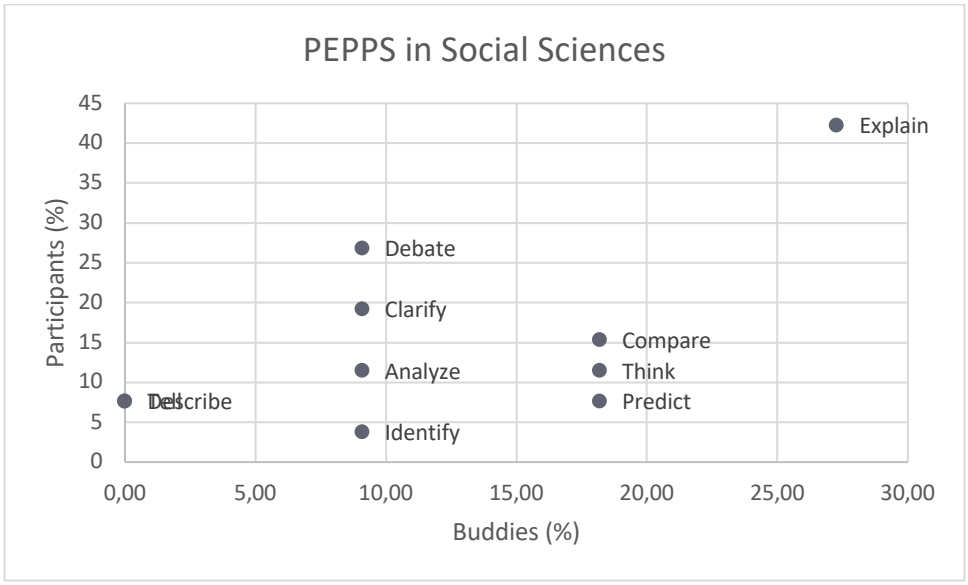
Faculty		SOLO				Total
		IV	III	II	I	
Leader	Observed	211	202	296	68	777
	Expected	183.84	158.78	345.75	88.630	777.00
Participant	Observed	376	305	808	215	1704
	Expected	403.16	348.22	758.25	194.370	1704.00
Total	Observed	587	507	1104	283	2481
	Expected	587.00	507.00	1104.00	283.000	2481.00

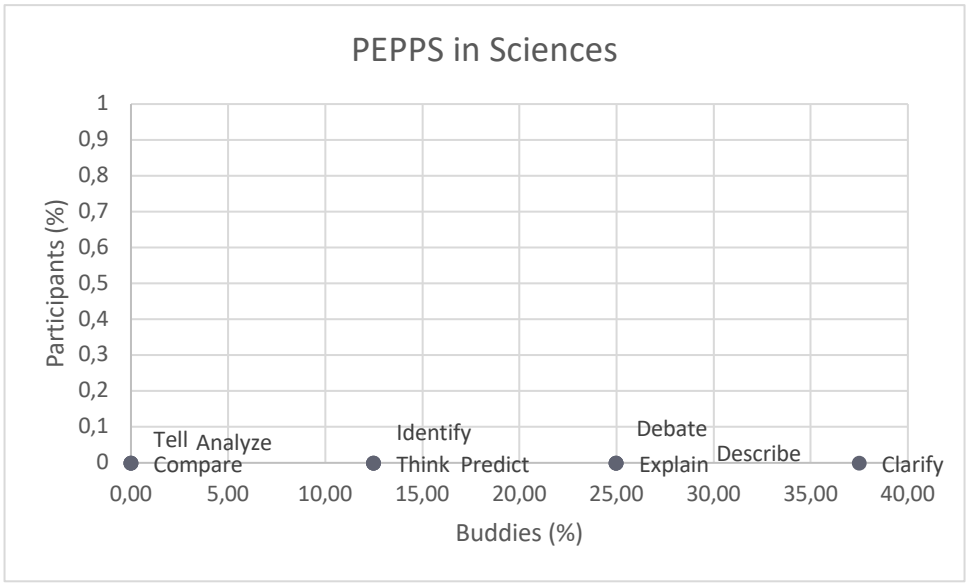
5.Graphic representations of top 10 verbs for SI-PASS faculties

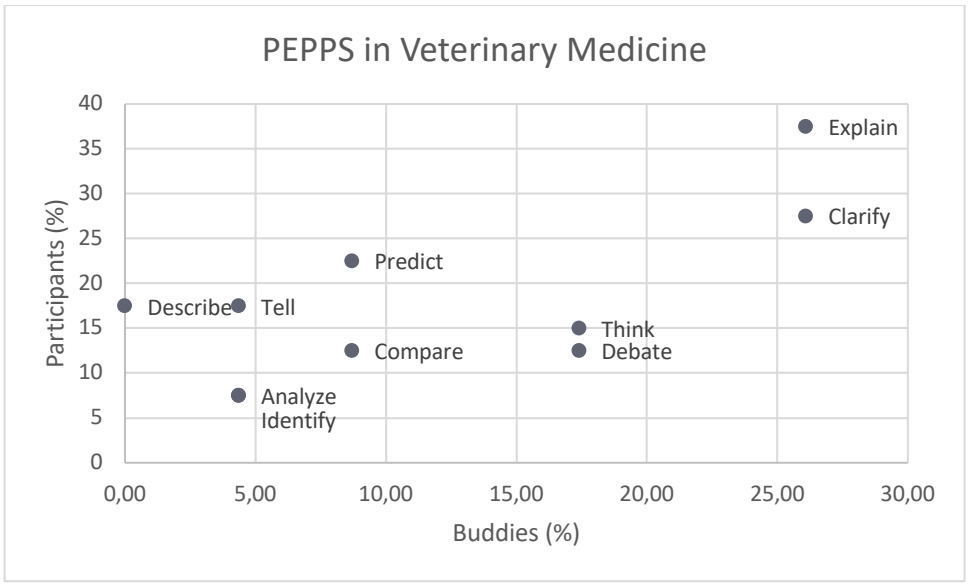





PEPPS in Philosophy
Participants (%)
Buddies (%)
0
5
10
15
20
25
30
35
40
0,00
5,00
10,00
15,00
20,00
25,00
Explain
Clarify
Predict
Describe
Think
Analyze
Compare
Debate
Identify
Tell


PEPPS in Social Sciences
Participants (%)
Buddies (%)
0
5
10
15
20
25
30
35
40
45
0,00
5,00
10,00
15,00
20,00
25,00
30,00
Explain
Debate
Clarify
Compare
Analyze
Think
Predict
Identify


PEPPS in Sciences
Participants (%)
1
0,9
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0
Tell
Analyze
Compare
Identify
Think
Predict
Debate
Explain
Describe
Clarify
0,00
5,00
10,00
15,00
20,00
25,00
30,00
35,00
40,00
Buddies (%)


PEPPS in Veterinary Medicine
Participants (%)
40
35
30
25
20
15
10
5
0
Explain
Clarify
Predict
Describe
Tell
Think
Debate
Compare
Analyze
Identify
0,00
5,00
10,00
15,00
20,00
25,00
30,00
Buddies (%)

6. PEPPS - Contingency Tables of chi-squared test

Faculty		SOLO				Total
		IV	III	II	I	
Law	Observed	86	104	170	68	428
	Expected	95.216	97.101	170.069	65.6141	428.000
Medicine	Observed	168	150	280	88	686
	Expected	152.612	155.634	272.587	105.1665	686.000
Veterinary Medicine	Observed	60	63	130	44	297
	Expected	66.073	67.381	118.015	45.5313	297.000
Philosophy	Observed	120	136	230	103	589
	Expected	131.033	133.628	234.043	90.2960	589.000
Sciences	Observed	14	6	17	8	45
	Expected	10.011	10.209	17.881	6.8987	45.000
Applied Sciences	Observed	10	11	13	11	45
	Expected	10.011	10.209	17.881	6.8987	45.000
Social Sciences	Observed	47	45	62	26	180
	Expected	40.044	40.837	71.524	27.5947	180.000
Total	Observed	505	515	902	348	2270
	Expected	505.000	515.000	902.000	348.0000	2270.000

Faculty		SOLO				Total
		IV	III	II	I	
Buddy	Observed	245	206	398	133	982
	Expected	218.46	222.79	390.20	150.54	982.00
Participant	Observed	260	309	504	215	1288
	Expected	286.54	292.21	511.80	197.46	1288.00
Total	Observed	505	515	902	348	2270
	Expected	505.00	515.00	902.00	348.00	2270.00

7. Distribution of SOLO verb categories in each video

Video	Faculty	Unistructural (I)	Multistructural (II)	Relational (III)	Extended Abstract (IV)
1	Sciences	40 (32.52%)	39 (31.71%)	26 (21.14%)	18 (14.63%)
2	Sciences	6 (10.35%)	22 (37.93%)	17 (29.31%)	13 (22.41%)
3	Sciences	3 (17.65%)	6 (35.29%)	6 (35.29%)	2 (11.77%)
4	Bioengineering	10 (20.83%)	19 (39.58%)	15 (31.25%)	4 (8.33%)
5	Applied Sciences	26 (24.53%)	38 (35.85%)	30 (28.3%)	12 (11.32%)
6	Sciences	27 (32.53%)	30 (36.15%)	20 (24.1%)	6 (7.23%)
7	Sciences	9 (15%)	30 (50%)	11 (18.33%)	10 (16.67%)
8	Bioengineering	4 (17.39%)	7 (30.44%)	10 (43.48%)	2 (8.7%)
9	Applied Sciences	36 (21.95%)	73 (44.51%)	38 (23.17%)	17 (10.37%)
10	Applied Sciences	32 (20.92%)	57 (37.26%)	46 (30.07%)	18 (11.77%)
11	Applied Sciences	27 (23.48%)	42 (36.52%)	32 (27.83%)	14 (12.17%)
12	Sciences	27 (36.99%)	18 (24.66%)	22 (30.14%)	6 (8.22%)
13	Sciences	9 (36%)	14 (56%)	1 (4%)	1 (4%)
14	Applied Sciences	19 (41.3%)	8 (17.39%)	13 (28.26%)	6 (13.04%)
15	Applied Sciences	10 (19.61%)	19 (37.26%)	8 (15.69%)	14 (27.45%)
16	Bioengineering	16 (25%)	34 (53.13%)	3 (4.69%)	11 (17.19%)
17	Sciences	36 (50%)	23 (31.94%)	9 (12.5%)	4 (5.56%)
18	Applied Sciences	44 (39.64%)	38 (34.23%)	17 (15.32%)	12 (10.81%)
19	Psychology	3 (25%)	7 (58.33%)	1 (8.33%)	1 (8.33%)
20	Applied Sciences	28 (50%)	18 (32.14%)	3 (5.36%)	7 (12.5%)
21	Applied Sciences	12 (31.71%)	21 (51.22%)	3 (7.32%)	4 (9.76%)
22	Psychology	13 (29.55%)	22 (50%)	8 (18.18%)	1 (2.27%)
23	Applied Sciences	4 (11.43%)	15 (42.86%)	10 (28.57%)	6 (17.14%)
24	Sciences	9 (12.5%)	20 (27.78%)	34 (47.22%)	9 (12.5%)
25	Applied Sciences	29 (19.86%)	56 (38.36%)	52 (35.62%)	9 (6.16%)
26	Psychology	20 (28.17%)	28 (39.44%)	17 (23.94%)	6 (8.45%)
27	Applied Sciences	8 (33.33%)	7 (29.17%)	6 (25%)	3 (12.5%)
28	Psychology	23 (35.39%)	22 (33.85%)	9 (13.85%)	11 (16.92%
29	Applied Sciences	31 (33.33%)	28 (30.11%)	17 (18.28%)	17 (18.28%)
30	Applied Sciences	15 (29.41%)	14 (27.45%)	14 (27.45%)	8 (15.69%)
31	Applied Sciences	15 (31.25%)	19 (39.58%)	4 (8.33%)	10 (20.83%)
32	Bioengineering	17 (25.37%)	23 (34.33%)	13 (19.4%)	14 (20.9%)
33	Bioengineering	24 (45.28%)	16 (30.19%)	7 (13.21%)	6 (11.32%)
34	Applied Sciences	28 (29.79%)	31 (32.98%)	28 (29.79%)	7 (7.45%)
35	Applied Sciences	22 (32.84%)	18 (26.87%)	11 (16.42%)	16 (23.88%)
36	Psychology	9 (18.75%)	34 (70.83%)	5 (10.42%)	0 (0%)
37	Bioengineering*	0 (0%)	2 (66.67%)	0 (0%)	1 (33.33%)
38	Sciences	5 (27.78%)	8 (44.44%)	1 (5.56%)	4 (22.22%)
39	Psychology	14 (16.87%)	36 (43.38%)	18 (21.69%)	15 (18.07%)
40	Applied Sciences	21 (20.39%)	33 (32.04%)	43 (41.75%)	6 (5.83%)
41	Applied Sciences	4 (11.43%)	14 (40%)	12 (34.29%)	5 (14.29%)

Note: Video marked by * was of poor quality, thus resulting in an impossibility to hear more verbs exactly pronounced.

8.Recorded videos - Contingency tables of chi-squared test

Proportions - Faculties - Unistructural

Modality		Quantity	Proportion
Bioengineering	Observed	71	0.096467
	Expected	107.60	0.14620
Psychology	Observed	82	0.111413
	Expected	107.60	0.14620
Sciences	Observed	171	0.232337
	Expected	179.70	0.24415
Applied Sciences	Observed	412	0.559783
	Expected	341.10	0.46345

Proportions - Faculties - Multistructural

Modality		Quantity	Proportion
Bioengineering	Observed	101	0.10010
	Expected	147.51	0.14620
Psychology	Observed	149	0.14767
	Expected	147.51	0.14620
Sciences	Observed	210	0.20813
	Expected	246.35	0.24415
Applied Sciences	Observed	549	0.54410
	Expected	467.62	0.46345

Proportions - Faculties - Relational

Modality		Quantity	Proportion
Bioengineering	Observed	48	0.075000
	Expected	93.567	0.14620
Psychology	Observed	58	0.090625
	Expected	93.567	0.14620
Sciences	Observed	147	0.229687
	Expected	156.257	0.24415
Applied Sciences	Observed	387	0.604688
	Expected	296.608	0.46345

Proportions - Faculties - Extended Abstract

Modality		Quantity	Proportion
Bioengineering	Observed	38	0.11310
	Expected	49.123	0.14620
Psychology	Observed	34	0.10119
	Expected	49.123	0.14620
Sciences	Observed	73	0.21726
	Expected	82.035	0.24415
Applied Sciences	Observed	191	0.56845
	Expected	155.719	0.46345

Transition

Study 5 continues the process-oriented turn initiated in study 4. While study 3 did not demonstrate significant improvements in academic performance, study 4 examined students' reported cognitive engagement during SI-PASS sessions. Study 5 moves one step further by investigating whether the program was enacted in accordance with its core principles and techniques. Given the highly structured nature of SI-PASS and its explicit international guidelines, implementation fidelity is central to interpreting any outcome associated with the scheme.

This study uses behavioural coding of video-recorded SI-PASS sessions with The Observer XT software, in line with cognitive ergonomics methodologies (Gómez-Bull et al., 2015). By focusing on program fidelity and the extent to which observed sessions align with SI-PASS principles, study 5 provides evidence for interpreting whether the absence of measurable academic effects may reflect limitations of the model itself or the conditions of its local implementation at ULiège.

In doing so, study 5 strengthens the methodological architecture of the dissertation and contributes to the broader peer-learning literature by illustrating the importance of process evaluation when interpreting program outcomes (Durlak & DuPre, 2008).

Study 5

SI-PASS at ULiège - Session content analysis through a video behavioral coding program

N. Puttaert, A.-S. Nyssen, V. Defaweux, D. Verpoorten

Under review in Studia Paedagogica, April 2026

"The class observations are central forms of evidence as they document what really happened and are the foundation of the validity and robustness of the study." (Pleschová & McAlpine, 2024, p. 5).

Abstract

Since 2019, SI-PASS, a peer learning program, has been implemented in four faculties at the University of Liège. During this period, data collection and monitoring primarily relied on attendance records and self-reported questionnaires. While informative, these sources provide little insight into what actually happens during the sessions, knowledge that is crucial for accessing patterns of engagement, evaluating the program's effectiveness and for assessing leaders' adherence to its principles. To address this gap, 41 SI-PASS meetings were video recorded and analysed with Noldus Observer XT. This study can be considered an insight into the "black box" of session activity. Using a structured observation grid, it enables fine-grained analysis of leader interaction dynamics, role orientation and compliance to core SI-PASS principles and recommended techniques. Overall, the findings point to moderate rather than full compliance with the official model, as leaders often adapted prescribed practices in response to contextual constraints. This underscores the importance of fidelity checks and process evaluation: without them, outcome studies are difficult to interpret, and null or mixed effects cannot be confidently attributed to the model itself versus its enactment. Results also suggest concrete action points for strengthening implementation: further reinforcing, the facilitation stance and the practical moves that keep peer interaction at the forefront, securing adequate session time, and sharpening shared operational definitions of what constitutes "doing SI-PASS".

1. Introduction

With more than fifty years of implementation across over thirty countries, Supplemental Instruction - Peer-Assisted Study Sessions (SI-PASS) is a peer-learning program attached to demanding courses and underpinned by an official framework of 21 principles (Appendix 1) and 4 techniques (Appendix 2) intended to support learning through student-to-student conversations about course material (European Centre for SI-PASS, 2018). Together, these documents delineate how an "ideal" SI-PASS session (Supervisor Manual, p. 14-15) should be conducted by "leaders" (second-year students in charge of a group of first-year students) around a challenging course (semester-long unit, Appendix 3).

Although this framework is a hallmark of SI-PASS schemes, its enactment in leaders' observable actions during the sessions they facilitate has rarely been examined as a research focus. Leaders' micro-behaviours are seldom treated as objects of inquiry. Instead, they are often implicitly assumed to align with the above program's defining principles and techniques. This puts a "black box" at the heart of the intervention: what, concretely, happens during sessions, and how closely do leaders' practices align with the official framework?

Ergonomics has long shown that prescribed tasks often diverge from real activity, as actors continually adapt, regulate, and transform prescriptions to make them workable in their specific contexts (Guérin & Deniellou, 2006; Leplat, 1992, 1997). Applied to SI-PASS, this means that analysing the program requires attention not only to its official principles, but also to what leaders and participants really do *in situ*, in order to establish whether a gap exists and, if so, how substantial it is.

1.1. Current state of research

The current lack of detailed knowledge about enacted practice affects how findings are interpreted across several research streams. In studies focused on academic performance, quasi-experimental designs and randomized trials (*e.g.*, Dekker et al., 2023; study 3 or Puttaert et al., 2025) do not question the session dynamics that are presumed to spur this performance. A similar uncertainty applies to the substantial qualitative literature which, from early case studies (Smith et al., 2007) to more recent work (Dekker, 2025), documents additional outcomes such as transferable skills (Ning & Downing, 2010) and confidence development (Drake, 2011). While these studies shed light on important perceived benefits, they likewise seldom establish whether such effects stem from adherence to the prescribed SI-PASS principles, local adaptations, or alternative facilitation practices. A modicum of work has sought to better understand what happens during sessions and how leaders (mis)understand their role (Chilvers, 2013). However, the evidence remains most often indirect, relying on surveys (Hizer, 2010; Longfellow et al., 2008) and retrospective self-reports (Bru, 2002). Although informative, these approaches are constrained by well-known weaknesses: self-report bias (Bressoux et al., 1999; Esterhazy & Gijbels, 2021), delayed account (Hora et al., 2013), and variability in how respondents interpret constructs such as "SI-PASS techniques" or "principles". Debriefings with leaders, interviews, or focus groups with participants (Bengesai, 2011) can provide richer accounts, but they remain comparatively underused and still depend on the accuracy of participants' recollections and descriptions.

The substantial SI-PASS literature currently remains unevenly distributed: outcome studies, interview-based explorations and perception surveys are well represented, whereas systematic observation of sessions as they unfold is rare. Neither Dawson et al.'s (2014) review of 29 studies reports, nor Bengesai et

al.'s (2023) meta-analysis includes observational studies of this kind. At the same time, emerging findings underscore the importance of detailed interactional processes in SI-PASS sessions (between leaders and participants, among participants themselves, and in relation to the learning materials as in Dekker et al., 2023; Zha et al., 2019). Taken together, these limitations point to the need for direct observation to understand SI-PASS dynamics in such a way that it becomes possible to connect observed effects (or null effects) to the behaviour of the key stakeholders, namely the leaders. Doing so may also clarify the extent to which SI-PASS, as implemented, differs from other academic support programs.

1.2. The need to examine in vivo activities

Without first-hand evidence of how sessions unfold, it will remain difficult to determine whether mixed results in the literature (Burkholder et al., 2021) reflect intrinsic limits of the SI-PASS model or shortcomings in its local enactment. Because SI-PASS mechanisms are fundamentally interactional, direct observation of in vivo activity is needed.

Video-based methods are particularly suited for this purpose, especially when enhanced with structured coding grids (Albero & Thievenaz, 2022). They preserve the temporal and sequential detail of action, enable repeated inspection, support the coding of indicators such as speaking time, redirection frequency, and group-work duration (Derry et al., 2010; Jordan & Henderson, 1995; Theureau, 2006), and capture subtle forms of interaction that live observers might miss (Beatty & Ulewicz, 2001; Brunvard, 2010; Van der Maren, 2014). Despite evidence that recording does not substantially alter participants' behaviour (Theureau, 2006), videotaping remains uncommon, partly due to its practical demands: time-intensive analysis (*e.g.*, a one-hour video requiring approximately between 3 to 5 hours of work in terms of coding,

Heath et al., 2007), the need for trained coders, and ethical considerations (Charron, 2004).

While video-based research exists more broadly for peer tutoring sessions (Arendale, 2022ab; Glassman, 1985; Pulling & Allen, 2014; Pleschová & McAlpine, 2024), few studies have videotaped SI-PASS sessions specifically. Holm (2014) analysed 14 recordings in Swedish upper secondary schools to identify learning conditions in mathematics discussions. Paideya & Sookrajh (2010) explored, through fifteen sessions over a ten-week period, chemistry students' engagement preferences. The relevance of observational approaches is further encouraged by early findings consistent with an ergonomic perspective emphasizing discrepancies between official prescriptions and real practice. For instance, Capstick et al. (2004) reported a lack of structure in group sessions, and Hammond et al. (2010) noted limited clarity regarding the activities performed by students during SI-PASS.

This study therefore responds to the general need for refined knowledge on session dynamics, while also addressing a local issue. A previous randomized controlled trial (RCT) conducted at ULiège in a high-risk statistics course for first-year psychology students (study 3 or Puttaert et al., 2025) found no significant overall effect of SI-PASS assignment on academic performance or socio-affective variables in the experimental comparison. However, the same study showed that positive effects emerged when attendance intensity was taken into account, and that students who participated in SI-PASS outperformed non-volunteers in the broader quasi-experimental comparison. This raises a core fidelity of implementation (Carroll et al., 2007) issue: do these null results reflect inherent limits of the SI-PASS model, or do they point to weaknesses in its local instantiation at ULiège? To address this question, the present paper contrasts the program's official guidelines, as elaborated in the

next section, with what occurs in sessions, using video-based behavioural coding to examine leaders' practices. Behavioural evidence is gathered to assess whether the following 21 principles and 4 techniques are implemented as intended.

1.3. SI-PASS - 21 principles and four leader techniques

The European Centre for SI-PASS has established a set of 21 principles (Appendix 1) and four leader techniques that define the essential components of SI-PASS meetings and how these sessions should be conducted (European Centre for SI-PASS, 2018). The central and overarching motto of SI-PASS is "Do not re-lecture" (principle 20), reflecting the goal of encouraging students to process the material themselves, rather than receiving passive instruction. This facilitative stance is widely emphasized in the SI literature, where leaders are described not as substitute lecturers but as process facilitators who guide students in constructing their own understanding through structured interaction (Hurley et al., 2006). In that sense, within the learning events framework (Leclercq & Poumay, 2005; Verpoorten et al., 2007), SI-PASS ideally revolves around the "debate/moderation" event, while the "reception/transmission" event (typical of lecture-based formats) is avoided as much as possible.

Practically, leaders (students who have previously completed the course and succeeded, principle 7) oversee weekly meetings with a group of new students, and they are specifically trained (two-day training, principle 18) to design activities that encourage collaboration and self-directed learning (principle 2). Their role is to facilitate active and collaborative learning (principle 11), promoting meaningful discussions in small groups (principle 4) about the high-risk course for which these meetings serve as supplemental support (principle 8) to encourage deep knowledge construction *versus* rote learning, especially before exams (Chambers-Turner, 2017). SI-PASS schemes are harnessed to

“high-risk” courses and not “high-risk students” (high failure, withdrawal, or repetition rates), preventing an interpretation of the supplemental instruction as “remedial” (Hurley et al., 2006).

Besides the 21 principles, the official Supervisor Training Manual for SI-PASS (European Centre for SI-PASS, 2018, p. 36) highlights four core competencies for leaders detailed in Appendix 2. The four techniques, operating at a finer granularity level than the 21 principles, are fundamental; as they define specific leader behaviors that support student learning. Overall, these principles and techniques define the expected essence of SI-PASS leader’s attitude during the sessions.

1.4. Research question and hypotheses

To address both the global aim of extending knowledge on SI-PASS *in vivo* dynamics and the convergent local aim of shedding light on the null effect on performance reported by Puttaert et al. (2025), hypotheses were formulated around program mechanisms that can reasonably be examined through behavioural indicators. Not all SI-PASS principles lend themselves to empirical hypothesis testing, however, as many are structural (*e.g.*, supervision, reporting) rather than directly observable during sessions. Accordingly, the present study focuses on principles that are both theoretically central and visible in practice. Priority was given to the student-driven nature of sessions (principle 2), the creation of collaborative small-group environments (principle 4), and alignment with course content while integrating study skills (principles 9-10).

Among the SI-PASS techniques, attention is restricted to those most directly involved in enacting the “student-led” spirit, those most emphasised in leader training, most distinctive of SI-PASS relative to traditional teaching, and

amenable to systematic coding in video data. By concentrating on these core, measurable elements, the hypotheses target mechanisms that are plausible candidates for explaining the RCT's null findings and enable an assessment of how faithfully (and with what adaptations) the SI-PASS model is enacted at ULiège.

Hypotheses are deliberately phrased as potential departures from the SI-PASS model, consistent with a fidelity-of-implementation perspective that treats deviation or drift as a plausible source of outcome variability. This choice also serves the diagnostic purpose: when outcomes are mixed or null, like in Puttaert et al. (2025) focusing hypotheses on "failure points" helps disentangle between weak theory/program and weak quality of delivery, between ineffective intervention and suboptimal enactment. In addition, negatively framed hypotheses tend to be easier to operationalise with behavioural indicators.

Hypothesis 1: Leaders reteach the course material. Although SI-PASS leaders are trained to promote independent learning and ensure that sessions are not transformed into lectures or tutorial substitutes (principle 20), non-compliance may occur in practice. This hypothesis is examined by comparing leaders' and students' speaking time in the recordings, in order to assess whether leaders effectively minimise direct teaching (thereby maintaining the student-driven nature of sessions (principle 2) and a collaborative small-group environment (principle 4), or whether they dominate interaction and, in doing so, reduce opportunities for student-led learning.

Hypothesis 2: Leaders select the content of the session instead of letting students choose. Principle 2 states that SI-PASS sessions are student-driven, with participants selecting the content of SI-PASS sessions facilitated by

leaders. This implies the construction of a "shared agenda", whereby topics emerge from students' expressed needs and are collectively negotiated at the beginning of the session, rather than following a predefined "meeting plan" prepared in advance by the leader. Video analysis comparing instances of leader-initiated (meeting plan) *versus* student-initiated (shared agenda) content taking place at the beginning of the session should reveal whether sessions are in practice leader-driven rather than student-driven.

Hypothesis 3: Leaders fail to redirect students' questions to peers. A core SI-PASS expectation is that leaders first redirect questions to the group, encouraging peer explanation and collaborative reasoning (technique 2). Excessive redirection toward notes, slides, or textbooks may indicate a drift toward more traditional, resource-dependent help. Comparing the frequency of group-redirection *versus* materials-redirection in the videos assesses whether leaders privilege peer interaction, or whether they rely more heavily on course materials, thereby weakening the collaborative dynamics central to SI-PASS.

Hypothesis 4: Sessions rely insufficiently on group work. Collaborative work is a core expectation of SI-PASS, as sessions are designed to encourage peer-to-peer interaction rather than individual problem-solving. This aligns with techniques 1 and 2, and principle 11. If the RCT yielded no significant effect, one possible explanation is that sessions may not have devoted enough time to group-based activities. Comparing the frequency of group work *versus* individual work in the videos ascertains whether SI-PASS sessions really provide the collaborative environment required by the model.

Hypothesis 5: SI-PASS sessions fail to establish the informal, collaborative atmosphere expected of the model. A defining feature of SI-PASS (principle 11) is its contrast with formal lectures: sessions should unfold in an informal

atmosphere. If the randomized trial yielded no significant effect, one possible explanation is that sessions did not encourage this relaxed peer-learning climate. Inspecting the frequency of welcoming rituals, laughter, and physical movement in the videos provides indications of whether SI-PASS meetings succeeded in creating the open, informal environment required for active peer engagement.

2. Methodology

2.1. Data sources and treatment

All data were collected during the second semester of the 2022-2023 academic year from the faculties who offer the SI-PASS program: Applied Sciences, Bioengineering, Psychology, and Sciences. To ensure the most rigorous assessment of all measures (Table 1), all sessions were recorded on video. More specifically, the beginning of each video corresponds to the beginning of the meeting. The recording ends when the leader closes the session.

Each video was subsequently coded by a single trained coder who was previously familiar with the SI-PASS framework and the local implementation of the program. Coding was done using the Noldus Observer XT tool (Noldus, 1991; Noldus Information Technology, 2012) and was based on a pre-established analysis grid (Table 1) aligned with the study's hypotheses. The coding scheme was constructed deductively from the hypotheses and from the official SI-PASS principles and techniques, with the aim of ensuring conceptual alignment between the theoretical framework and the observable indicators. Each recording was coded in full, from the opening to the closing of the session, by assigning the predefined categories to the corresponding behavioural episodes as they unfolded in time. Because the coding was conducted by only one coder, no inter-rater reliability coefficient could be calculated. This choice ensured consistency in the application of the coding scheme across the full dataset, but it also limits the robustness of the behavioural measures and should be kept in mind when interpreting the findings. The program facilitated the collection of both duration data and the frequency (occurrences) of specific behavioral patterns (Jansen et al., 2003). The total length and frequency (occurrences) of each measure was recorded. Because the hypotheses concerned contrasts between paired behavioural

indicators at the session level (*e.g.,* leader *vs*. student speaking time, group work *vs*. individual work, redirection to peers *vs*. redirection to notes), the analyses relied on t-tests comparing the observed frequencies or durations of these indicators across the recorded sessions.

Table 1 - Video analysis grid: Observable actions on 4 measures and 12 indicators each associated to a hypothesis (into brackets).

Measures	Observable action
1. Students	
a. Total speech time (H1)	When a student is speaking during the session.
b. Individual work (H4)	Length of time the student is working on their own.
c. In group work (H4)	Length of time the student is working with their peers (a group is considered 2 people or more interacting).
2. Leaders	
a. Total speech time (H1)	When the leader is speaking during the session.
b. Meeting plan (H2)	Moment taken by the leader to explain what the meeting will be about (the leader decides).
c. Shared Agenda (H2)	Moment taken by the leader to explain what the meeting will be about (students decide).
d. Redirection towards students (H3)	Each time the leader redirects a question towards other students.
e. Redirection towards notes (H3)	Each time the leader redirects a question towards the student's notes.
3. Verbal exchanges (H1)	When both the leader and the students are talking together.
4. Ambiance	
a. Welcome to meeting (H5)	Welcoming students to the session.
b. Laughs (H5)	When students laugh.
c. Movement (H5)	Students (not the leader) are moving around, they are not seated anymore.

2.2. Hypothesis 1 - No re-lecture

To address Hypothesis 1, the principle of "not re-teaching" (Hypothesis 1) was operationalized through three indicators. This operationalisation should be understood as indirect and exploratory: relative speaking time provides a useful behavioural proxy for leader presence in the interaction, but it does not in itself capture the pedagogical function of that speech. In other words, longer leader talk may reflect direct explanation, but it may also correspond to

facilitation moves such as prompting, questioning, clarifying instructions, or scaffolding discussion. The present analysis therefore treats talk-time balance as a first indicator of possible drift toward re-lecturing, not as a direct measure of re-teaching in the strict pedagogical sense.

- Total speech time of the leader (2a): Given that the primary goal of SI-PASS leaders is to stimulate conversations on course material, their interventions should focus on prompting and maintaining interactions (techniques 1-4), resulting in shorter speaking time.
- Total speech time of students (1a): This indicator, which mirrors 3a, is expected to show greater speaking time for the students, as the SI-PASS philosophy emphasizes that students should be doing most of the talking and active engagement in the sessions.
- Verbal exchanges (3): This indicator measures moments where the audio is too unclear to determine with certainty who is speaking. Such exchanges are nevertheless central to SI-PASS, as they reflect informal, rapid conversations around course material without clearly identifiable or stable speaking turns. Their inclusion is also theoretically grounded in the peer-learning literature, where discussion is treated as a core mechanism of learning rather than a neutral background feature. As Draper puts it, *"ANY discussion is good for PAL because it a) practises peer interaction on course material, b) gets clients doing mental reprocessing of the material and so promotes learning, c) is an occasion for them getting to know each other better, feel more part of the class. You can hardly lose."* (2002). In this sense, verbal exchanges were retained not as a sufficient indicator of cognitive depth, but as a relevant proxy for the activation of peer interaction around the material.

Please note that these measures are transversal to all other categories, which means for instance that students tagged as “moving around” while parts of this segment were also coded with “leader speech time”.

2.3. Hypothesis 2 - Session opening

To address Hypothesis 2, which posits that students contribute the content for the meetings, the principle was broken down into two indicators:

- Meeting plan (2b - the leader decides): This refers to the time taken by the leader to explain the focus of the meeting. It occurs when students contact the leader between sessions to request clarification on specific points in the course or when the leader did not receive any request for the next meeting. As a result, the leader arrives with a pre-established plan for the session.
- Shared agenda (2c - students decide): At the start of the session, an agreement is made between the leader and the students about the course material they will focus on. In this scenario, the topics to be covered become a point of discussion at the beginning of the session. Students are encouraged to raise personal concerns about the material and, in collaboration with the group, influence the topics that will be addressed during the session.

It sometimes occurred that one of these two patterns was used a second time during the session. This happened when, for instance, the exercises planned for the session were solved faster than anticipated and both the leader and students had to discuss the rest of the meeting.

2.4. Hypothesis 3 - Redirecting questions

To address Hypothesis 3, the indicators are self-explanatory: SI-PASS should encourage an active and collaborative experience for students, encouraging

them to discuss and debate course materials. As such, leaders should not give direct answers but instead redirect questions to the group (2d as first option). Occurrences of this practice were measured in the video recordings. The second option (2e) occurs when no one has the answer, and the group is at an impasse. In this case, the leader redirects the students to their notes and textbooks to encourage them to continue seeking answers independently. This second option is expected to occur less frequently, as it is considered a last resort for maintaining student engagement.

2.5. Hypothesis 4 - Groupwork

To address Hypothesis 4, the principle that group work is essential in SI-PASS sessions is operationalized through two indicators:

- Group work (1c): In "optimal" SI-PASS session, group work is always encouraged, even though not pinpointed as a mandatory activity. Group settings increase the likelihood of student interaction, whereas a plenary may result in deferring conversation to peers.
- Individual work (1b): This indicator contrasts the time spent on group work with moments of independent learning. While independent work is not a core feature of SI-PASS, it may occasionally be used as preparation for a subsequent group discussion. Given that central aim of SI-PASS is to encourage group collaboration around course materials, time spent in groups should be greater than time spent working individually.

2.6. Hypothesis 5 - Ambiance

To address Hypothesis 5, the principle of a casual atmosphere in SI-PASS sessions is operationalized through three indicators. This operationalisation should be understood as partial and indirect. These behaviours were selected because they provide visible traces of a relaxed and active peer-learning

environment, but they do not exhaust the broader construct of social and interactional climate. In particular, they do not capture more subtle dimensions such as participation balance, perceived safety, inclusion, or the quality of turn-taking.

- Welcome to meeting (4a): SI-PAS meetings are supposed to provide an informal atmosphere in which the leader takes a few minutes to welcome everyone, perform an ice-breaker game, or simply ask them how they are.
- Laughs (4b): Laughs are an indicator of a more informal and relaxed atmosphere. Measuring spontaneous laughter during recorded sessions provides insight into the positive interpersonal dynamics at play, highlighting the social, rather than solely academic, nature of the interactions.
- Physical movement (4c): SI-PASS sessions are supposed to revolve around collective thinking, active discussion and debate amongst students, ideally in an environment that is both focused and informal. Observable signs of this casual yet structured dynamic can be seen in students' freedom of movement and body posture during the sessions, which serve as indicators of a comfortable, collaborative atmosphere. The measure taken refers to the moments students were not seated as they would in an auditorium, which involves group work, solving exercises on the blackboard, explaining something to the group on the board, etc.

3. Results

3.1. Usable sample

A total of 42 videos has been recorded during the second semester of academic year 2022-2023 (from 17th February 2023 to 5th May 2023, with 3 videos in February, 15 in March, 17 in April, and 7 in May). Number of recordings, mean length (in minutes) and standard deviation are given between brackets for the faculties of Applied Sciences (n = 20, M = 58.64, SD = 4.71), Bioengineering (n = 6, M = 45.14, SD = 10.37), Psychology (n = 6, M = 65.89, SD = 17.06) and Sciences (n = 10, M = 54.15, SD = 13.81). Amongst these videos 42, one had to be removed due to a sound issue. The total usable sample thus equalled n = 41 (faculty of Applied Sciences n = 19). The longest meeting recorded lasted 87 minutes, while the shortest lasted 29 minutes with an average of M = 56.63, SD = 11.78. Differences in mean session length between faculties are consistent with the flexible nature of SI-PASS implementation, where meetings are adapted to local scheduling conditions, course organisation, and students' immediate needs. In that sense, shorter average sessions in some faculties, such as Bioengineering, should not be interpreted as atypical in themselves, but rather as reflecting local implementation conditions.

3.2. Hypothesis 1 - No re-lecture

As shown in Table 2, the mean leader speech time was 24 minutes, while students recorded a mean of 25 minutes. Rapid verbal exchange totalled 4 minutes. A t-test comparing the leaders' total speech time to that of students revealed no significant differences in speech length between the two groups ($t(80) = 0.34$, $p = 0.73$). These results do not allow to refute the hypothesis that leaders reteach course material. Additionally, no significant differences were found between faculties for leader speech time, students' speech time or verbal exchanges (all *ps* > .05).

Table 2 - Numbers, means and standard deviations of occurrences and total duration of leader speech time, students speech time and verbal exchanges from SI-PASS meetings observations.

Observed behavior and Faculties (*n* videos)	Occurrences			Duration		
	n	*M*	*SD*	Total (min)	*M* (min)	*SD* (min)
Leader speech time	6464	157.66	69	983.11	23.98	10.40
Applied Sciences (19)	3344	176	59.95	535.45	28.18	7.50
Bioengineering (6)	766	127.67	67.44	92.02	15.34	9.26
Psychology (6)	791	131.83	59.31	156.14	26.02	12.95
Sciences (10)	1563	156.3	87.95	199.50	19.95	10.93
Students' speech time	5085	124.02	56.76	1021.62	24.92	14.24
Applied Sciences (19)	2489	131	56.42	505.90	26.63	13.81
Bioengineering (6)	822	137	72.07	114.37	19.06	10.21
Psychology (6)	682	113.67	51.99	145.99	24.33	14.82
Sciences (10)	1092	109.2	55.06	255.37	25.54	17.61
Verbal Exchanges	183	9.15	11.72	88.07	4.40	8.00
Applied Sciences (19)	71	7.1	6.95	17.70	1.77	1.25
Bioengineering (6)	32	16	18.38	34.94	17.47	23.81
Psychology (6)	19	4.75	1.71	11.68	2.92	2.33
Sciences (10)	61	15.25	22.1	23.75	5.94	7.93

3.3. Hypothesis 2 - Session opening

When comparing the frequency of occurrence of a shared agenda that organizes the meeting to that of a meeting plan, the data from Table 3 shows that the first scenario occurred in 17 videos out of 41, while the second took place in 31, with 15 videos showing both options. Amongst those, 25 sessions started with a meeting plan and 9 with a shared agenda. A t-test comparing shared agenda to meeting plan yielded no significant difference ($t(46) = -0.92$, $p = 0.36$), thus not allowing to confirm or refute the hypothesis that leaders select the content of the session instead of letting students choose. No significant difference was found between faculties for welcoming students to the meeting, shared agenda or meeting plan (all *ps* > .05).

Table 3 - Number, means and standard deviations of occurrences and total duration of shared agenda and meeting planification from SI-PASS meetings observations.

Observed Behavior and	Occurrences			Duration		
Faculties (*n* videos)	*n*	*M*	*SD*	Total (min)	*M* (min)	*SD* (min)
Shared agenda	26	1.53	0.94	12.48	0.73	0.94
Applied Sciences (19)	14	1.4	0.97	17.70	1.77	1.25
Bioengineering (6)	4	2	1.41	0.96	0.48	0.35
Psychology (6)	5	1.67	1.15	2.26	0.75	0.40
Sciences (10)	3	1.5	0.71	4.14	2.07	2.79
Meeting plan	55	1.77	0.84	26.47	0.85	0.88
Applied Sciences (19)	26	1.63	0.81	12.44	0.78	0.84
Bioengineering (6)	8	1.6	0.55	2.77	0.55	0.59
Psychology (6)	12	2.4	0.89	5.84	1.17	1.41
Sciences (10)	9	1.8	1.1	5.43	1.09	0.66

3.4. Hypothesis 3 - Redirecting questions

The two measures used to assess redirections were 'question from students redirected to other students', and 'question from student redirected towards notes' (Table 4). A t-test comparing the frequency of questions redirected towards students' notes *versus* their peers revealed a significant difference ($t(65) = -8.48$, $p < .001$). The results show a higher rate of questions redirected towards other students ($M = 5.17$, $SD = 4.23$) compared to those redirected towards students' notes ($M = 0.59$, $SD = 0.95$) during SI-PASS sessions, thus invalidating the hypothesis that leaders fail to redirect students' questions to peers. No significant differences were found between faculties regarding redirection to students or to notes (all *ps* > .05).

Table 4 - Numbers, means and standard deviations of questions redirections to students and questions redirections to notes from SI-PASS meetings observations.

Observed Behavior and Faculties (*n* videos)	Occurrences			Duration		
	n	*M*	*SD*	Total (min)	*M* (min)	*SD* (min)
Students' redirection	2755	67.2	38.49	211.86	5.17	4.23
Applied Sciences (19)	1500	78.95	41.85	116.85	6.15	4.61
Bioengineering (6)	347	57.83	48.66	23.58	3.93	4.24
Psychology (6)	372	62	35.09	30.27	5.04	5.44
Sciences (10)	536	53.6	22.56	41.16	4.12	2.55
Notes redirection	76	2.92	2.73	15.38	0.59	0.95
Applied Sciences (19)	26	2	1.53	2.06	0.16	0.19
Bioengineering (6)	5	1.67	1.15	0.89	0.30	0.41
Psychology (6)	15	5	4	2.47	0.82	0.05
Sciences (10)	30	4.29	3.68	9.96	1.42	1.54

3.5. Hypothesis 4 - Groupwork

Regarding the amount of time students spend working individually *versus* in groups, Table 5 shows a mean of 10 minutes for individual work, while group work averages 23 minutes. A t-test comparing the time spent working individually *versus* in groups turns revealed a significant difference ($t(48) = 2.95$, $p = 0.005$). The results indicate that more time is spent working in groups ($M = 22.61$, $SD = 18.51$) than working individually ($M = 9.92$, $SD = 9.86$) during SI-PASS sessions, thus invalidating the hypothesis that SI-PASS sessions rely insufficiently on group work. No significant differences were found between faculties for solo work or group work (all $ps > .05$).

Table 5 - Numbers, means and standard deviations of occurrences and total duration of individual work and group work from SI-PASS meetings observations.

Observed Behavior and Faculties (*n* videos)	Occurrences			Duration		
	n	*M*	*SD*	Total (min)	*M* (min)	*SD* (min)
Individual work	58	2.52	2.09	228.09	9.92	9.86
Applied Sciences (19)	23	2.09	1.22	88.00	8.00	9.44
Bioengineering (6)	13	4.33	4.93	34.42	11.47	12.20
Psychology (6)	5	1.67	1.15	43.31	14.44	12.62
Sciences (10)	17	2.83	1.72	62.37	10.39	10.22
Group work	50	1.85	1.63	610.60	22.61	18.51
Applied Sciences (19)	13	1.18	0.4	232.37	21.12	19.88
Bioengineering (6)	6	2	1.73	51.29	17.10	21.86
Psychology (6)	4	1.33	0.58	87.17	29.06	23.63
Sciences (10)	27	2.7	2.31	239.76	23.98	17.09

3.6. Hypothesis 5 - Ambiance

This research question is composed of three elements. The first concerns the time spent welcoming students to the SI-PASS meetings. Table 6 shows that this event occurred on eleven occasions out of the 41 videos recorded, with an average time spent of 2 minutes on this activity. The second element concerns the amount of time students spend moving (*e.g.,* not remaining in a seated static position) during a session. On average, students spent 26 minutes moving away from their seat, as shown in Table 6. This indicates that, during a typical one-hour SI-PASS meeting, half the session is spent moving freely. The last element pertains to the frequency of laughter during the sessions. On average, students laugh nine times per session, with a mean duration of 21 seconds per occurrence. These indicators point against the hypothesis that SI-PASS sessions fail to establish the informal, collaborative atmosphere expected of the model. No significant differences were found between faculties for movement or laughter (all *ps* > .05).

Table 6 - Numbers, means and standard deviations of time spent welcoming students to the meeting, movement, and laughs from SI-PASS meetings observations.

Observed Behavior and Faculties (*n* videos)	Occurrences			Duration		
	n	*M*	*SD*	Total (min)	*M* (min)	*SD* (min)
Welcome to meeting	11	1	0	22.01	2.00	2.76
Applied Sciences (19)	6	1	0	6.34	1.06	0.75
Bioengineering (6)	1	1	0	0.66	0.66	0.00
Psychology (6)	2	1	0	14.84	7.42	0.29
Sciences (10)	2	1	0	0.17	0.09	0.08
Movement	126	3.32	4.38	984.83	25.92	20.10
Applied Sciences (19)	42	2.33	2.66	479.82	26.66	21.99
Bioengineering (6)	8	2	1.15	145.11	36.28	8.11
Psychology (6)	21	3.5	2.74	33.63	5.61	4.94
Sciences (10)	55	5.5	7.26	326.27	32.63	18.38
Laughs	326	9.31	9.25	12.26	0.35	0.38
Applied Sciences (19)	93	6.2	7.15	3.21	0.21	0.20
Bioengineering (6)	46	9.2	6.69	1.53	0.31	0.19
Psychology (6)	57	11.4	10.5	1.93	0.39	0.38
Sciences (10)	130	13	11.88	5.59	0.56	0.56

4. Discussion

For 50 years, SI-PASS has broadly been acclaimed as an impactful program on student learning. In their meta-analysis, Dawson et al. summarise this pattern as follows: « Students participating in SI within the targeted high-risk courses earn higher mean final course grades than students who do not participate in SI. » (2014, p. 611). The present study, while not directly challenging this overall pattern, questions and nuances the mechanisms through which SI-PASS effects may (or may not) materialise in a given local context. Because the present study relies on behavioural observation rather than transcript-based interaction analysis or participant interviews, the interpretations proposed below should be read as data-informed but partly inferential. Wherever possible, empirical findings are distinguished from more speculative explanations.

4.1. Hypothesis 1 - No re-lecture

As displayed in Table 2, SI-PASS sessions show a nearly equal distribution of speaking time between students (25 minutes) and leaders (24 minutes). At first glance, this pattern may seem difficult to reconcile with the SI-PASS aspiration of student-driven sessions in which leaders primarily facilitate peer discussion rather than deliver content. In learner-centred frameworks, student talk is often expected to outweigh teacher or instructor talk, with some authors proposing ratios around 70% student talk to 30% instructor talk (Kostadinovska-Stojchevska, 2019). However, SI-PASS reference documents do not define any quantitative target of this kind, likely because facilitation quality cannot be reduced to a single metric.

The interpretation of this result therefore requires caution. First, not all leader talk should be equated with re-lecturing. Leaders also spend time welcoming students, giving task instructions, managing transitions, encouraging

participants to revisit their notes, launching ice-breakers, and sustaining the flow of the session. These forms of verbal presence are part of the facilitation process (Appendices 2 and 3) and do not necessarily imply direct teaching. In this respect, balanced talk-time may reflect, at least in part, the practical work required to maintain participation and support collaborative activity, rather than a straightforward drift away from SI-PASS (Baran & Correia, 2009; Uffen et al., 2025).

Second, SI-PASS leaders should not be treated analytically as equivalent to teachers. Unlike experienced instructors, they occupy an intermediate pedagogical position: they are more advanced than first-year students, yet remain cognitively, linguistically, and experientially closer to them. This proximity is often described as one of the strengths of peer learning, since near-peers may be better able to identify what students do not yet understand and to phrase explanations in ways that remain accessible to them; a mechanism commonly discussed in terms of cognitive and social congruence (Loda et al., 2020; Schmidt & Moust, 1995). Leader talk in SI-PASS therefore does not have the same pedagogical meaning as teacher talk in a conventional class. Even when leaders speak at length, their contribution may still operate within the logic of peer learning rather than that of formal instruction.

A further plausible interpretation is that this strong leader presence partly reflects inexperience. These are newly trained tutors, not seasoned facilitators, and their relatively high verbal presence may indicate the difficulty of enacting student-centred methods in practice. A similar pattern was observed by Pleschová and McAlpine (2024), where newly trained student-centred teachers remained strongly present in peer-learning class sessions. In the present study, this pattern is compatible with the idea that leaders may intervene when students appear unsure how to proceed, hesitate, or wait passively for answers.

Under such circumstances, leaders may shift toward more guided facilitation or scaffolding, not necessarily in contradiction with SI-PASS, but possibly as a way of keeping the session moving and preserving opportunities for peer learning.

This ambiguity should also be interpreted cautiously across faculties. Descriptively, Bioengineering showed a higher mean duration of verbal exchanges than the other faculties, but this may partly reflect methodological difficulty rather than a purely interactional difference: the recordings were sometimes harder to code because of lower audio quality and, in some cases, more simultaneous talk, making the distinction between leader speech and student speech less straightforward. This result should therefore not be overinterpreted as evidence of a substantively different interactional model.

Taken together, these findings suggest that global talk-time alone is too coarse an indicator to determine whether leaders are truly "re-teaching." Relative speaking time is useful as a first descriptive signal of leader presence, but it cannot distinguish between qualitatively different forms of speech. What matters is not only how much leaders speak, but what they do while speaking. Explaining, questioning, prompting, redirecting, scaffolding, evaluating, and supplying answers may all occupy similar amounts of time while carrying very different pedagogical implications. Interaction research suggests that equity and learning opportunity in small groups depend not only on duration, but also on turn-taking patterns, responsiveness, the distribution of epistemic authority, and the sequencing of redirection and uptake (Archibeque et al., 2018). A natural next step is therefore to complement global talk-time measures with more fine-grained functional coding of leader moves.

4.2. Hypothesis 2 - Session opening

SI-PASS sessions are supposed to be student-led, meaning that content should emerge from students' needs rather than a leader-imposed plan (European Centre for SI-PASS, 2018). A preliminary observation from the time-coded data is that, regardless of the opening scenario, only about one minute is devoted on average to determining the session's focus (Table 3). Given that SI sessions commonly run about one hour, one plausible interpretation is that leaders work under tight time constraints, which may partly account for the brevity of the agenda-setting segments.

Regarding the style of agenda setting (leader-led *vs* student-led), no marked differences appear across sessions. A recurrent pattern appears to involve leaders seeding the opening with a small set of candidate topics and then adjusting quickly based on student input. This "front-loading + rapid co-construction" may be interpreted as a pragmatic adaptation: it appears to preserve some room for student voice, but within a set of options already pre-structured by the leader. Such a reading aligns with work cautioning that minimal guidance can underserve novices (Hmelo-Silver et al., 2007; Kirschner et al., 2006). Within that frame, a short and structured opening followed by renegotiation (as needs surface) may be read as a plausible adaptation to time pressure, rather than a straightforward dilution of SI-PASS. Practically, techniques such as intentional wait-time (technique 4) could be emphasised to deepen the negotiation of focus even when the prevailing pattern is a brief agenda-setting segment combined with blended leadership. In addition, leader training (initial and ongoing) could explicitly invite reflection on the pedagogical trade-offs involved in compressing agenda negotiation to "save time for covering the material", since such a framing may subtly reorient the session toward teaching-oriented priorities rather than peer-led sense-making.

4.3. Hypothesis 3 - Redirecting questions

Since SI-PASS sessions revolve around student interaction, one should observe more questions redirected to the group than redirected to course materials (such as slides or textbooks). Behavioural indicators show that this is the case (Table 4). Peer-interaction literature indicates that when students explain, discuss, or debate content among themselves, they not only fill in knowledge gaps but also build deeper understanding through co-construction of knowledge (Brundage, et al., 2023; Tullis & Goldstone, 2020). The preference for peer redirection over referral to textbooks or notes suggests that the interactional organisation of these sessions gives priority to dialogical inquiry and collective reasoning over individual retrieval. This is consistent with findings on "redirecting questions" as a tutoring strategy: tutors or facilitators encourage students to use available resources (including peers and prior knowledge) to answer questions, rather than supplying the answer directly (Van de Pol et al., 2019).

This strong tendency to redirect questions toward peers can be situated within a broader pedagogically relevant sequence in peer-learning contexts (Roscoe & Chi, 2007; Tullis & Goldstone, 2020). In SI-PASS, students are encouraged to first ask peers, then consult their notes or textbooks, then return to the tutor if necessary, and only finally refer back to the lecturer. Within the logic of the model, this progression is intended to maximise student autonomy and cognitive responsibility. When a leader ends up answering directly or redirecting to lecture material instead, this may signal that earlier steps in the progression were skipped or that previous scaffolding attempts were insufficient.

At the same time, the fact that leaders still speak for a substantial amount of time (see Hypothesis 1 results) indicates that the practice of peer redirection

does not automatically result in minimalist leadership. Leaders may need to intervene when students appear uncertain or wait passively for answers, thus shifting toward more guided facilitation or scaffolding. This suggests that while redirection techniques are aligned with the SI-PASS philosophy of student-autonomy and discovery, there may remain tension between leader talk balance and actual student participation.

4.4. Hypothesis 4 - Groupwork

As presented in Table 5, significantly more time is spent in groups than alone; with approximately 23 minutes devoted to it in a typical 57-minute session. This is consistent with the SI-PASS emphasis on collaborative activity (European Centre for SI-PASS, 2018, pp. 28-29) and with the strong emphasis placed on this dimension in Liège leader training. Individual work also seems to hold a place in Liège sessions, as indicated by the 10 minutes of solo work recorded. This may partly stem from the training, as leaders practice various interactive techniques (such as Kagan structures, the Pyramid, and SI-PASS tools like the Think-Pair-Share method), which include a "think time" to prepare for discussions. This suggests a possible influence from these modelled strategies.

Without questioning the high levels of engagement, critical thinking, and long-term retention associated with collaborative learning (Kaddoura, 2013); strategies like Think-Pair-Share (which deliberately combine individual reflection with subsequent peer discussion) have been shown to encourage equitable participation and deeper understanding (Guenther & Abbott, 2024). In this perspective, the presence of individual work may reflect a facilitation choice that prepares students for richer dialogue rather than a deviation from the model. Moreover, the European Centre for SI-PASS highlights collaborative techniques in its "Session Strategies" resources as an essential

part of the leader's toolkit, explicitly recommending methods that alternate between individual preparation and collective discussion (European Centre for SI-PASS, 2018). This alignment suggests that both group and individual work, when embedded in a coherent structure, may be compatible with SI-PASS philosophy and may contribute to the programme's effectiveness. The articulation between individual and collective moments is a promising topic for future research.

4.5. Hypothesis 5 - Ambiance

Finally, as SI-PASS sessions are designed as student-led, low-stakes spaces for discussing course content, some degree of informality is not only expected but encouraged (European Centre for SI-PASS, 2018). This aspect was assessed through three variables: welcoming to the session, laughter, and movement.

In our sample, a well-structured welcome (ice-breaker or formal opening) appears in only eleven of 41 videos. Two contextual factors plausibly explain this. First, observations occurred at the end of the semester, when groups were already acquainted. Ice-breakers are most useful early in term to establish safety and cohesion, then naturally recede (Barkley & Major, 2020). Second, sessions are time-constrained (often between classes or during lunch break, and about one-hour long), so leaders may, in practice, prioritise task time over extended openings, although this remains an interpretative reading rather than a directly observed intention. Classic work on time-on-task and opportunity-to-learn suggests that limited allocated time tends to push instructors to compress ancillary segments (Carroll, 1963). This points to a possible practical lever for implementation: scheduling longer slots (even if not fully used) could improve pacing of openings and transitions.

Regarding laughter and movement, Table 6 shows students move around the room for an average of 26 minutes and laugh about nine times per session (21 seconds on average). While not direct measures of learning, both behaviours are consistent with a positive classroom climate and active peer interaction: classroom humour is associated with attention, affect, and rapport (Banas et al., 2011); and movement aligns with research linking physically active participation to engagement and, in many contexts, cognitive benefits (Donnelly & Lambourne, 2011; Mavilidi et al., 2018). In turn, such climates may support participation in discussion and problem-solving situations that are central to SI-PASS. Finally, beyond academic outcomes, regular attendance may also strengthen belonging and friendship networks that facilitate first-year adjustment and persistence (Pittman & Richmond, 2008; Tinto, 1993; Wilcox et al., 2005).

These indicators suggest that the recorded sessions generally displayed a relatively informal and active atmosphere. However, this interpretation should remain cautious, as welcoming rituals, laughter, and movement are only partial proxies for the broader construct of social and interactional climate. They provide visible traces of informality, but do not fully capture dimensions such as inclusion, participation balance, or collaborative safety. Future research would therefore benefit from complementing these behavioural measures with more fine-grained indicators of interactional quality.

Overall, the behavioural indicators suggest a mixed picture of fidelity: several core interactional elements appear present (notably peer redirection and substantial group work), while other patterns (notably leader talk-time parity and highly compressed agenda-setting) show greater discrepancies with the model. These findings support a cautious interpretation of outcome results. For contexts where performance effects are null (study 3 or Puttaert et al., 2025),

such process evidence can help refine the explanatory space by shifting the question from “does SI-PASS work?” to “under what enactment conditions does SI-PASS realise its intended mechanisms?”.

4.6. Limits and perspectives

From the 41 observations recorded and analyzed with the Noldus Observer XT program, several points deserve emphasis for a more nuanced understanding of the results.

First, it is important to note that all videos were recorded during the same semester of a single academic year, primarily mid to end of the semester. The nature of the recorded sessions may therefore reflect, in part, the specific needs of the students at that point in the semester. To enable more in-depth comparison and allow for generalization of the findings, it would be beneficial to conduct additional recordings in the coming years and at different points within the same semester. Seasonal and temporal effects on classroom dynamics have been noted in higher education, with studies showing that student engagement and participation fluctuate across the academic year (Boulton et al., 2019). For example, the sense of freedom that students seem to gain at the end of the second semester might be less evident at the beginning of the first semester, when students do not yet know each other and are unfamiliar with the ins and outs of SI-PASS.

Secondly, for organizational reasons, the session leaders were all contacted in advance to agree on a specific date and time for the recording. This prior arrangement may have biased the results for two reasons: the first being session preparation, and the second a potential social desirability bias. Indeed, it is possible that leaders spent extra time preparing their sessions knowing they would be observed by a SI-PASS trainer, aiming to present a more

“exemplary” session. Regarding social desirability bias, it is plausible that being observed by a university staff member led both leaders and students to exhibit more controlled behaviour to present an “ideal” SI-PASS session. This could have temporarily inhibited certain spontaneous interactions, which might only have emerged towards the end of the session once students became comfortable with the idea of being observed. Social desirability bias in educational contexts has been widely documented, particularly in self-report and observational studies (Bressoux, 2001; Bru, 2002; Clanet & Talbot, 2012). Unfortunately, this bias is difficult to avoid, as it would be unethical to film students without their consent. One alternative would be to have observations conducted by a student rather than a university staff member, thereby reducing the hierarchical dimension of the situation. However, if another leader assumed this role, it could create a form of competition, introducing yet another form of social desirability bias.

Another limitation concerns the coding procedure itself. Although the recordings were coded using a structured observation grid and the coder underwent a preliminary familiarisation and pilot-coding phase, all videos were ultimately coded by a single coder. As a result, no inter-rater reliability coefficient could be established. This limits the possibility of independently assessing coding stability and should be taken into account when interpreting the behavioural indicators. Future research would benefit from involving multiple coders and reporting inter-rater reliability measures.

This study is also limited by the faculty context: except for Psychology (which sits at the intersection of “hard” and social sciences) the other participating faculties are in the hard sciences. Replicating the study in faculties such as Philosophy or Law could test whether session dynamics generalise or require refinement. Although no result here appears to be clearly faculty-specific, it

would be speculative to infer from this a general absence of disciplinary differences. Additionally, this study could be replicated in other countries with different education systems. While SI-PASS is based on specific principles that set it apart from other peer-learning schemes, contextual variations might arise outside ULiège. For instance, in countries or faculties where students have more opportunities for interaction early in their studies (such as during practical sessions), the dynamics observed during SI-PASS sessions might differ from those identified here (Capstick et al., 2004).

Replicating this video-based methodology across other peer-learning schemes would enable systematic comparisons and help characterise the "typical formula" of different peer-led programs. Even where frameworks differ from SI-PASS, comparative recordings could clarify distinctive features and likely mechanisms, including contrasts with lectures and other active formats (*e.g.*, practicals) (Holm, 2014; Pleschová & McAlpine, 2024). More broadly, the study demonstrates the analytic value of video methods for assessing fidelity in peer-learning environments (Derry et al., 2010). Within this design, the use of Noldus Observer XT was particularly appropriate because it enabled systematic behavioural coding across a relatively large set of recordings and the extraction of time-based indicators directly aligned with the fidelity perspective adopted here. More specifically, the software made it possible to code the onset, duration, and sequencing of predefined behaviours in a structured and replicable way, thereby supporting comparisons across sessions and faculties. In that sense, it offered an appropriate compromise between qualitative observation and quantitative treatment of behavioural data. At the same time, its use also implies limitations. Coding precision remained dependent on the quality of the recordings and on the clarity of the observation grid. In situations involving overlapping speech, uneven audio quality, or blurred interactional boundaries, the distinction between leader and student

contributions became less straightforward. More broadly, while Observer XT is highly useful for quantifying observable behaviours, it is less well suited to capturing the full discursive richness of interaction than more transcript-based qualitative approaches. This is particularly relevant for Hypothesis 1, where leader talk-time was used as a proxy for possible re-lecturing. While useful descriptively, such an indicator cannot by itself distinguish between directive explanation and facilitative moves such as questioning, prompting, or scaffolding. This limitation also affects the operationalisation of Hypothesis 5. Although indicators such as laughter, movement, and welcoming rituals offer visible traces of a relaxed atmosphere, they remain only partial proxies for the broader construct of social and interactional climate. They cannot fully capture more subtle dimensions such as inclusion, trust, participation balance, or the quality of peer exchange.

A final limitation concerns the interpretability of SI-PASS outcomes at ULiège in light of fidelity. As shown in Puttaert et al., 2025, no significant improvement in academic performance was detected in a full experimental design. Yet, the present observations reveal only moderate compliance with the SI-PASS principles, with leaders often adapting or abbreviating key elements of the model. This means that the absence of measurable gains in this study cannot be conclusively attributed to the inherent limits of SI-PASS as a pedagogical approach; it may equally reflect shortcomings in its local implementation. This ambiguity highlights the critical importance of process evaluation: without robust evidence of how closely the sessions follow the prescribed principles and techniques, outcome data alone risk leading to misleading conclusions about program efficacy.

Taken together, these limitations point to a broader tension between prescription and practice in peer-learning programs. SI-PASS rests on an

officially codified framework of principles and techniques, yet its effectiveness depends on how these are translated into the lived dynamics of sessions. At ULiège, leaders demonstrate both creativity and autonomy, but sometimes at the cost of fidelity. This raises a central question not only for research but also for practice: what *counts* as "doing SI-PASS"? If the program is to realize its potential, attention must be given not only to outcomes but also to the conditions that sustain them: adequate session time, rigorous and consistent leader training, and above all, a commitment to maintaining the student-led nature of the sessions. Recognizing this complexity shifts the conversation from compliance alone to a more nuanced understanding of how SI-PASS can, under the right circumstances, promote both academic and social integration (Van Herpen et al., 2025).

5. Conclusion

After five years of implementation, the SI-PASS program at the University of Liège shows moderate compliance with the international model rather than full alignment. The analysis of 41 video-recorded sessions across four faculties revealed that leaders frequently adapt the prescribed principles to the constraints of their context, demonstrating autonomy and flexibility rather than strict adherence. To strengthen fidelity of implementation, several means can be derived from the findings. Leaders may need longer session slots to allow time for both structured openings and student-driven negotiation of content. Training could place even stronger emphasis on the core elements of SI-PASS and highlight the importance of resisting the drift towards leader-led formats. Future research could also be enriched by a "comparative compass" that would clarify whether the patterns observed at ULiège are context-specific or symptomatic of a more general tension between prescribed SI-PASS principles and real-world practice. Rather than being seen as a lack of compliance, the adaptations documented here could be interpreted as a sign of leaders' autonomy; but they also prompt the essential question of what counts as SI-PASS and under what conditions it most effectively supports student learning, autonomy, and integration.

6. Appendices

1. Appendix 1 - Essential elements for a certified SI-PASS program (from the Supervisor training manual for SI-PASS)

1. SI-PASS Programs:

    1. are managed by a certified SI-PASS Supervisor who has undertaken training with a Certified Trainer, based at a National or Regional Centre (*e.g.*, European Centre at Lund University).
    2. are student-driven with participants determining the content of SI-PASS sessions facilitated by SI-PASS Leaders.
    3. are monitored and evaluated through attendance data, student feedback, and students' final marks. Outcomes are reported to stakeholders where appropriate.

2. SI-PASS sessions:

    4. are small supplementary study groups in which there are no more than 20 participants, with groups of 8-12 being best practice. Sessions are facilitated by SI-PASS Leaders working individually or in pairs dependent on what is appropriate at the Institution.
    5. are voluntary and are open to all students enrolled in the unit/subject/course.
    6. are not linked to the awarding of marks for the unit/course/subject.
    7. are facilitated by a student who is at least one year beyond the level of the target unit in their own studies and has successfully completed the unit they are supporting.
    8. are designed to supplement existing learning opportunities open to all students, such as lectures, tutorials, practicals, etc.

9. are aligned with unit/subject/course content, with SI-PASS Leaders planning regular sessions and related activities based upon the previous week's lecture(s) or core content.
10. integrate both course content and related study skills.
11. provide an active, positive collaborative peer learning environment.
12. do not deal directly with assessable tasks (anything that has marks attached homework/assignments).
13. attendance is taken and Leaders are regularly observed and monitored by a SI-PASS representative and provided with guidance and feedback for on-going improvement.
14. are attached to a class or discipline, never a student and are non-remedial in their approach.

3. SI-PASS Supervisors:

15. and senior Leaders/Mentors/Coordinators model SI-PASS principles and facilitation skills both in training and on-going professional learning in order to inform best practice. The same is true of other locally specified roles such as Mentors (senior Leaders) and Coordinators.
16. work collaboratively with academic colleagues to ensure SI-PASS is linked appropriately into the course schedule and course content.

4. SI-PASS Leaders/Facilitators:

17. are recognized and rewarded (some Institutions pay their Leaders, some offer academic credit or other appropriate compensation).
18. are provided with an initial minimum two-day training program and on-going professional learning.
19. are provided with resources to support them in their role.

20. do not reteach the course material. They are specifically trained and supported in order to develop students as independent learners and to ensure that SI-PASS sessions do not become another lecture or a replacement for tutorials.
21. have regular contact with course teaching team so that they are knowledgeable about what is occurring in the course to ensure that the following aims are met:
    1. Leaders are modelling good study behavior
    2. Marketing the purpose and benefits of SI-PASS
    3. Leaders are maintaining currency in subject content/ relevant unit information in order to support preparation
    4. Leaders have awareness of difficult content
    5. Leaders are able to provide feedback to inform the course teaching team.

2. Appendix 2 - Leader techniques definitions (from the Supervisor training manual for SI-PASS)

Leader technique 1: Student to student interaction

“ Collaborative learning can be defined as a learning method in which students work in groups toward a common academic goal. The patterns of interaction in a collaborative learning environment, like SI-PASS sessions, should be primarily student-to-student rather than student-leader or leader-student.”

Leader technique 2: Redirecting questions

“ Redirecting questions can be considered the process most central to the SI-PASS program. The process itself is fairly simple to understand but difficult to practice without a context in which to do so. The goal of this process is to

encourage more and better student-to-student interactions in the sessions. It is based on the concept that we all learn better when we have to explain something to someone else. The natural tendency for anyone is to answer questions asked; this process requires the leader to suppress that tendency and redirect questions back to the group."

Leader technique 3: Checking for understanding

" The learning strategies that SI-PASS leaders use in their sessions are designed to promote student-to-student interactions. We cannot automatically assume, however, that the students are gaining understanding from their interactions. Instead, we must check for understanding by asking the students to confirm that they have learned the content."

Leader technique 4: Wait time

" Wait-time is the time that elapses between an SI-PASS leader-initiated question and the next behavior (student response or the leader talking again). There are two kinds of wait-time:

1) The time the leader waits after asking a question
2) The time the leader waits after a response "

3. Appendix 3 - Courses targeted by SI-PASS at ULiège

Applied Sciences: Physique 2 (Pr. H. Caps)
https://www.programs.uliege.be/cocoon/20232024/cours/PHYS2021-1.html

Bioengineering: Mécanique des particules (Pr. B. Longdoz)
https://www.programs.uliege.be/cocoon/20232024/cours/PHYS3025-1.html

Psychology: Fondements méthodologiques des sciences psychologiques (Pr. A. Ferrara)
https://www.programs.uliege.be/cocoon/20242025/cours/PSYC5867-1.html

Sciences: Analyse fondamentale, part. 2 (Pr. S. Nicolay)
https://www.programs.uliege.be/cocoon/20242025/cours/MATH0072-1.html

Transition

Study 6 shifts the focus from participants and session processes to the student leaders themselves. This perspective is important because leaders play a central role in the enactment of SI-PASS, yet their experiences, motivations, and perceived role development remain comparatively less documented in the peer-learning literature (Fox et al., 2010). The study therefore adopts a mixed-method design combining questionnaire data and semi-structured interviews.

This approach makes it possible to examine both broader motivational patterns and more nuanced accounts of how leaders understand their role. Exploring their perceptions is relevant not only for recruitment, but also for the design of training and support structures that help sustain facilitation quality.

In this sense, study 6 adds a leader-focused perspective to the dissertation and complements the preceding studies by showing that implementation quality also depends on how leaders interpret, inhabit, and negotiate their role within the SI-PASS framework.

Study 6

SI-PASS at the University of Liège: Recruiting leaders, what key arguments?

N. Puttaert, V. Defaweux, A.-S. Nyssen, D. Verpoorten

"We believe that peer learning can foster social mobility and employability in new ways to ensure universities remain relevant in preparing young people for entry into the labour market." (Donald & Ford, 2023, p. 676)

Abstract

A key stakeholder central to the peer-learning SI-PASS program is the leader, a student trained to facilitate meetings and safeguard the scheme's tenets. The present study, conducted across four faculties of a Belgian university that has run the program for the past five years, explores leaders' perspectives on their engagement in the role. Specifically, it inspects the motivations that initially prompted students to apply, as well as the perceived benefits that emerged once they had assumed the position. Data were collected through online questionnaires and individual semi-structured interviews. Results show that leaders are not firstly motivated by financial aspects, but by their desire to help fellow students and their positive prior experience as SI-PASS' participants. Secondary benefits are also highlighted, such as the development of transversal skills, the valorising use of this experience on a resume, or as a potential steppingstone to subsequent positions within the Institution. These findings have practical implications for peer-learning policy and implementation, as they suggest that leader recruitment may be strengthened by emphasizing not only altruistic motives and prior positive experience, but also the developmental and institutional value of the role.

1. Introduction

1.1. Peer-learning programs

Peer-learning is a pedagogical approach widely implemented internationally. Its principle lies in collaboration among students, encouraging mutual support, discussion, and the progressive collective construction of knowledge. Unlike a lecture, the aim is not to re-teach the course material but to accompany students in their own internalization of the content.

At the University of Liège, one possible variation of such programs was introduced in 2019 through SI-PASS (Supplemental Instruction - Peer Assisted Study Sessions). This program specifically targets first-year students and has several distinctive features (European Centre for SI-PASS, 2023):

- Each weekly meeting focuses on a course renowned for its difficulty and is facilitated by a second-year student who has successfully passed it.
- The role of the peer leader is not to substitute for the teacher, but to guide discussion and encourage collaboration among students in solving exercises and clarifying difficult points.
- Peer leaders receive an initial two-day training (2 × 4 hours) that equips them with group facilitation techniques (redirecting questions, promoting pair work, creating synergy, planning a session, etc.).

Each semester, participating faculties launch a call for applications, in June for the first semester and in December for the second. Applicants are selected by the SI-PASS faculty contact persons based on a motivation letter and confirmation that they have successfully completed the targeted course. Selected candidates are then entrusted with a group of first-year students.

1.2. Leaders' motivation

Despite their central role, peer leaders have attracted only limited scientific attention. Meta-analyses of peer-led programs (Dawson et al., 2014; Bengesai et al., 2023; Zha et al., 2019) have consistently documented benefits for participants in terms of academic success, motivation, and self-efficacy, yet the profile, motivations, and gains of the peer leaders themselves remain comparatively underexplored. Only a handful of research papers have been published on the topic, many of which appear in the *Supplemental Instruction Journal* and the edited SI volumes (Strømmen-Bakhtiar, 2021a; 2021b). This imbalance is also reflected in Malm et al. (2022a), who note that the motivations underlying students' engagement as leaders remain less explored than the much larger body of work devoted to benefits for participants. Across these works, four recurring motivational and developmental dimensions emerge: financial compensation, transferable skills development, self-efficacy related gains, and employability investment. These four clusters structure the first part of the present review.

However, recent empirical studies suggest a richer and more complex picture. Lozada and Turner Johnson (2018) show that SI leadership can encourage deep perspective transformation, shaping leaders' sense of identity and agency beyond transactional benefit. Similarly, Mason-Innes (2015) demonstrates that SI leadership contributes to leadership identity development in ways not fully captured by earlier studies, stressing the importance of relational and contextual influences. Ellison, Haynes, and Toglia (2023) highlight that SI leaders at a U.S. university with a high proportion of Hispanic/Latino students reported gains in confidence, communication, and community (outcomes that may be particularly relevant for underrepresented groups as in Ellison et al., 2023). Other work documents shift in long-term goals and learning approaches among leaders in two-year colleges, especially within diverse and minority

student populations (Hoiland et al., 2020). Finally, studies focusing on employability show that leadership roles are perceived by graduates as instrumental for securing jobs and bridging into post-graduation life (Lozada & Turner Johnson, 2019; Malm et al., 2012).

Taken together, these findings indicate that financial incentives alone do not fully explain why students engage in SI-PASS leadership. Leaders may also experience perspective transformation (Lozada & Turner Johnson, 2018), leadership identity development (Mason-Innes, 2015), and enhanced employability (Malm, 2012). Yet, despite this growing body of research, the literature remains fragmented: many studies focus on specific populations (*e.g.*, HSIs, community colleges, engineering contexts), and several rely either on retrospective surveys of former leaders or on qualitative case studies, which limits the scope for generalization (Lozada & Turner Johnson, 2018; Mason-Innes, 2015). The present study addresses this gap by combining quantitative and qualitative data from leaders currently active in the program at the University of Liège, allowing for a more integrative understanding of their motivations and of the transferable skills they perceive as developing through their role.

1.2.1. Axis 1 - Motivation, the role of money

The University of Liège pays its leaders for their active contribution to the SI-PASS program and for their full engagement in all the responsibilities the role entails (ongoing training, recording student attendance, participation in surveys, etc.). Other universities rely on unpaid leaders, although compensation may take alternative forms, such as academic credit or access to training and personal development opportunities. The existence of this paid/unpaid distinction has logically led previous studies to treat remuneration as a debated incentive and to question the extent to which it genuinely shapes

leaders' decision to engage. For instance, Terrion and Leonard's (2010) comparison of paid peer mentors and unpaid peer helpers at the University of Ottawa shows that while financial compensation plays a role, both groups are also motivated by intrinsic factors such as generativity, social connection, career preparation, and personal growth. Similarly, Malm et al. (2022a) acknowledge that institutional policies regarding pay differ internationally and may influence initial applications, yet they emphasize that the development of transferable skills and the sense of community remain consistent motivators across contexts. These findings suggest that financial incentives interact with, rather than replace, altruistic and developmental motives. The present study does not claim novelty in identifying remuneration as a factor; rather, it examines how systematic payment, as implemented at Liège, may influence the balance between extrinsic and intrinsic motivations among SI-PASS leaders.

1.2.2. Axis 2 - Transferable skills

University teaches students knowledge and specific skills related to the good execution of their future daily tasks as professionals in the domain they have chosen. There are, however, a few transferable skills that are not explicitly taught in a formal way (except in some communication curricula) and that students need to develop. Amongst these skills, one could cite the ability to design clear presentation materials, to speak in public and convey a message in a concise way, or to collaborate with colleagues on a task in a constructive manner. Public speaking is trained during SI-PASS meetings due to the interactive nature of the program, while the other skills require further investigation to evaluate their relative predominance in this context. Notably, the European Centre for SI-PASS status report explicitly identifies communication, leadership, and employability as core gains for student leaders across institutions, alongside improvements in confidence and facilitation

skills (Malm et al., 2024). This recognition at the European level underscores the importance of systematically documenting how such skills are acquired and experienced in different national and institutional contexts.

These transversal skills have become so important in our current working society that a comprehensive list of 6 skills categories has been provided by UNESCO (2016). These skills relate to interpersonal and intrapersonal skills, critical thinking, global citizenship, information literacy, and problem-solving/leadership/communication skills. This framework best encompasses other author's attempts at enumerating these skills. For instance, Curtin (2004) states that key skills are communication, problem-solving, planning and organization, teamwork, initiative and enterprise, self-management, relevant use of technology, and ongoing learning and improvement. Secretary's Commission on Achieving Necessary Skills (United States Department of Labor, 1991) also developed a list of five categories of essential skills: interpersonal, informational, resources, systems, and technology. Rychen (2001) were even more synthetic in their classification, as they identified only four categories: personal competencies, social competencies, methodological competencies, and personal competencies.

Several studies have examined the transversal skills SI-PASS leaders develop, but their approaches have been either exploratory or confirmatory. Confirmatory studies typically rely on standardized questionnaires to measure leaders' agreement with predefined skill-development outcomes (*e.g.,* Carr et al., 2018), while exploratory studies have used interviews or reflective reports to capture leaders' perceptions (Eller & Milacci, 2017). However, few combine these approaches in a mixed-methods design, and the motivational dimension has often been overlooked. Malm et al. (2022a), for example, synthesize 23 studies highlighting the development of communication, organization, group

management, and broader personal and professional skills among SI-PASS leaders. Their international study produced both quantitative and qualitative data, as it relied on questions with numeric items and open-ended questions. They start their reflection around the mandatory training all leaders have to take to secure their position within the scheme and the three major skills they are taught: use pauses after questions, checking for students' understanding and redirecting questions among them (see Appendix 2 of study 5 for more details). From these elements flow other secondary skills such as implementing collaboration during meetings or reinforcing students' engagement with the course materials. This study reveals that SI-PASS leaders gain skills in group management and communication both through the application process and their active role and are highly transferable to the workplace or any domain that requires some sort of social mediation.

While Malm et al.'s (2024) contribution advances the field by explicitly including three SI-PASS programs across different continents (United States, South Africa, Sweden), thereby mitigating the risk of institution-specific bias, questions remain regarding the extent to which their findings are generalizable. Their results suggest that a core set of transferable skills (such as communication, group management, facilitation, and leadership confidence) emerges consistently across contexts, which points toward a degree of universality. However, they also acknowledge that contextual factors, including institutional culture, program maturity, disciplinary distribution, and supervision practices, shape leaders' experiences and reported outcomes. Moreover, despite their international scope, the study covers only three HEIs and does not systematically investigate the long-term transfer of these skills into professional life. This limitation justifies the need for further replications in varied contexts. In this respect, the University of Liège represents a distinctive case: the program is relatively young (launched in 2019), leaders

are systematically remunerated for their role (which is not the case in all international contexts), and training follows a short, standardized format (2 × 4 hours). By examining whether the skills identified by Malm et al. (2022a) also manifest in this specific European setting, and whether remuneration or program design introduce local variations, the present study contributes both to testing the robustness of existing findings and to clarifying the contextual conditions under which SI-PASS leadership promotes transferable skills.

Even though the need for these skills is recognized by both the work market and higher education institutions, the issue is seldom addressed directly, and students are rarely aware of the importance of developing such abilities (Succi & Canovi, 2020). More specifically, institutions prefer to encourage students to develop these skills through extracurricular activities (Young, 2016; Chan et al., 2017). SI-PASS could thus be fitting with the development of such transversal skills and the desire for institutions to encourage students to train those outside of the official curriculum. Besides, many European SI-PASS schemes stress the importance of transversal skills as an important element for ongoing institutional support for such activities (Malm et al., 2021b).

1.2.3. Axis 3 - Self-efficacy

In Supplemental Instruction Volume 2, Suzen et al. (2021) have written about the idea of SI-PASS as a leadership development program. A phenomenological approach was used for this research, and interviews were conducted with SI leaders and reveal that they indeed benefit from this experience in terms of leadership development. The six main terms that emerge from this research are communication, leadership, situational leadership, collaboration, facilitation in learning, and transferability of skills to working life. In the same volume, Suzen (2021) delves deeper into her data (two interviews per leader) and concludes by saying that SI leaders reported

expecting that their work will play a role in their personal development. They need to be reactive when facing unexpected situations, to create a secure environment for students, adapt their leadership to the specificities of the group they oversee. They perceive themselves and their role as an important form of learning support for students.

From the articles present in Supplemental Instruction Volume 3, the study of Helde (2021) on leadership learning and development sheds some light on the way leaders have acquired leadership competence, how they have understood their role, and how they perceive their overall experience as a significant contribution to their leadership development. This hermeneutic phenomenological research based on a survey and interviews focuses solely on the link between SI leaders and leadership, not on other transferable skills. Due to the nature of the methodology used, collected data consists of self-reported perceptions from the leaders which were then interpreted by the researcher. The same can be said about the studies carried by Suzen et al. (2021) and Suzen (2021). A broader approach is brought by Malm (2021b) and relates to the employability skills enhancement through the experience of being a SI leader. This study was conducted on leaders after their graduation, not during their time as leaders. These *a posteriori* results revealed that the main skills developed by leaders and used in their current professional career are presentation skills, leadership confidence, and facilitation. Over 80% of the respondents ($n = 91$) stated that their position as a SI-PASS leader helped them getting hired.

In his 2006 study, Harmon highlighted the beneficial impact of the role of leader on confidence in group management skills and empathy towards others. In the same vein, leaders report developing interpersonal skills as well as organizational skills (*e.g.* time-management, presentation, written

communication as in Ender et al., 2010; Keup, 2010; Wawrzynski et al., 2012). As leaders' perspective papers remain a modicum, further work is therefore needed to get a refined picture of leaders: characteristics, motivation and benefits, among which the training of transferable skills.

1.2.4. Axis 4 - Employability investment

Importantly, some contributions do mention employability and the value of leadership experience on a résumé or curriculum vitae. For instance, Nourrit (2019), reporting on the implementation of PASS at the University of Manchester, explicitly emphasized to potential leaders that their involvement would strengthen their CV and develop competencies in communication and leadership. This suggests that employability considerations are present in the discourse, but they have seldom been investigated systematically through empirical data on leaders' actual perceptions. The present study addresses this gap by examining not only the transferable skills developed by SI-PASS leaders at the University of Liège, but also the extent to which they view their engagement as an investment for their future professional trajectory.

1.3. Research question

From the above-mentioned elements, the general research question could be phrased as: What elements motivate students to take on the role of SI-PASS leaders? More specifically, four themes were formed and investigated through online questionnaires and individual interviews with leaders:

1. Money as a preponderant motivational factor for students enrolling in a leader role.
2. The improvement in transferable skills associated with the leader position.
3. The self-efficacy and personal development gains leaders derive from the experience.

4. The way leaders evaluate and valorize the overall experience, particularly in relation to future employability.

2. Methodology

The data collected corresponds to the faculties of Applied Sciences, Bioengineering, Psychology, and Sciences from the University of Liège leaders from academic years 2019-2020, 2020-2021, and 2022-2023 for the questionnaires; and 2022-2023 for the interviews. Data collection followed approval from the Ethics Committee of the Faculty of Psychology, Speech Therapy, and Education Sciences (protocol 2122-098, amendment approved on 13/10/2023). All data were pseudonymised prior to analysis: names, student IDs, and leader identifiers were removed and replaced with numerical codes.

2.1. Data Sources

2.1.1. Exit surveys

Each year for the past four years, both students and leaders from SI-PASS groups are requested to fill in exit surveys. These surveys aim at collecting participants' overall impression on their experience as members of a peer learning scheme and allow the local managers of the program to improve the quality of the training and tools they provide. These questions related to each theme are:

1. Money as a preponderant motivational factor for students enrolling in a leader role.
    - The two main motivations that incited me to (re)take the role of SI-PASS leader are… (open question).
    - Being paid for this SI-PASS leader role is to me… (Likert question, added in 2020-2021).
2. The mention of improvement in transferable skills the leader position provides.
    - My role as a SI-PASS leader helped me train the following skills…(open question).

3. The self-efficacy elements that leaders reap from their experience.
    - My role as a SI-PASS leader reinforced my self-confidence (Likert question).
    - What this experience taught me about myself is… (open question).
4. The positive outlook leaders gather from the overall experience.
    - At the end of the semester, I am a (happy/.../somewhat happy/…/ unhappy) leader (Likert question).
    - Based on my former experience as a SI-PASS leader, I intend to take on this role again (Likert question, added in 2021-2022).
    - I was happy with my SI-PASS group of students (Likert question).
    - I felt comfortable in my role of SI-PASS leader (Likert question).
    - I would recommend to others the role of SI-PASS leader (Likert question).
    - I would agree to be a SI-PASS leader on another difficult course (Likert question).

2.1.2. Interviews

To measure the validity of implementation of the SI-PASS program within the university of Liège and ensure that all leaders comply with the main guidelines given by the SI-PASS center, one observation of each leader takes place throughout the year. Each leader then received personalized feedback based on their performance during the observed session.

For the academic year 2022-2023, the feedback discussion was followed by an individual interview to gather information regarding the leaders' appreciation of the scheme and their perception of the skills developed through their role.

This method was the most suited to obtain elaborate explanations from leaders and, more importantly, allowed additional questions to ensure a thorough understanding of the answers given and to connect emerging themes. Interview questions were:

- What led you to enroll again in this role?
- How do you think this experience will help you in the future and how are you going to valorize it?
- What aspects of your role forced you out of your comfort zone?
- What are the skills developed during your time as a leader that you transpose to other aspects of your personal life or work?

Although the study was not initially designed as a comparison between first-time and returning leaders, the final interview sample included a small number of first-time leaders (five out of 42) alongside a much larger group of more experienced ones. This created an exploratory opportunity to examine whether seniority in the role was associated with noticeable differences in motivation, perceived gains, or difficulties. Any such comparison, however, remains secondary to the main aims of the study and has to be interpreted with caution given the strong imbalance between the two groups.

2.2. Analysis method

Although the dataset includes Likert-scale items and frequency tables, the present study is primarily qualitative in design and intent. The aim is not to test statistical differences between faculties or subgroups, as in other articles of the dissertation; but rather to identify, describe, and synthesize the main themes emerging from leaders' accounts across data sources. In this perspective, counts and frequency distributions are used only as descriptive indicators to show the relative salience of the themes mentioned, not as a basis for inferential comparison.

Online questionnaires contained both Likert-scale items and open-ended questions. Quantitative Likert responses were therefore analysed using descriptive statistics only (counts and frequency distributions). Qualitative material drawn from both the open questions and the one-to-one interviews was examined using a structured qualitative content analysis (Schreier, 2012). Following standard procedures, the data were read iteratively, relevant meaning units were identified, and thematic categories (*e.g.*, socialising, improving performance, curiosity, etc.) were inductively derived (Elo & Kyngäs, 2008).

Because answers from the online questionnaire were not mandatory, some students offered fewer elements than requested, while others provided multi-layered responses touching on several themes. In these cases, each distinct idea embedded within a single answer was coded separately, in line with recommendations for qualitative categorisation where the same text segment can be broken down into different "units of meaning" (Braun & Clarke, 2006).

All codes were then grouped, counted, and compared across sources to determine thematic frequency and relative salience. A synthesis graph is presented to integrate these elements and provide an overarching visual representation of leaders' perceptions, thereby offering a consolidated view of the qualitative patterns emerging from the data.

3. Results

3.1. Sample

Table 1 represents the number of online questionnaires collected from SI-PASS leaders over the past years for each semester and each faculty involved in the scheme. As shown in Table 1, the number of online questionnaires collected adds up to a total of *n* = 293, and for a total of *n* = 102 for academic year 2022-2023. Comments from all years have been examined to ensure the most precise results possible.

Table 1 - Number of online questionnaires collected from SI-PASS leaders from 4 faculties over 4 years.

Faculty	19-20 S1	19-20 S2	20-21 S1	20-21 S2	21-22 S1	21-22 S2	22-23 S1	22-23 S2	Total
Applied Sciences	.	16	14	7	11	15	24	21	108
Bioengineering	12	.	8	10	15	9	10	10	74
Psychology	.	.	.	29	22	6	11	5	73
Sciences	.	.	6	.	3	8	11	10	38
Total	12	16	28	46	51	38	56	46	293

Concerning the post-feedback interviews that took place during the second semester of the academic year 2022-2023 only, we note the following repartition: Applied Sciences *n* = 20 (2 new leaders), Bioengineering *n* = 6 (3 new leaders), Psychology *n* = 6 (no new leaders), and Sciences *n* = 10 (no new leaders), for a total of *n* = 42 leaders interviewed (37 returning and 5 new in total).

3.2. Axis 1 - Motivation, the role of money

When asked how important it is to be paid to endorse the role of a SI-PASS leader, 52.8% (*n* = 56) claimed that this is mildly important, while 36.8% (*n* = 39) claimed that this is very important to them. This question was presented as

a Likert scale, and we thus wanted to get more details about the choice of answer and understand what the other sources of motivations were for students who took part in the SI-PASS scheme as leaders. Table 2 represents the number of occurrences of each theme (response category) mentioned to the question "The two main elements that incited me to (re)take the role of SI-PASS leader are…" in the online questionnaires. The top three categories mentioned are the will to help other students succeed, the will to develop new skills through the leader role, and finally the financial aspect of the role. Please note that answers to the questionnaire were not mandatory. This implies that not all students answered the questions, thus making a difference between the initial sample size and the specific sample sizes for each question.

Table 2 - Number of occurrences of themes for motivation in becoming a leader (in online questionnaires).

Theme	Applied Sciences (n = 73)	Bioengineering (n = 60)	Psychology (n = 63)	Sciences (n = 24)	Total (n = 220)
Help other students	36 (49.3%)	31 (51.7%)	32 (50.8%)	10 (41.7%)	109 (49.5%)
Skills development	18 (24.7%)	21 (35%)	26 (41.3%)	8 (33.3%)	73 (33.2%)
Financial aspect	13 (17.8%)	25 (41.7%)	13 (20.6%)	6 (25%)	57 (25.9%)
Previous positive experience as participant	27 (37%)	8 (13.3%)	15 (23.8%)	6 (25%)	56 (25.5%)
Transmission	13 (17.8%)	10 (16.7%)	11 (17.5%)	5 (20.8%)	39 (17.7%)
Liked the course	14 (19.2%)	8 (13.3%)	13 (20.6%)	1 (4.2%)	36 (16.4%)
Social aspects	7 (9.6%)	16 (26.7%)	8 (12.7%)	2 (8.3%)	33 (15%)
Involvement in faculty / CV	14 (19.2%)	2 (3.3%)	6 (9.5%)	1 (4.2%)	23 (10.5%)

The question used to cover this aspect during the interviews was: "What led you to enroll again in this role". The three main elements mentioned by leaders and displayed in Table 3 were the good contact they had with students (*"I had*

a good group last semester and was really excited to see them again this time."), the positive former experience they had as either a former participant to the scheme or as a leader from a previous semester ("*I really enjoyed my SI-PASS meetings last year and wanted to continue the experience as a leader this time.*"), and the strong motivation they have to see other students succeed and help them in the process reaches the third position ("*I wanted to provide the same help I had received.*"). The financial aspect only reaches the fourth position.

Table 3 - Number of occurrences of themes for reasons to enrol again as a leader (during interviews).

Theme	Applied Sciences ($n = 18$)	Bioengineering ($n = 3$)	Psychology ($n = 6$)	Sciences ($n = 10$)	Total ($n = 37$)
Social aspects	13 (72.22%)	3 (100%)	4 (66.7%)	7 (70%)	27 (73%)
Positive experience	13 (72.22%)	2 (66.6%)	2 (33.3%)	8 (80%)	25 (67.6%)
Help other students	8 (44.4%)	3 (100%)	5 (83.3%)	3 (30%)	19 (51.4%)
Financial aspect	6 (33.3%)	2 (66.6%)	3 (50%)	5 (50%)	16 (43.2%)
Fun	6 (33.3%)	1 (33.3%)	3 (50%)	2 (20%)	12 (32.4%)
Like to "teach"	3 (16.7%)	1 (33.3%)	2 (33.3%)	5 (50%)	11 (29.7%)
Liked the course	8 (44.4%)	0 (0%)	1 (16.7%)	2 (20%)	11 (29.7%)
Skills development	5 (27.8%)	1 (33.3%)	3 (50%)	1 (10%)	10 (27%)
Freedom	2 (11.1%)	1 (33.3%)	2 (33.3%)	0 (0%)	5 (13.5%)
Meeting other leaders	2 (11.1%)	0 (0%)	1 (16.7%)	0 (0%)	3 (8.1%)
Responsibility	2 (11.1%)	0 (0%)	0 (0%)	0 (0%)	2 (5.4%)

A comparison between the two tables reveals that helping other students remains in the top 3 position, and that the financial aspect and positivity of the experience switch place. One specification needs to be made here: during the interview, the financial aspect was never mentioned as the main reason that pushed students to enroll in their role. They all mentioned that the pay was a

pleasant bonus, and out of the 16 students that mentioned it, 13 said that they would still do it for free, as the experience in itself is what matters the most ("*It's an interesting student job, very practical in terms of organization and it is paid. But I have so much fun I would even do it for free.*"). The theme related to money as not being the main motivational element for students to engage in a leader role thus seems to be confirmed by these silences and declarations, as this element is not the most often chosen in the online questionnaires and is not even in the top three during the interviews. This step also allowed us to gain a refined understanding of this aspect and showed us that, for some students, it could even be completely discarded without impact on the motivation of students to be leaders.

3.3. Axis 2 - Transferable skills

Table 4 represents the number of occurrences of each theme to the question "My role as a leader helped me train the following skills" in the online questionnaires. The top three elements (all faculties confounded) are the ability to manage a group and its interactions, improved abilities to communicate, and better knowledge transmission skills. Group management abilities is the most cited element for all faculties, except Sciences which cited knowledge transmission skills the most. Communication is the second most cited element for all faculties, and social skills is cited as often in the faculty of Psychology.

Table 4 - Number of occurrences of themes for skills developed as a leader (in online questionnaires).

Themes	Applied Sciences (n = 73)	Bioengineering (n = 57)	Psychology (n = 60)	Sciences (n = 22)	Total (n = 212)
Group management	31 (42.5%)	25 (43.9%)	27 (45%)	5 (22.7%)	88 (41.5%)
Communication	29 (39.7%)	24 (42.1%)	26 (43.3%)	6 (27.3%)	85 (40%)
Knowledge transmission	20 (27.4%)	19 (33.3%)	18 (30%)	11 (50%)	68 (32.1%)
Organization	18 (24.7%)	20 (35.1%)	21 (35%)	6 (27.3%)	65 (30.7%)
Social skills, empathy	19 (26%)	13 (22.8%)	26 (43.3%)	5 (22.7%)	63 (29.7%)
Synthesis and reflection	13 (17.8%)	4 (7%)	12 (20%)	2 (9.1%)	31 (14.6%)
Improvisation and creativity	7 (9.6%)	4 (7%)	11 (18.3%)	2 (9.1%)	24 (11.3%)
Patience	3 (4.1%)	2 (3.5%)	8 (13.3%)	0 (0%)	13 (6.1%)
Stress management	4 (5.5%)	3 (5.3%)	3 (5%)	0 (0%)	10 (4.7%)

In a wish to delve more into the details of these skills, the following question was raised to cover this theme during all interviews: "What are the skills developed during your time as a leader that you transpose to other aspects of your personal life or work?". Table 5 shows that the top three elements spontaneously mentioned during the interviews are better communication skills (*"I am now able to express ideas in a clearer way.", "I feel more at ease in front of a group now.*"), more ease at managing a group and its interactions ("*At first, I was a bit scared that the group would not be able to focus on a task for a long time. It took me a few meetings, but I now feel much more confident in my ability to catch and maintain a whole group's attention.*"), and the ability to deal with different ways of thinking. The latter element was not mentioned in the online questionnaires but appears here as a form of empathy towards the students ("*I was having a hard time understanding that the students in my group did not think in the same way as me, thus I had to adapt to this fact."*). Out of the 8 students that mentioned this aspect of their role, 5 stated that this new ability had already been useful in other settings (personal and academic

related) ("*A few months ago, I was having dinner with family members I rarely see and was surprised to have an easier time understanding everyone's perspective during a debate we had, which was nearly impossible for me before!"*).

Table 5 - Number of occurrences of themes for skills developed as a leader (during interviews).

Themes	Applied Sciences (n = 18)	Bioengineering (n = 3)	Psychology (n = 6)	Sciences (n = 10)	Total (n = 37)
Communication	12 (60%)	1 (25%)	3 (50%)	3 (30%)	19 (51.4%)
Group management	5 (41.7%)	1 (25%)	3 (50%)	3 (30%)	12 (32.4%)
Dealing with different ways of thinking	6 (30%)	0 (0%)	1 (16.7%)	1 (10%)	8 (21.6%)
Improvisation and creativity	3 (15%)	1 (25%)	2 (33.3%)	1 (10%)	7 (18.9%)
Patience	2 (10%)	1 (25%)	2 (33.3%)	2 (20%)	7 (18.9%)
Organization	3 (15%)	1 (25%)	1 (16.7%)	2 (20%)	7 (18.9%)

The second theme related to the improvement in transferable skills is thus addressed, as all leaders mentioned at least two skills developed both in the online questionnaires and during the interviews. This convergence across the two sources suggests an appreciable consistency in leaders' accounts, a pattern that could only be made visible because the study deliberately triangulated questionnaire and interview data. Most of them even stated that the improvement of these skills has already helped them on several occasions and helped strengthen their self-confidence ("*I feel much more confident in my ability to express myself clearly in public and, as a consequence, feel less stressed and experience less anxiety before my presentations.*").

3.4. Axis 3 - Self-efficacy

From online surveys, and when asked if being a SI-PASS leader reinforced their self-confidence, 70.5% (n = 72) said that they agree with the statement while 23.5% (n = 24) remained neutral. Table 6 represents the number of occurrences of each theme to the question "What my experience as a leader taught me about myself is" in the online questionnaires. The top three elements are the realization that they should be much more confident in their abilities, that they actually enjoy sharing knowledge with a group ("teaching"), and that they are able to manage groups effectively.

Table 6 - Number of occurrences of themes for secondary benefits as a leader (in online questionnaires).

Themes	Applied Sciences (n = 59)	Bioengineering (n = 47)	Psychology (n = 53)	Sciences (n = 11)	Total (n = 170)
Should be more confident	13 (22%)	13 (27.7%)	15 (28.3%)	2 (18.2%)	43 (25.3%)
Like transmission	15 (25.4%)	7 (14.9%)	10 (18.9%)	6 (54.5%)	38 (22.4%)
Ability to manage groups	15 (25.4%)	7 (14.9%)	13 (24.5%)	0 (0%)	35 (20.6%)
Self confidence	11 (18.6%)	7 (14.9%)	11 (20.8%)	0 (0%)	29 (17.1%)
Good material knowledge	6 (10.2%)	1 (2.1%)	2 (3.8%)	2 (18.2%)	11 (6.5%)
Ability to adapt	3 (5.1%)	1 (2.1%)	5 (9.4%)	0 (0%)	9 (5.3%)
Tendency to stress	2 (3.4%)	5 (10.6%)	0 (0%)	0 (0%)	7 (4.1%)
Lack assertiveness	0 (0%)	4 (8.5%)	3 (5.7%)	0 (0%)	7 (4.1%)
Patient	2 (3.4%)	3 (6.4%)	0 (0%)	0 (0%)	5 (2.9%)
Good study orientation	1 (1.7%)	0 (0%)	2 (3.8%)	1 (9.1%)	4 (2.4%)
Different from the rest	2 (3.4%)	1 (2.1%)	1 (1.9%)	0 (0%)	4 (2.4%)
Good organizational skills	0 (0%)	3 (6.4%)	0 (0%)	0 (0%)	3 (1.8%)
Responsible	1 (1.7%)	0 (0%)	1 (1.9%)	0 (0%)	2 (1.2%)

Another aspect that piqued our interest were the personal challenges encountered by leaders during their experience. The question used to cover this

aspect during the interview was: “What aspects of your role forced you out of your comfort zone?”. Results displayed in Table 7 show that the three main difficulties encountered by leaders during their meetings are the need to adapt to a specific situation (*“students are not as active as usual”, “an unexpected question emerges and I don’t know what to reply*”), the need to be patient (*“I find that the most difficult thing for me is to remain patient and not ‘impose’ knowledge on them.”*), and the stress some encounter with speaking in public (“*I am very shy and it is always difficult for me to speak in front of an audience.*”). From the interviews, these elements are considered the hardest part of the leader role, but all students report that this is also part of the learning experience and that they are somehow happy to train these skills.

Table 7 - Number of occurrences of themes for difficulties as a leader (during interviews).

Themes	Applied Sciences (n = 18)	Bioengineering (n = 3)	Psychology (n = 6)	Sciences (n = 10)	Total (n = 37)
Adaptability	8 (40%)	2 (50%)	4 (66.7%)	4 (40%)	18 (48.6%)
Patience	5 (25%)	2 (50%)	2 (33.3%)	3 (30%)	12 (32.4%)
Speaking in public	5 (25%)	1 (25%)	1 (16.7%)	3 (30%)	10 (27%)
Assertiveness	1 (5%)	2 (50%)	1 (16.7%)	3 (30%)	7 (18.9%)
Release control	6 (30%)	0 (0%)	1 (16.7%)	0 (0%)	7 (18.9%)
Responsibility	2 (10%)	1 (25%)	0 (0%)	0 (0%)	3 (8.1%)

The third theme, related to self-efficacy and broader personal development, is addressed here. Through both online questionnaires and interviews, we see that elements such as self-confidence, assertiveness, and patience are developed or reinforced. These are not transversal skills as defined by the UNESCO classification system but are, nonetheless, secondary benefits and positive aspects leaders have enjoyed during their experience.

3.5. Axis 4 - Overall experience and employability investment

From the online questionnaire surveys taken over the past four years, and when asked how they feel when looking back at their experience as leaders, 89.1% (n = 204) stated that they were quite happy or very happy with their role. When asked if they would like to apply another time for the same position, 79.45% agreed (n = 103), 90.2% (n = 202) stated that they have been happy with their group of students and 88.8% (n = 99) said that they felt good in this role. Lastly, when asked if they would recommend this role to future students, 97.3% (n = 217) agreed; and 85.6% (n = 184) would also agree to be SI leaders for another difficult course.

Since leaders seemed to be consistently pleased with their experience over the years, the question was to investigate their way of promoting the scheme for their prospective career (through a résumé for instance or during a job interview). The interviews conducted thus used the question "How do you think this experience will help you in the future and how are you going to valorize it?" to investigate the question of ulterior use of this experience for the leader on the job market. Table 8 displays that the three main elements that leaders are going to highlight when speaking about their experience as a leader are the teaching/knowledge transmission aspect of the position ("*I now know that I am able to share knowledge with other people and teach them something in a way they understand.*"; *"Being a leader confirmed my vocation for teaching."*), the social skills and empathy developed ("*I have noticed an evolution in my ability to put myself in first-year students' shoes, something I was not able to do in the beginning.*") and the ability to manage groups for a given period ("*I have had a few group projects and have noticed that the work ran more smoothly than before, and I know that this is a direct consequence of my experience as a leader.*").

Table 8 - Number of occurrences of themes for valorising their experience as a leader (during interviews).

Themes	Applied Sciences ($n = 18$)	Bioengineering ($n = 3$)	Psychology ($n = 6$)	Sciences ($n = 10$)	Total ($n = 37$)
"Teaching" experience	11 (55%)	3 (75%)	3 (50%)	7 (70%)	24 (64.9%)
Social skills, empathy	9 (45%)	1 (25%)	3 (50%)	2 (20%)	15 (40.5%)
Group management	6 (30%)	3 (75%)	2 (33.3%)	2 (20%)	13 (35.1%)
Public speaking	6 (30%)	1 (25%)	3 (50%)	0 (0%)	10 (27%)
Reinforce knowledge	5 (25%)	0 (0%)	3 (50%)	1 (10%)	9 (24.3%)
PhD	2 (10%)	0 (0%)	1 (16.7%)	3 (30%)	6 (16.2%)
Established program	1 (5%)	1 (25%)	1 (16.7%)	2 (20%)	5 (13.5%)
Responsibility	2 (10%)	0 (0%)	1 (16.7%)	1 (10%)	4 (10.8%)
Structure	1 (5%)	1 (25%)	1 (16.7%)	0 (0%)	3 (8.1%)

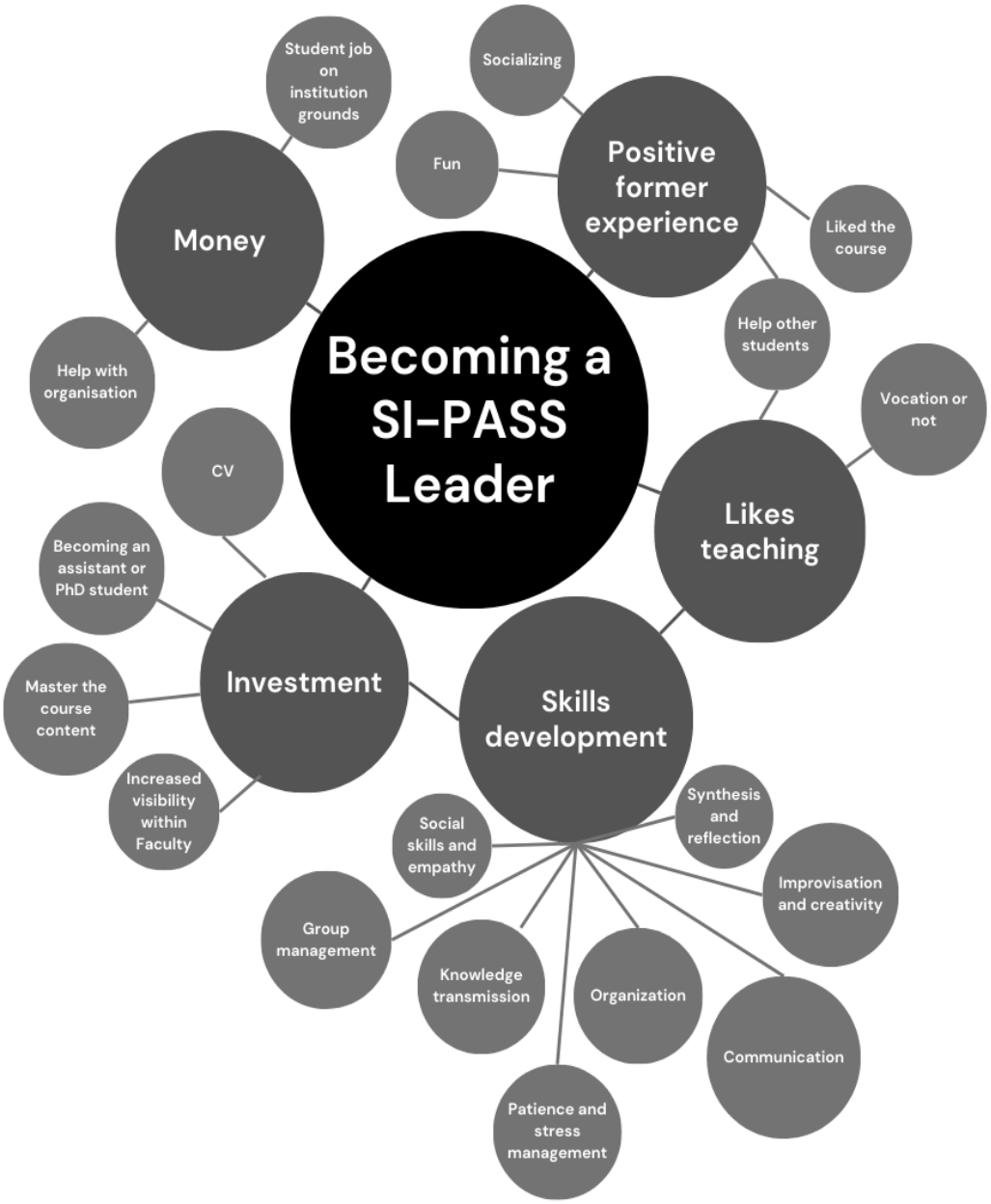
Some of them also mentioned the added value, or "investment" as one of them said, of their experience regarding a future PhD application. They explained that this is a way for them to be known by the teaching staff, display "proof" that they have mastered the course content ("*I want to do a PhD and I view this experience as a proof of my interest in academic matters and competence in the course worked on.*"), and even reinforce weaker spots ("*I know I am not always able to communicate in a straightforward way. I feel like being in charge of first year students for one hour max helped me master this skill.*"). Others also mentioned that the official character of the program incited them to enroll as they perceive it as a positive involvement in an international practice ("*We were told that SI-PASS is an international program, I believe this is always a good thing to have such a mention on your résumé.*").

3.6. Results summary

Overall, the results show a coherent picture across the four axes investigated. SI-PASS leaders at the University of Liège do not primarily describe remuneration as their main reason for applying; rather, they emphasize helping other students, extending a previously positive experience of the scheme, and, for some, using the role as a strategic steppingstone within the institution. Across both questionnaires and interviews, they also report the development of transferable skills, especially in communication, group management, and the ability to adapt to different ways of thinking. In addition, the role appears to promote broader forms of self-efficacy, including greater confidence, patience, and adaptability. Finally, the overall experience is described in overwhelmingly positive terms, with many leaders explicitly viewing it as valuable for their future trajectory and employability.

Lastly, an exploratory comparison between first-time and returning leaders was also attempted. Although one might have expected differences in the way these two groups described their motivations, difficulties, or perceived gains, no clear difference emerged from the available material. This result should be interpreted cautiously, but it nonetheless supports the decision to treat the leaders as a single group in the overall synthesis presented here. In that sense, Figure 1 should be read as a global representation of what becoming an SI-PASS leader means in this context, rather than as a contrast between distinct leader profiles according to seniority.

Figure 1 - Graphic synthesis of the main motivational and developmental themes associated with becoming a SI-PASS leader based on the results from online questionnaires and interviews.



4. Discussion

Several lessons can be drawn from the data collected over the past four years at the University of Liège for the faculties of Applied Sciences, Bioengineering, Psychology, and Sciences. These findings not only provide insights into the local implementation of peer-learning schemes but also contribute to the broader body of knowledge on this pedagogical approach.

4.1. Axis 1 - Motivation, the role of money

Students from the University of Liège are paid for their participation in the SI-PASS scheme, whereas some other universities do not remunerate leaders directly and instead rely on alternative incentives (*e.g.,* credentials, special SI-PASS events). At first glance, one might expect financial compensation to be the main attraction. Yet, results from both questionnaires and interviews consistently show that remuneration is not the primary self-reported driver.

Several distinct motivational profiles emerge:

- Profile 1: Some leaders are former participants who valued the program so highly that they wanted to contribute in turn, often highlighting the enjoyment of the sessions and the opportunity to build lasting peer relationships. Such altruistic and social motivations are frequently reported in the broader peer-mentoring literature, where the desire to "give back" and to promote a sense of belonging are emphasized as central drivers (Colvin & Ashman, 2010; Terrion & Leonard, 2010).

- Profile 2: Others emphasized their interest in "teaching" and their desire to support first-year students, perceiving SI-PASS as an accessible platform to practice knowledge transmission. Similar motivations have been identified in previous SI studies,

where leaders reported developing pedagogical confidence and valuing opportunities to explain concepts to peers (Gunn et al., 2017; Stigmar, 2016).

- Profile 3: A smaller but particularly noteworthy group approached the role strategically, framing it as a step toward an academic trajectory. For these leaders, SI-PASS was not only an enjoyable or altruistic commitment, but also a way of building a profile that could later support applications for positions such as student teaching assistant and, potentially, PhD candidate. While previous research has acknowledged that SI-PASS leadership may enhance employability and, in some contexts, increase contact with staff (Crisp & Cruz, 2009; Malm et al., 2022a), the present finding should not be interpreted primarily in terms of closer relationships with professors. In the Liège context, such proximity appears more limited in practice than in principle. Rather, this strategic profile suggests that some leaders perceive the role itself as a valuable institutional steppingstone, independently of any sustained faculty involvement. This pattern appears especially clearly established in Applied Sciences.

While financial compensation was not identified as the primary driver of motivation, its role cannot be dismissed. In the Liège context, remuneration appears less as a purely motivational incentive than as one possible lever for maintaining the scale, regularity, and organizational stability of the program across several faculties. Comparative studies have shown that financial incentives can attract different profiles of mentors while still leaving room for strong intrinsic motivations (Malm et al., 2022a; Terrion & Leonard, 2010). At

the same time, the present findings suggest that a purely voluntary model cannot be ruled out in principle, since many leaders also emphasized altruistic, developmental, and career-related motives. The issue is therefore not whether leaders must necessarily be paid, but under what institutional conditions a paid or unpaid model can remain viable and coherent with the ambitions of the scheme. In this sense, the balance between extrinsic and intrinsic motivations is not merely a theoretical issue, but also a question of local program design and sustainability.

4.2. Axis 2 - Transferable skills

It is perhaps not surprising that the skills most frequently reported by leaders are group management and communication, as these have consistently been identified in prior studies on peer-learning and SI-PASS leadership (Cutright & Evans, 2016; Gunn et al., 2017; Lim et al., 2017; Malm et al., 2022a). This is also coherent with the pedagogical design of the scheme: leaders are expected not to "teach" content in a unilateral manner, but to facilitate group interaction, redirect questions, and encourage collaborative problem-solving. The interviews further illustrate this distinction: leaders spoke of learning to articulate their ideas more clearly, regulate their pace of speech, and above all, encourage peers to express themselves and build on each other's contributions.

An element that appears more distinctive in the Liège data, however, is the emphasis on dealing with different ways of thinking. Leaders (particularly those from the Faculty of Applied Sciences) highlighted how they came to realize that peers approach problems, concepts, or theories in diverse ways, and that adapting to these differences was crucial for effective facilitation. This recognition resonates with prior research showing that peer leaders must navigate heterogeneous learning styles and approaches to knowledge construction (Felder & Brent, 2005; Micari & Pazos, 2012; Stigmar, 2016). It

is also closely tied to the patience some leaders reported developing during their sessions, which aligns with the SI-PASS principle of guiding rather than instructing and has been similarly emphasized as a developmental outcome in previous studies (Dawson et al., 2014; Harmon, 2006). Beyond confirming what has been established in the literature regarding communication and group management, this finding enriches our understanding by showing how leaders reflect on their own adaptive processes, displaying both introspective and relational growth (Lozada & Turner Johnson, 2018; Mason-Innes, 2015).

4.3. Axis 3 - Self-efficacy

Being a SI-PASS leader also promotes important dimensions of self-discovery, often referred to in the literature as "personal development" or "self-efficacy gains" (Crisp & Cruz, 2009; Stigmar, 2016). Leaders frequently reported realizing that they had greater abilities than they initially believed, or that they mastered course content more thoroughly than expected. Stigmar (2016) categorizes these effects as academic and personal growth. In the Liège data, this empowerment dynamic was particularly salient: greater self-confidence encouraged leaders to pursue further skill development, creating a 'snowball effect' of motivation and self-improvement.

A novel and more marginal observation emerged from the interviews, concerning the discovery of a genuine interest in teaching. During the interviews, four leaders reported that, through SI-PASS, they realized that pedagogy might be a viable career path for them, even if their current master's program was in another discipline. While some already suspected an affinity for knowledge transmission, they had not previously considered teaching as a professional trajectory. It is worth noting, however, that this perception diverges from the core SI-PASS principle, which emphasizes facilitation rather than teaching. The fact that some leaders interpreted their experience through

the lens of “teaching” underscores how role expectations can be differently internalized, and how SI-PASS may sometimes be reframed by students according to their own aspirations. This observation also opens an unusual line of inquiry. While the literature has long established that teachers hold personal teaching philosophies (Schönwetter et al., 2002), located along a continuum between the two unescapable polarities of the educational practice, instructivism and constructivism (Barr & Tagg, 1995), little attention has been paid to whether peers in learning-support roles convey or develop comparable internal conceptions of teaching and learning.

Leaders also mentioned challenges such as nervousness before sessions or difficulties asserting themselves. Similar concerns have been documented elsewhere, with peer leaders frequently describing initial anxiety, uncertainty about their role, or a lack of confidence in managing groups (Colvin & Ashman, 2010; Gunn et al., 2017). Yet these difficulties were often reframed as opportunities for growth, as students reported actively trying to overcome them and valuing the progress they achieved. This dynamic echoes previous findings that peer leadership promotes resilience and adaptability by encouraging students to transform obstacles into developmental gains (Crisp & Cruz, 2009; Stigmar, 2016). In this respect, the development of patience and adaptability appears as both a personal challenge and a deliberate objective, consistent with the facilitative ethos of SI-PASS. Such outcomes align with broader accounts of SI leadership as a vehicle for perspective transformation and the cultivation of empathy (Harmon, 2006; Lozada & Turner Johnson, 2018). Rather than being secondary or anecdotal, these dimensions suggest that the program can be as transformative for leaders as it is supportive for first-year students, albeit for different reasons.

4.4. Axis 4 - Overall experience and employability investment

Lastly, beyond specific skills and self-efficacy gains, the data also document how leaders evaluate the role as a whole and how they position it in relation to their future trajectory. For those considering academic careers (*e.g.*, assistantships or PhD positions), SI-PASS is not only valued for the transferable skills it provides, but also strategically framed as evidence of course mastery and institutional involvement. Prior studies have emphasized the employability dimension of SI-PASS leadership, with graduates reporting that the role enhanced their confidence and was instrumental in securing jobs (Malm, 2021b; 2022a). Mentoring literature has also recognized the career value of such experiences (Crisp & Cruz, 2009; Gershenfeld, 2014). However, the explicit articulation of SI-PASS leadership as a deliberate step toward a PhD or academic appointment has not, to our knowledge, been reported. This career-oriented appropriation thus represents one of the most original contributions of the Liège data.

Contrary to other studies that identified confusion or role ambiguity among peer leaders (Colvin, 2007; Gunn et al., 2017), students from this sample did not report difficulties in understanding their role during the one-to-one interviews. Their responsibilities appeared clear and well defined and did not raise concern during their sessions. This difference may be linked to the structured two-day intensive training provided at Liège, which explicitly defines the facilitation role, expected boundaries, and pedagogical principles. Prior work has stressed the importance of such preparation: Dawson et al. (2014) argue that well-designed training is crucial to establishing leader confidence, while Stigmar (2016) highlights that clarifying the distinction between facilitation and teaching is a prerequisite for successful practice. Our findings therefore lend further support to the claim that systematic training

plays a decisive role in preventing confusion and reinforcing leaders' confidence in their responsibilities.

4.5. Limitations and perspectives

First of all, making answers to all questions of the online surveys mandatory would have allowed for a larger collection of data. When planning the questionnaires, two options were available: either leaving questions non mandatory and hoping that students would reach the end of the questionnaire or making all questions obligatory and have no certitude that students would not close the survey once they were bored. The first option was adopted, as we thought it was much more interesting for us to gather data on questions that piqued the interest of students rather than forcing them to answer questions perceived as less relevant. This trade-off between response completeness and the risk of participant dropout is well recognized in survey methodology (Galesic & Bosnjak, 2009; Rolstad et al., 2011).

Also, the present study could be improved by gathering longitudinal data, as this would allow for observing the evolution of each leader that decided to take on the role several times in terms of transferable skills (speaking in public, group animation, etc.) and self-development. Moreover, such data would be even more complete and interesting if the full academic trajectory of the student is included, as we would be able to see if those who wished to remain active members of the institution eventually did so. Longitudinal perspectives have been strongly encouraged in the broader peer-learning literature, as they provide insights into the sustained impact of such roles on personal and professional trajectories (Topping, 2005).

Another aspect that could be investigated would be to compare students who started the SI-PASS adventure as first-year and then decided to become leaders

to students who did not enrol in the program when they arrived and started out directly as leaders. One might notice discrepancies in terms of motivational elements or perception of the scheme. For instance, students who discovered the program when they first arrived may put forward arguments relating to the social aspect of the scheme or to the feeling that they received most needed assistance from a senior student and wish to help other students too.

A final limitation concerns the extremely small number of new leaders in the interview sample (five out of 42), which made any meaningful comparison between first-time and returning leaders impossible. This imbalance is largely structural: the SI-PASS scheme examined here was implemented during the second semester, meaning that many "new" leaders had, in fact, already served as leaders in the first semester, or had participated as students the previous year. As a result, the interview cohort was composed almost entirely of experienced leaders by the time data collection occurred. Had interviews been conducted during the first semester, a more balanced distribution between novice and returning leaders would likely have emerged, increasing the analytical value of cross-group comparisons.

5. Conclusion

This study has examined the perspective of SI-PASS leaders at the University of Liège, offering insights into their motivations, the transferable skills they develop, and the broader personal benefits they associate with the role. By situating these findings within the international literature, two points stand out as particularly consequential. First, financial compensation, while not the primary driver of engagement, appears as an important lever for sustaining the scheme at its current scale. This suggests that recruitment policies cannot simply rely on intrinsic motivations or symbolic recognition: where the size of the program requires continuity and reliability, systematic remuneration appears, in the ULiège context, less as the primary motive for engagement than as a stabilizing condition for sustaining the scheme at its current scale. Second, the finding that some leaders frame their role strategically as a step toward an academic career highlights a new dimension of motivation that may be relevant for institutions wishing to attract students interested in pedagogy and research pathways.

These implications raise the broader question of how universities should design recruitment strategies for SI-PASS leaders. In contexts like Liège, the issue may not be to secure a sufficient number of applicants, since recruitment has not generally been problematic, but rather to clarify how the role is positioned and valued. Explicitly acknowledging both its developmental and strategic benefits could make the scheme more attractive not only to students with diverse aspirations, but also to faculties and institutions that seek to promote transversal skill development and recognize it more explicitly within students' trajectories.

Future research should further examine differences between leaders who previously participated in SI-PASS sessions and those who did not, as well as

between leaders who perceive the role as primarily altruistic and those who approach it strategically for career advancement. Such comparisons could refine our understanding of leader profiles and inform tailored recruitment and support policies across institutions.

Transition

Study 7 closes the empirical sequence of the dissertation by addressing a methodological issue that emerged across the previous studies: the difficulty of comparing students' perceptions of peer-led schemes in the absence of a shared measurement instrument. The study therefore develops and validates the PEERS-Q, a psychometric scale designed to assess students' perceptions across different forms of peer-led support, including SI-PASS and PEPPS.

The validation process relies on exploratory factor analysis, confirmatory factor analysis, and reliability testing, in line with established recommendations for scale development (DeVellis & Thorpe, 2022; Hinkin, 1995). By covering several perceptual dimensions, including perceived learning, satisfaction, motivation, social integration, and perceived value, the instrument provides a structured basis for comparing student experiences across programs and contexts.

In this sense, study 7 contributes not only a final empirical study, but also a methodological tool for future monitoring and evaluation. It supports more systematic comparison across faculties, cohorts, and peer-learning formats, and offers a basis for continuous improvement grounded in students' reported experience.

Study 7

Development and validation of the PEERS-Q, a psychometric scale for higher education - First-year students' perception of peer-learning programs

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"The comparability, or equivalence, of the measurement instruments is a prerequisite for any meaningful comparison between individual countries." (Behr et al., 2016, p. 2)

Abstract

Since 2019, the University of Liège has collected systematic feedback from first-year students participating in two peer- led support programs. Building on this rich dataset, a standardized survey instrument was developed and validated to capture key dimensions of students' experiences. Item structure was established through exploratory factor analysis (EFA) and cross-validated via confirmatory factor analysis (CFA), with internal consistency assessed using Cronbach's α. The resulting scale demonstrates robust psychometric properties and provides comprehensive coverage of eight dimensions of student's experience: evaluation, course perception, usefulness, orientation confirmation, support, social experience, engagement, and belonging. After evidence of internal consistency and construct validity was secured, the PEERS-Q was applied to both programs at ULiège. Results indicate discriminative power for five of the eight dimensions, suggesting that the scale can meaningfully differentiate between peer-learning formats and become a resource for broader comparative studies across programs and institutions.

1. Introduction

1.1. Students' evaluation of peer-learning programs

As reflected in Arendale's extensive reference bibliography (2022a), peer-learning presents under a variety of names, definitions (Pleschová & McAlpine, 2024) and designs (Keerthirathne 2020; Topping, 1996). Despite this heterogeneity, a unifying description can be proposed as: "The practice of more experienced students being trained to guide and facilitate the learning of less experienced students in an organized and supported way" (Keenan, 2014, p.5). Evaluation of such programs has often been approached in a binary way: whether they improve academic success or not (Dehghani et al., 2014; Reid et al., 2016). Alongside these outcome-focused approaches, a substantial qualitative and survey-based literature has documented participants' perceptions of peer-learning schemes. Reported benefits, however, are scattered across studies and rarely captured in a systematic, comparable way. They include, for instance, enhanced understanding (Ebrahim et al., 2023), increased motivation or engagement in studies (Dosoftei & Alexa, 2024), relationship building and social support, opportunities to get valuable feedback (Misiejuk et al., 2021), self-reflection on learning strategies (Planas Lladó et al., 2014), etc.

With the global expansion of peer-learning schemes in post-secondary education (Crisp & Cruz, 2009), this qualitative evidence has also grown and is summarized in three major works: Dawson et al.'s review (2014, period 2001-2010) which is specifically focused on SI-PASS research, Bengesai et al.'s meta-analysis (2023, period 2010-2021) which is broader and encompasses all research done on peer learning and Zha et al.'s (2019), which concerns 28 peer-led learning research conducted between 1993 and 2017.

1.2. The need for a reliable multifaceted tool

Although the above syntheses refer to survey-based studies none report a widely adopted, standardized instrument specifically designed to measure how students exposed to peer-learning programs perceive these. Yet such a controlled take on program reception by students would serve at least two complementary purposes. First, it would support within-program triangulation by allowing systematic comparison between students' perceptions and other evidence (*e.g.*, participation metrics, academic outcomes, and, where available, observational data). Second, it would enable between-program comparisons by providing a common measurement framework across peer-learning formats, institutions, and contexts.

Against this backdrop, this paper is the first of its kind, as it aims to create a comprehensive scale (Hinkin, 1995) that can assess the key dimensions of students' perceptions of peer-learning schemes in higher education. Two design requirements guide this work: standardization, so that scores can be interpreted consistently across cohorts; and cross-context generalizability, allowing the instrument to be applied across different peer-learning formats (beyond the two programs implemented at ULiège).

1.3. Peer-learning programs at ULiège

Since 2019, depending on the faculty concerned, first-year students at the University of Liège have access to two peer-led support programs.

1.3.1. SI-PASS

SI-PASS (Supplemental Instruction-Peer-Assisted Study Sessions) is a long-established and well-documented model targeting courses with historically high failure rates. It revolves around principles that Martin started to define in the early 1970s at the University of Missouri-Kansas City. A key element of

this program is the collaborative group sessions guided by a trained ‘leader (*aka* an older student who successfully passed the difficult course and was trained to mentor SI-PASS meetings). The leader is not considered a substitute to the class teacher, but rather a facilitating element in the group interactions (Martin & Arendale, 1992). During the whole semester, students meet once per week after each new lecture has been delivered and work together on the material covered by this lecture. Evidence over the past decades suggests that SI-PASS not only enhances academic performance (Adebola et al., 2020; Hoiland et al., 2020) but also bolsters student confidence (Bronstein, 2008), critical thinking skills, and encourages a sense of community (Abegglen et Morris., 2015).

1.3.2. PEPPS

The PEPPS program consists of five meetings, each centered on a topic related to the first-year university experience (ULiège, 2023). The 5 topics are reflected in the acronym :

- P(erception): students discuss initial impressions of the transition from high school to university.
- E(stablishment of a Plan): students share techniques for taking and structuring notes.
- P(rogress): students explore ways to assess progression towards mastery.
- P(reparation): students focus on organizing the study period before the first exam session.
- S(ession): students reflect on their first exam period experience.

Both programs share similarities in their dynamics: interactions between freshmen and senior students and the conversational nature of the meetings. However, they also differ in intensity (5 one-hour meetings *versus* 13), focus

(overall university experience *versus* a targeted high-risk course), leader training (3 hours *versus* 6 hours). These contrasts can be boiled down in an overarching distinction: SI-PASS primarily targets academic integration through course-specific work, whereas PEPPS is designed to support transition and social integration. This distinction matters for the present study as the first application of the new scale examines its sensitivity to differentiate between these two program stances. Taken together, the two programs thus provide both the empirical basis for scale development and its initial testbed.

2. Methodology

2.1. Context

The study is situated within the SI-PASS and PEPPS programs implemented at the University of Liège across three academic years: 2019-2020, 2020-2021, and 2021-2022. PEPPS was implemented in the Faculties of Architecture, Law, Medicine, Philosophy, Social Sciences, Sciences, and Veterinary Medicine, whereas SI-PASS was implemented in the Faculties of Applied Sciences, Agronomy, Psychology, and Sciences. Only the faculty of Sciences appeared in both programs. In total, the three-year period yielded 16 SI-PASS implementations, defined at a semester level, and 19 PEPPS implementations, defined at an academic-year level. Each of the 35 implementations officially ended with an invitation for all participants to complete the same exit survey, allowing aggregated analyses across schemes (Appendix 1). The study protocol received ethical approval from the committee of Psychology, Speech Therapy, and Education Sciences from the University of Liège under number 2122-098.

2.2. Exit survey

The exit survey administered across cohorts provides the longitudinal dataset that supports psychometric development. Part of its material was used to construct the instrument (item selection and factor structure), and the remaining data were used to test the stability of this structure and to examine whether the resulting scale can sensitively reflect expected differences between SI-PASS and PEPPS; thereby providing an initial test of transferability across peer-learning formats.

The initial exit survey, not originally designed for scientific purposes but for practical endeavours of monitoring and accountability, was assembled pragmatically. In an unstructured attempt to be as comprehensive as possible,

the items drew from multiple pre-existing sources: an inquiry (itself conducted with a compound of validated questionnaires) by Pittman & Richmond (2008) on positive adjustment in the first year of college, the evaluation questionnaires used by Thalluri et al. (2014) or Abdul-Fattah et al. (2014) in the context of "buddy programs", the surveys by Tariq (2005) or Mayes & Cutts, (2010) probing perceptions of a peer-assisted learning setting, all contexts akin to the implementations at ULiège, the "leader post-survey" by Skalicky & Caney (2010). Items were also derived from theoretically grounded traditional constructs coming from literature on transition to higher education: belonging and social integration (Hurtado & Carter, 1997; Tinto, 1997), role of peer relationships (Buote et al., 2007), confidence, self-efficacy or learning strategies (Collings et al., 2014; Topping, 2005), importance of understanding academic expectations and institutional structures during the first year (Kift et al., 2010; Thomas, 2012).

Beyond internal factorial validation, the present study also sought to examine whether the emerging scale could meaningfully discriminate between theoretically distinct peer-learning formats. The instrument's transferability was probed by testing a straightforward expectation: if the scale captures core dimensions of the peer-learning experience, it should detect systematic differences between programs that differ in pedagogical orientation. Evidence of such discriminative capacity provides an initial indication of broader applicability across heterogeneous peer-learning initiatives.

2.3. Analysis method

Since the questions included in the online surveys were developed and administered at the beginning of the peer-learning programs' implementation in 2019, no previously validated scale corresponding to the targeted constructs was available. Consequently, the only viable option was to rely on the existing

items and retain those that best matched the underlying theoretical dimensions of peer-learning schemes.

All analyses were performed using JAMOVI version 2.3 or R version 4.4. Likert-type items were extracted from the online questionnaires and split into two independent samples; baseline equivalence between the two samples was checked prior to the analyses. Item scores were then standardized as z-scores to facilitate interpretation of the results. An exploratory factor analysis was first conducted (maximum likelihood extraction with oblimin rotation). Based on these results, an item refinement process was applied using multiple criteria. In addition to retaining items with primary factor loadings above .40, items were also required to show limited cross-loadings on other factors (< .30), acceptable communalities ($h^2 \geq .20$), and adequate corrected item-total correlations (≥ .30). Content relevance was also considered to ensure that theoretically important facets of peer learning were not discarded solely on statistical grounds. A confirmatory factor analysis was subsequently conducted, together with reliability assessments (Cronbach's α and McDonald's ω), to evaluate the internal consistency and overall quality of the measurement model.

In a second step (using the other part of the split dataset), external validity was examined through a comparative analysis of two distinct peer-learning schemes implemented at ULiège: SI-PASS and PEPPS. This comparison relies on a known-groups validation approach (DeVellis & Thorpe, 2022; Furr, 2018), meaning that the scale is expected to differentiate between groups that should, on theoretical grounds, score differently on specific dimensions. SI-PASS is designed to support mastery of a specific high-risk course, whereas PEPPS targets broader socio-academic integration and study skills. On this basis, differences were expected on several dimensions revealed by the factor

analyses, particularly those related to course perception, usefulness, orientation, and sense of belonging.

To operationalize this comparison, a mean score was calculated for each dimension, and independent-samples t-tests were conducted to assess whether significant differences were present between the two programs on each dimension. The Benjamini-Hochberg procedure was applied to control the false discovery rate (FDR) in the context of multiple hypothesis testing (Benjamini & Hochberg, 1995). This strategy was adopted because no pre-existing validated questionnaire was available to allow for convergent or criterion validity testing using external instruments. In this context, combining split-sample factorial validation with theoretically grounded program comparisons constituted the most appropriate methodological approach to assess both the structural robustness and the discriminative capacity of the scale. The instrument developed through this process is hereafter referred to as the Peer-learning Experience and Engagement Rating Scale - Questionnaire, or PEERS-Q.

3. Results

3.1. Sample description

The number of online questionnaires collected from students adds up to a total of $n = 721$ for the PEPPS program, and $n = 714$ for the SI-PASS program (total $n = 1435$) as displayed in Table 1.

Table 1 - Sample sizes of both SI-PASS and PEPPS groups.

Program	Faculty	*n*
SI-PASS	Applied Sciences	304
	Agronomy	154
	Psychology	186
	Sciences	64
PEPPS	Architecture	23
	Law	127
	Medicine	233
	Philosophy	148
	Social Sciences	39
	Sciences	11
	Veterinary	107

3.2. Items description

Table 2 shows the description of each item used to create the scale in terms of *n,* missing values, mean, and standard deviation. The items are presented in their full form in Appendix 1. A substantial proportion of missing responses was observed for several items. These missing data were treated as missing at random and may be partly attributable to a fatigue effect, as participants completed relatively long questionnaires.

Table 2 - n, missing data, Ms and STDs for each item in total and peer program.

Item	Total				PEPPS				SI-PASS			
	n	Missing	*M*	*STD*	*n*	Missing	*M*	*STD*	*n*	Missing	*M*	*STD*
1	1428	25	2.43	0.99	718	3	2.51	0.97	710	5	2.35	1.01
2	1080	356	2.79	1.06	492	229	2.77	1.10	588	127	2.81	1.03
3	1423	30	4.10	0.96	715	6	4.05	0.99	708	7	4.15	0.94
4	1416	37	3.84	0.95	721	0	3.63	0.93	695	20	4.07	0.91
5	1415	38	3.81	0.96	721	0	3.75	1.00	694	21	3.87	0.93
6	1415	38	3.90	1.01	720	1	3.90	1.04	695	20	3.90	0.99
7	1413	40	3.90	1.13	719	2	3.43	1.14	694	21	4.40	0.88
8	1413	40	3.61	1.02	719	2	3.73	1.02	694	21	3.49	1.01
9	1410	43	3.65	1.06	718	3	3.29	1.06	692	23	4.03	0.91
10	1409	44	3.46	1.04	718	3	3.49	1.02	691	24	3.43	1.06
11	1407	46	3.55	0.96	716	5	3.54	1.00	691	24	3.55	0.92
12	1408	45	3.48	1.15	716	5	3.50	1.11	692	23	3.47	1.18
13	1410	43	4.06	0.96	718	3	4.15	0.94	692	23	3.96	0.97
14	1405	48	3.74	0.99	715	6	3.74	1.03	690	25	3.75	0.96
15	1404	49	3.50	1.14	714	7	3.26	1.14	690	25	3.74	1.08
16	1401	52	3.61	1.20	716	5	3.52	1.25	685	30	3.70	1.15
17	1402	51	4.17	0.89	717	4	4.20	0.89	685	30	4.14	0.89
18	1369	84	2.13	1.13	702	19	2.39	1.08	667	48	1.86	1.11
19	1396	57	3.96	1.01	713	8	4.17	0.95	683	32	3.75	1.03
20	1385	68	3.36	1.17	704	17	3.60	1.12	681	34	3.11	1.18
21	1367	86	3.20	1.08	705	16	3.34	1.08	662	53	3.06	1.06
22	1367	86	3.46	1.04	705	16	3.53	1.06	662	53	3.39	1.03
23	1367	86	3.47	1.05	704	17	3.57	1.08	663	52	3.37	1.00
24	1365	88	3.59	1.07	703	18	3.85	1.05	662	53	3.30	1.03
25	1363	90	3.73	1.04	700	21	3.56	1.10	663	52	3.91	0.94
26	1364	89	3.33	1.05	701	20	3.21	1.08	663	52	3.46	0.99
27	1351	102	3.59	1.09	692	29	3.51	1.10	659	56	3.68	1.07
28	1354	99	4.46	0.93	696	25	4.46	0.96	658	57	4.46	0.89
29	1347	106	4.01	0.99	691	30	3.77	1.04	656	59	4.26	0.87
30	1353	100	4.51	0.79	695	26	4.60	0.74	658	57	4.41	0.83
31	1304	149	3.10	1.37	649	72	3.31	1.39	655	60	2.88	1.31
32	1345	108	4.53	0.81	689	32	4.48	0.81	656	59	4.58	0.80

3.3. Exploratory factor analysis

The exploratory factor analysis with maximum likelihood extraction and oblimin rotation was performed on the first subsample (z-score transformed data and randomly split into two equivalent subsamples). Item retention was based on multiple criteria detailed in point 2.2. Based on the criteria detailed in point 2.2., four items were removed: question 1, 18, 30, and 31. Out of the 32 original items, 28 were retained for subsequent analyses.

Table 3 - Exploratory factor analysis

Item	Factor								Unicity
	Course	Scheme	Usefulness	Orientation	Support	Social	Engagement	Belonging	
7	**0.795**	0.075	0.052	0.088	0.104	0.139	0.073	-0.002	0.31625
9	**0.653**	0.176	0.034	0.139	0.144	0.131	0.118	0.053	0.46789
4	**0.641**	0.244	0.146	0.159	0.062	0.118	0.237	0.155	0.38484
13	**0.526**	0.272	0.197	0.114	0.041	0.101	0.132	0.098	0.55821
29	0.159	**0.595**	0.161	0.057	0.196	0.168	0.158	0.204	0.45840
28	0.257	**0.522**	0.117	0.178	0.161	0.138	0.041	0.163	0.31269
3	0.264	**0.473**	0.217	0.252	0.224	0.046	0.161	0.304	0.35523
32	0.247	**0.446**	0.122	0.201	0.173	0.111	0.107	0.275	0.49099
19	0.163	0.112	**0.759**	0.201	0.117	0.071	0.164	0.177	0.26822
17	0.370	0.159	**0.607**	0.198	0.154	0.088	0.149	0.196	0.33875
27	0.258	0.214	**0.546**	0.164	0.168	0.103	0.155	0.358	0.37195
20	0.157	0.231	**0.475**	0.156	0.169	0.006	0.223	0.072	0.58927
23	0.128	0.198	0.166	**0.630**	0.134	0.166	0.155	0.138	0.43145
24	0.100	0.359	0.259	**0.501**	0.085	0.127	0.103	0.151	0.40471
21	0.162	0.228	0.202	**0.438**	0.118	0.133	0.132	0.028	0.50803
8	0.244	0.320	0.196	0.093	**0.560**	0.098	0.166	0.141	0.42007
15	0.245	0.148	0.324	0.096	**0.546**	0.152	0.096	0.120	0.38344
6	0.342	0.357	0.171	0.074	**0.532**	0.063	0.122	0.163	0.31331
10	0.282	0.379	0.154	0.081	**0.475**	0.119	0.366	0.054	0.36980
16	0.184	0.092	0.157	0.066	0.075	**0.932**	0.040	0.040	0.05058
2	0.161	0.133	0.085	0.056	0.015	**0.548**	0.080	0.103	0.62799
11	0.270	0.246	0.207	0.255	0.073	0.162	**0.634**	0.109	0.31329
12	0.211	0.254	0.209	0.050	0.089	0.126	**0.446**	0.076	0.61706
5	0.206	0.204	0.268	0.125	0.086	0.381	**0.431**	0.161	0.46441
14	0.298	0.260	0.361	0.110	0.078	0.306	**0.405**	0.144	0.41764
25	0.184	0.093	0.114	0.085	-0.008	0.075	0.067	**0.848**	0.20762
26	0.163	0.069	0.234	0.055	0.086	0.107	0.041	**0.600**	0.52991
22	0.150	0.173	0.029	0.162	0.297	0.197	0.101	**0.600**	0.42356

Note: n = 1435. The extraction method was 'maximum likelihood' factoring with an oblique (oblimin with Kaiser Normalization) rotation. Factor loadings above .30 are in bold.

Table 3 displays the results of the exploratory factor analysis performed on the retained items. Eight factors emerged, accounting for 58.54% of the total variance. These factors are:

1. Course: this factor evaluates the extent to which participation in the peer-learning scheme enhances students' understanding of the targeted course, including clarification of difficult concepts, perceived

relevance of the material, and better comprehension of the instructor's expectations.

2. Scheme: this factor reflects students' overall appraisal of the peer-learning program, including satisfaction with the experience, perceived value of the method, and willingness to recommend the scheme to other first-year students.
3. Usefulness: this factor assesses the perceived practical utility of the program in supporting students' study practices, particularly through the acquisition of concrete strategies related to studying, organizing course material, and preparing for examinations.
4. Orientation: this factor captures the extent to which participation in the program reassures students about their choice of studies and helps them navigate the transition to university life, including managing uncertainties related to their academic trajectory.
5. Support: this factor reflects the perceived academic and emotional support provided by the program, including increased confidence, reduced stress related to the course, and improved capacity to manage academic workload.
6. Social: this factor assesses the extent to which the program fosters peer connections and informal interactions among students, thereby strengthening social integration within the learning environment.
7. Engagement: this factor captures the degree to which the program stimulates active involvement in academic activities, including increased responsibility toward learning, motivation to attend lectures, and perseverance despite academic difficulties.
8. Belonging: this factor reflects the extent to which participation in the program strengthens students' feeling of being part of the institution and reduces perceptions of anonymity within the university context.

Table 4 presents the inter-factor correlations, which ranged from .19 to .64, indicating sufficient coherence among dimensions while suggesting that no factor was redundant with another.

Table 4 - Inter-factor correlations.

	1	2	3	4	5	6	7	8
1	-	0.63800	0.56761	0.45377	0.40980	0.54586	0.30840	0.48547
2		-	0.30603	0.24089	0.34970	0.47634	0.36682	0.41300
3			-	0.48076	0.28783	0.53002	0.24184	0.53294
4				-	0.36896	0.52431	0.43662	0.34247
5					-	0.30363	0.19330	0.20791
6						-	0.37501	0.49703
7							-	0.19941
8								-

3.4. Internal consistency

Cronbach's alphas and McDonald's omegas were calculated for each dimension, they vary between [.71; .85] and [.72; .85], which attests for solid internal consistency for each factor (Table 5).

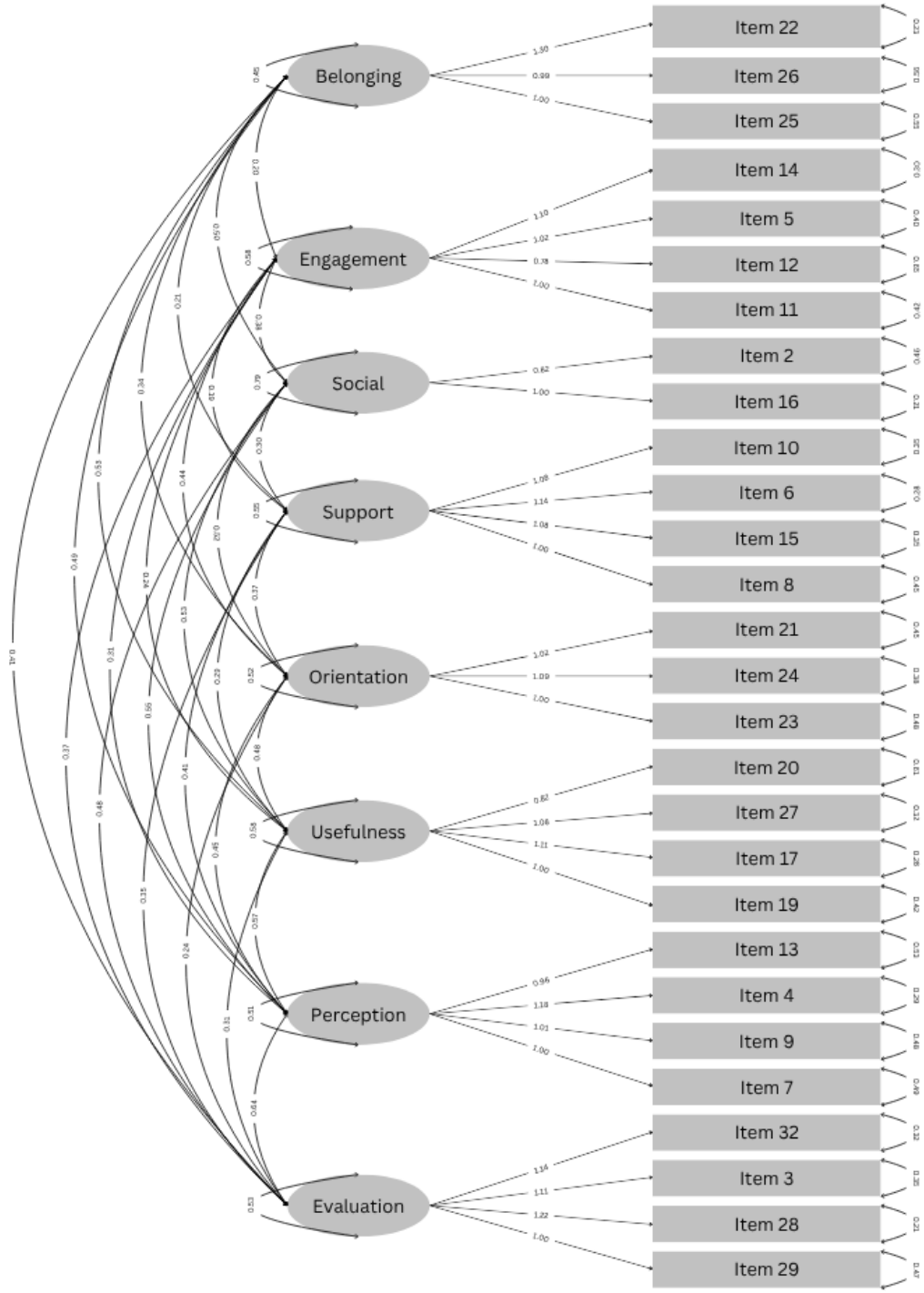
Table 5 - Internal consistency

Factor	Cronbach's *α*	McDonald's *ω*	*M*	*STD*
1 Course	.79	.80	3.88	0.80
2 Scheme	.84	.84	4.31	0.76
3 Usefulness	.81	.82	3.80	0.83
4 Orientation	.77	.78	3.48	0.88
5 Support	.85	.85	3.63	0.87
6 Social	.71	.72	3.23	1.00
7 Engagement	.80	.81	3.66	0.80
8 Belonging	.71	.72	3.51	0.83

3.5. Confirmatory factor analysis

The confirmatory factor analysis was conducted on the second half of the sample (n ≈ 718), testing the eight-factor model suggested by the EFA. The model showed a significant $\chi^2(295) = 746.3$, $p < .001$, which is expected given the large sample size. Fit indices indicated good model fit: $\chi^2/df = 2.52$, CFI = .95, TLI = .95, SRMR = .04, and RMSEA = .057 (90% CI [.050, .064]). These values meet conventional thresholds (CFI/TLI ≥ .95, RMSEA ≤ .06, SRMR ≤ .08), supporting the adequacy of the proposed structure.

Figure 1 - Confirmatory factor analysis model.



Note: Rectangles are measured variables, and the large circles are the latent construct. Factor loadings are standardized.

3.6. Programs comparison

Due to the specificities of each program, SI-PASS and PEPPS participants should logically report higher scores on different factors. Table 6 displays the means, standard deviations, t-test results, *p*-values, and effect sizes for both programs on each factor. Results show significant differences on the following dimensions: course (advantage: SI-PASS), scheme (advantage: SI-PASS), usefulness (advantage: PEPPS), orientation (advantage: PEPPS), and belonging (advantage: SI-PASS). No significant differences were observed on the support, social, and engagement dimensions.

Table 6 - Comparison of both programs on the 8 dimensions (M, STD, t, p, d).

Dimension	SI-PASS		PEPPS		*t*	*p*	Cohen's *d*
	M	*STD*	*M*	*STD*			
Course	4.13	0.71	3.64	0.80	12.80	<.001***	0.65
Scheme	4.38	0.76	4.21	0.80	4.17	<.001***	0.21
Usefulness	3.69	0.82	3.90	0.83	4.99	<.001***	0.25
Orientation	3.26	0.85	3.61	0.88	7.99	<.001***	0.41
Support	3.64	0.85	3.62	0.88	0.54	0.59	0.03
Social	3.36	0.98	3.29	1.11	1.19	0.23	0.06
Engagement	3.67	0.76	3.66	0.83	0.26	0.80	0.01
Belonging	3.59	0.78	3.44	0.87	3.54	<.001***	0.18

4. Discussion

4.1. The PEERS-Q

A validated instrument for assessing the perceived quality of peer-learning programs has long been missing from the field. To date, many evaluations have relied either on observation grids (*e.g.*, Pêgo et al., 2013) or on *ad hoc* self-reported questionnaires whose psychometric properties were seldom documented (Devlin et al., 2012; Longfellow et al., 2008). In this context, developing a structured and statistically validated scale helps address a methodological gap and responds to broader calls for more rigorous and comparable evaluation tools in student-support initiatives (Malm et al., 2012; Stigmar, 2016).

Beyond the need for standardisation, the present analyses also contribute to empirical clarity on the multidimensional nature of students' experiences in peer-learning schemes. The eight constructs identified through exploratory factor analysis correspond to mechanisms repeatedly described in the literature: academic understanding and study strategies (Topping, 2005), social integration and peer support (Collings et al., 2014), confidence and academic self-efficacy (Capstick et al., 2004), and institutional belonging (Tinto, 1997). Taken together, these dimensions reflect both cognitive and psychosocial processes that are widely recognised as jointly shaping engagement and persistence in higher education. The resulting factor structure therefore appears theoretically coherent and compatible with established frameworks of student transition and academic support. Finally, the application of the scale to the two programs suggests that both SI-PASS and PEPPS contribute (albeit with different intensities) to addressing these needs and generating these perceived benefits.

From a psychometric perspective, the PEERS-Q shows satisfactory internal consistency across dimensions and acceptable inter-factor correlations, suggesting that while the constructs are related, they are not redundant. Such a pattern is generally expected in multidimensional instruments measuring complex educational experiences, where moderately correlated factors reflect distinct but interdependent aspects of the same phenomenon (DeVellis & Thorpe, 2022; Fabrigar & Wegener, 2012). This supports the idea that peer-learning quality cannot be reduced to a single global perception but instead involves several complementary experiential components. The resulting structure thus offers both conceptual richness and practical interpretability, allowing researchers to target specific strengths and weaknesses of peer-learning schemes.

The PEERS-Q was also designed to be flexible. Researchers may use the full instrument or select only the dimensions relevant to their program, a practice commonly recommended in scale development when instruments are intended for use across heterogeneous educational contexts (DeVellis & Thorpe, 2022; Worthington & Whittaker, 2006). For instance, when evaluating schemes not embedded in an institutional strategy, the dimension related to institutional programme identity may reasonably be omitted. This modularity increases the applicability of the scale across heterogeneous peer-learning initiatives, ranging from structured academic support programs such as SI-PASS to broader transition-support schemes such as buddy or mentoring programs, which are known to differ substantially in objectives and pedagogical focus (Keeling, 2014; Kift et al., 2010).

Regarding differences between the two ULiège schemes, the results primarily support the external (known-groups) validity of the PEERS-Q. The fact that the scale confirms theoretically anticipated differences between two

structurally distinct peer-learning formats suggests that it does not merely capture generic satisfaction but meaningfully reflects pedagogical variation. In this sense, its discriminative capacity supports its potential applicability beyond the local context in which it was developed.

An additional important observation is that all mean scores are above the midpoint (2.5/5) for both SI-PASS and PEPPS. Overall, the instrument captures the generally positive perceptions of peer-learning experiences, consistent with prior findings on high student satisfaction and perceived benefit in peer-learning environments (Capstick, 2004; Smith et al., 2007).

Lastly, the fact that the scale confirms theoretically anticipated differences between two structurally distinct peer-learning formats suggests that it does not merely capture generic satisfaction but reflects the specific aims and design of each program. As expected, SI-PASS, designed around mastery of specific course content, scores higher on Course; whereas PEPPS, focused on broader socio-academic transition, scores higher on Usefulness and Orientation.

The higher score observed for *Belonging* in SI-PASS, however, is less immediately intuitive and therefore deserves further consideration. One possible explanation lies in the nature of the activities themselves. SI-PASS sessions are structured around collaborative work on course material, meaning that students actively engage in a shared academic task. This joint problem-solving dynamic may promote a stronger feeling of participating in a collective intellectual endeavour, whereas PEPPS meetings rely more on discussion and reflection about the university experience. In this sense, *doing* academic work together may contribute more directly to the emergence of a shared group identity.

A second explanation relates to the distinction between social and academic integration described in Tinto's model of student persistence (Tinto, 1997). While both forms of integration are important for student retention, academic integration (developed through engagement with disciplinary content and academic practices) may play a particularly central role in shaping students' sense of belonging within the institution. If belonging is partly rooted in the perception of being part of an intellectual community, then the stronger course-centred structure of SI-PASS could logically contribute to higher *Belonging* scores.

Taken together, these results suggest that the scale does not merely capture general satisfaction but is sensitive to the pedagogical orientation of different peer-learning models. The fact that it detects such theoretically interpretable differences between schemes reinforces both its construct validity and its capacity to capture meaningful variation between peer-learning formats, supporting its potential applicability beyond the local context in which it was developed. While no direct validation against academic performance indicators was conducted in the present study, this known-groups approach represents an established form of external validation in educational measurement when no gold-standard instrument is available (Messick, 1995). Future research could further strengthen validity evidence by examining associations between scale scores and objective indicators of student success or persistence.

4.2. Limitations

The PEERS-Q was created using a sample of first-year students from a single university across three consecutive academic years. Because factor-analytic solutions are highly sample-dependent, one may legitimately question whether the structure identified here would replicate in populations with different

characteristics or in other institutional contexts (Fabrigar et al., 1999; Floyd & Widaman, 1995). For instance, would second-year students respond similarly to items related to usefulness or sense of belonging, or would greater familiarity with university norms reduce the salience of transition-related dimensions? Such concerns are consistent with evidence that factor structures may vary across educational stages and institutional cultures (Putnick & Bornstein, 2016).

At the same time, scale development guidelines emphasise the value of beginning with a theoretically coherent and relatively homogeneous population so that early factor solutions reflect core psychological constructs rather than uncontrolled demographic variation (DeVellis & Thorpe, 2022; Worthington & Whittaker, 2006). In this sense, the standardisation of the sample and the stability of implementation conditions across three years strengthen the internal coherence of the present model and provide a sound basis for future multi-group validation studies.

4.3. Perspectives

Directly linked to these limitations, the PEERS-Q should now be tested beyond the original context to establish its psychometric robustness. Cross-validation in independent samples is an essential step in scale development (DeVellis & Thorpe, 2022; Fabrigar & Wegener, 2012), and applying the instrument to students from different years, faculties, and institutions would allow researchers to verify the stability of the eight-factor structure. Translation and cultural adaptation would further enable testing of measurement invariance across linguistic and institutional settings, which is crucial for international comparative research (Putnick & Bornstein, 2016).

In addition, the diversity of peer-learning schemes suggests that additional dimensions may become relevant when addressing contexts or pedagogical goals not captured by the present factors. Instrument refinement and extension are common in educational measurement as new constructs emerge (Zumbo & Chan, 2014). Nevertheless, maintaining a relatively short scale remains essential, as longer questionnaires are associated with higher dropout rates and lower data quality (Galesic & Bosnjak, 2009). This tendency is already visible in Table 2, where missing data accumulate toward the end of the instrument.

Finally, establishing a shared measurement tool represents an opportunity for the peer-learning field more broadly. Standardized instruments facilitate comparison across institutions and program types, enabling cumulative evidence building and theory refinement (Borsa et al., 2012). If adopted more widely, the PEERS-Q could function as a common reference framework for integrating self-report data, observational measures, and performance indicators, thereby strengthening both the methodological and theoretical foundations of peer-led learning research.

5. Conclusion

The analyses conducted on data collected from both SI-PASS and PEPPS programs over three academic years (September 2019 to June 2022) across ten faculties at the University of Liège led to the development of a 28-item scale assessing peer-learning quality across eight dimensions: scheme evaluation, course perception, usefulness, orientation confirmation, support, social integration, engagement, and sense of belonging. This instrument provides a structured and psychometrically supported framework for capturing the multidimensional nature of students' experiences in peer-learning schemes.

Beyond scale construction, the application of the PEERS-Q to two distinct peer-learning models offered additional evidence of its discriminative capacity. Significant differences emerged on several theoretically relevant dimensions, including course perception, scheme evaluation, usefulness, orientation confirmation, support, and sense of belonging. These contrasts reflect the pedagogical orientations of each program rather than differences in overall quality, as mean scores remained above the scale midpoint across all dimensions for both schemes. In this sense, the results support both the construct validity of the scale and its potential for meaningful program-level comparisons.

Taken together, this study contributes a much-needed standardized measurement tool to the peer-learning literature and demonstrates its practical relevance for evaluating heterogeneous support schemes within and across institutions. By enabling systematic comparison of program profiles rather than relying solely on satisfaction indicators or performance outcomes, the PEERS-Q opens new avenues for research on how different peer-learning designs support student transition, engagement, and academic development.

6. Appendices

1. Original Items

1. En dehors des rencontres « officielles », il m'est arrivé de discuter (oralement, par mél, par les réseaux sociaux, etc.) avec le parrain/la marraine de mon groupe.
2. En dehors des rencontres « officielles », il m'est arrivé de discuter (oralement, par mél, par les réseaux sociaux, etc.) avec d'autres membres de mon groupe.
3. Au terme du dispositif de parrainage, je me sens un·e participant·e heureux·se.
4. Grâce au parrainage, j'ai mieux compris l'intérêt du cours particulièrement travaillé.
5. Grâce au parrainage, j'ai eu envie de m'engager davantage le cours particulièrement travaillé.
6. Grâce au parrainage, j'ai abordé le cours particulièrement travaillé avec plus de confiance.
7. Le parrainage m'a donné des occasions de clarifier des concepts difficiles liés au cours particulièrement travaillé.
8. Le parrainage a diminué mon stress par rapport au cours particulièrement travaillé.
9. Le parrainage m'a fourni de nombreuses occasions d'apprentissage au sujet du cours particulièrement travaillé.
10. Grâce au parrainage, j'ai pu mieux gérer la charge de travail liée au cours particulièrement travaillé.
11. Grâce au parrainage, j'ai renforcé mon sentiment de responsabilité par rapport au cours particulièrement travaillé.
12. Le parrainage m'a incité à assister aux séances présentielles ou à distance de l'enseignant du cours particulièrement travaillé.
13. Le parrainage m'a permis de mieux comprendre les exigences de l'enseignant du cours particulièrement travaillé.
14. Le parrainage a renforcé ma persévérance dans le cours particulièrement travaillé, malgré les difficultés.
15. Le parrainage va contribuer à ma réussite à l'examen du cours particulièrement travaillé.

16. Le parrainage m'a permis de développer des relations avec d'autres étudiants.
17. Le parrainage m'a apporté des informations utiles pour travailler mes cours.
18. Grâce au parrainage, au moins un·e étudiant·e de première que je connais a renoncé à abandonner ses études.
19. Le parrainage m'a apporté des informations utiles sur la manière de préparer mes examens.
20. Le parrainage m'a apporté des informations utiles pour créer le plan ou la table des matières d'un cours.
21. Le parrainage m'a aidé·e à négocier la transition de l'enseignement secondaire vers l'enseignement supérieur.
22. Le parrainage a développé mon sentiment d'appartenance à l'Université de Liège.
23. Le parrainage m'a conforté·e dans le choix de mes études.
24. Le parrainage m'a aidé·e à gérer des inquiétudes relatives à la vie universitaire.
25. Le parrainage m'a montré que je fais partie d'une université qui se soucie de ma réussite.
26. Grâce au parrainage, j'ai moins l'impression de n'être, à l'université, qu'un « numéro ».
27. Les rencontres de parrainage ont été plus utiles que ce à quoi je m'attendais.
28. En tant que participant·e, j'ai été content·e de mon/ma responsable de groupe.
29. Mon expérience du parrainage m'a fait voir celui-ci comme une méthode intéressante pour apprendre avec d'autres.
30. J'ai trouvé intéressant de rencontrer un·e étudiant·e qui a réussi sa première année d'université.
31. Après avoir vécu l'expérience comme participant·e cette année, je me vois bien responsable d'un groupe de parrainage l'an prochain.
32. Je recommanderai à d'autres étudiant·e·s de première année de participer au projet de parrainage.

2. Final Scale - French Version

Facteur 1 : Cours

1. Le parrainage m'a donné des occasions de clarifier des concepts difficiles liés au cours particulièrement travaillé.
2. Grâce au parrainage, j'ai mieux compris l'intérêt du cours particulièrement travaillé.
3. Le parrainage m'a fourni de nombreuses occasions d'apprentissage au sujet du cours particulièrement travaillé.
4. Le parrainage m'a permis de mieux comprendre les exigences de l'enseignant du cours particulièrement travaillé.

Facteur 2 : Programme

1. Au terme du dispositif de parrainage, je me sens un·e participant·e heureux·se.
2. En tant que participant·e, j'ai été content·e de mon/ma responsable de groupe.
3. Je recommanderai à d'autres étudiant·e·s de première année de participer au projet de parrainage.
4. Mon expérience du parrainage m'a fait voir celui-ci comme une méthode intéressante pour apprendre avec d'autres.

Facteur 3 : Utilité

1. Le parrainage m'a apporté des informations utiles sur la manière de préparer mes examens.
2. Le parrainage m'a apporté des informations utiles pour travailler mes cours.
3. Le parrainage m'a apporté des informations utiles pour créer le plan ou la table des matières d'un cours.
4. Les rencontres de parrainage ont été plus utiles que ce à quoi je m'attendais.

Facteur 4 : Orientation

1. Le parrainage m'a conforté·e dans le choix de mes études.
2. Le parrainage m'a aidé·e à gérer des inquiétudes relatives à la vie universitaire.
3. Le parrainage m'a aidé·e à négocier la transition de l'enseignement secondaire vers l'enseignement supérieur.

Facteur 5 : Support

1. Le parrainage va contribuer à ma réussite à l'examen du cours particulièrement travaillé.
2. Le parrainage a diminué mon stress par rapport au cours particulièrement travaillé.
3. Grâce au parrainage, j'ai abordé le cours particulièrement travaillé avec plus de confiance.
4. Grâce au parrainage, j'ai pu mieux gérer la charge de travail liée au cours particulièrement travaillé.

Facteur 6 : Social

1. Le parrainage m'a permis de développer des relations avec d'autres étudiants.
2. En dehors des rencontres « officielles », il m'est arrivé de discuter (oralement, par mél, par les réseaux sociaux, etc.) avec d'autres membres de mon groupe.

Facteur 7 : Engagement

1. Grâce au parrainage, j'ai renforcé mon sentiment de responsabilité par rapport au cours particulièrement travaillé.
2. Le parrainage m'a incité à assister aux séances présentielles ou à distance de l'enseignant du cours particulièrement travaillé.
3. Grâce au parrainage, j'ai eu envie de m'engager davantage le cours particulièrement travaillé.
4. Le parrainage a renforcé ma persévérance dans le cours particulièrement travaillé, malgré les difficultés.

Facteur 8 : Appartenance

1. Le parrainage m'a montré que je fais partie d'une université qui se soucie de ma réussite.
2. Grâce au parrainage, j'ai moins l'impression de n'être, à l'université, qu'un « numéro ».
3. Le parrainage a développé mon sentiment d'appartenance à l'Université de Liège.

3. Final Scale - English Version

Factor 1: Course

1. The peer-led program provided me with opportunities to clarify difficult concepts related to the specific course I focused on.
2. Thanks to the peer-led program, I better understood the importance of the specific course I focused on.
3. The peer-led program provided me with numerous learning opportunities regarding the specific course I focused on.
4. The peer-led program helped me better understand the expectations of the instructor for the specific course I focused on.

Factor 2: Scheme

1. At the end of the peer-led program, I feel happy.
2. As a participant, I was satisfied with my group leader.
3. I would recommend first-year students to participate in the peer-led program.
4. My experience with the peer-led program led me to see it as an interesting method for learning with others.

Factor 3: Usefulness

1. The peer-led program provided me with useful information on how to prepare for my exams.
2. The peer-led program provided me with useful information for studying my courses.
3. The peer-led program provided me with useful information for creating the outline or table of contents of a course.
4. The peer-led sessions were more useful than I expected.

Factor 4: Orientation

1. The peer-led program reassured me about my choice of studies.
2. The peer-led program helped me manage concerns related to university life.
3. The peer-led program helped me transition from secondary education to higher education.

Factor 5: Support

1. The peer-led program will contribute to my success in the specific course I focused on.
2. The peer-led program reduced my stress regarding the specific course I focused on.
3. Thanks to the peer-led program, I approached the specific course I focused on with more confidence.
4. Thanks to the peer-led program, I was able to better manage the workload related to the specific course I focused on.

Factor 6: Social

1. The peer-led program allowed me to develop relationships with other students.
2. Outside of the "official" meetings, I occasionally interacted (verbally, via email, on social media, etc.) with other members of my group.

Factor 7: Engagement

1. Thanks to the peer-led program, I strengthened my sense of responsibility regarding the specific course I focused on.
2. The peer-led program encouraged me to attend in-person or online sessions with the instructor of the specific course I focused on.
3. Thanks to the peer-led program, I felt more motivated to engage with the specific course I focused on.
4. The peer-led program strengthened my perseverance in the specific course I focused on, despite difficulties.

Factor 8: Belonging

1. The peer-led program showed me that I am part of a university that cares about my success.
2. Thanks to the peer-led program, I feel less like "just a number" at the university.
3. The peer-led program enhanced my sense of belonging to the University of Liège.

Section 3 : General Discussion

Discussion

"Ainsi, bien qu'imparfaite et avec toutes les précautions que cette imperfection requiert, la cartographie de l'aide à la réussite (...) permet d'instruire la réflexion de l'instance coordinatrice et des acteurs de l'aide à la réussite, de porter un discours sur l'aide à la réussite telle qu'elle est et de ce qui pourrait être amélioré. De ce fait, elle est un outil de choix au service d'une aide à la réussite optimisée, dont on souhaite qu'elle soit l'affaire de tous." (Leduc et al., 2026, p. 25)[1]

The dissertation starts from a deceptively simple yet demanding question: how is SI-PASS implemented at the University of Liège? How does it compare to PEPPS? Does it work? If so, how and why? To answer, the thesis unpacks the system layer by layer: pedagogical foundations, context and metrics, outcomes and issues of implementation fidelity, cognitive processes *in situ*, and the human and measurement infrastructure that enables programs to continue, learn and evolve over time.

This discussion unfolds in five steps. First, it synthesizes the findings from the seven empirical studies presented in the experimental section ("Studies overview and main findings"). Second, it connects selected salient results to concrete challenges encountered in the day-to-day management of the schemes ("Local challenges"). Third, it situates the local findings in relation to relevant benchmarks drawn from peer-learning research ("Broader implications"). Fourth, it critically examines the limitations associated with each dimension of the multimodal approach adopted in the dissertation. Finally, it derives a set of

[1] Thus, although imperfect and with all the caveats that this imperfection requires, the mapping of support for academic success (…) allows the coordinating body and those involved in supporting academic success to reflect on their current state and what could be improved. As such, it is a valuable tool for optimizing support for academic success, which we hope will become everyone's responsibility.

actionable recommendations from the overall findings of the thesis. Across these five parts, the analysis remains in dialogue with the existing literature and highlights directions for future research where appropriate.

1. Studies overview and main findings

1.1. Studies 1 & 2: The ecology of participation and perception

The first step of this thesis was to establish metrics for the two peer-led programs run through the years at ULiège. Across faculties and semesters, study 1 shows that interest is real (roughly half of students try SI-PASS at least once), but sustained attendance depends on exposure and logistics (protected time slots, timetable clashes, clear information). This exposure logic is not incidental, it is a central moderator of impact in SI research (Malm et al., 2011). Effects typically emerge beyond attendance thresholds (often about five to eight sessions here), and they vary by discipline and cohort. That pattern aligns with recent multivariable analyses showing that grades, pass rates, and reenrolment probabilities rise monotonically with SI attendance even after adjusting for observed covariates (Allen et al., 2021; Ning & Downing, 2010); and with meta-analytic syntheses reporting positive average effects for formal peer learning while warning about heterogeneity and design sensitivity (Bengesai et al., 2023; Dawson et al., 2014). Together, these results support an outcomes-monitoring stance that treats participation as graded, not binary, and that reports exposure-response rather than "ever *vs*. never".

Study 2 replicates the same investigation for the PEPPS program, a home-made creation, thereby providing a basis for comparison. Students primarily cite academic motives (clarifying course content, staying on track), yet consistently report social benefits (a supportive atmosphere, reduced isolation). This profile is consistent with theories of student success in which belonging and engagement support persistence, especially early in the

transition to university (Korpershoek et al., 2020; Pittman & Richmond, 2008; Tinto, 2012). Framed this way, SI-PASS and PEPPS sit at different points on the socioacademic spectrum: SI-PASS is mastery-oriented with social side-benefits, while PEPPS is social-integration-first with potential academic spillovers. That distinction matters for messaging, design, and evaluation criteria.

1.2. Study 3: The trial by fire

The randomized controlled trial in a high-risk statistics course did not detect a main effect of being assigned to SI-PASS on exam performance or socio-affective outcomes unless attendance intensity is considered (Puttaert et al., 2025). Two interpretive lenses are crucial.

First, design sensitivity and effect size realism: field-based education interventions often yield small average effects by Cohen's conventional benchmarks. What matters is whether an effect is detectable given the actual exposure, measurement precision, and sample size (Kraft, 2020). A null in the presence of low or variable exposure is epistemically weaker than a null under assured, high-fidelity exposure. Second, process ambiguity: without credible evidence of how sessions were enacted, impact data alone cannot settle the debate of "model *vs*. implementation" cause. This is a recurring lesson from implementation science: outcomes and implementation fidelity covary and interpreting the former without the latter risks category mistakes (Carroll et al., 2007; Durlak & DuPre, 2008). Therefore, the trial raises precisely the follow-up question: What actually happens in sessions at ULiège?

1.3. Studies 4 & 5 : What happens in session?

The trial raises a structural ambiguity: if no main effect is observed, is this due to limits of the SI-PASS model, or to how the program is enacted locally? To address this question, studies 4 and 5 shift focus from outcomes to process,

examining the cognitive and interactional dynamics that unfolds during sessions themselves.

Study 4 begins by replicating Malm's (2021a) approach, in which students identify the action verbs that characterise their cognitive activity during SI-PASS, mapped to the SOLO taxonomy (Biggs & Tang, 2011). The ULiège replication converges with this prior work: students report engaging in meaning-oriented processing (explaining, reasoning, comparing). Yet, as with all self-report measures of cognitive engagement, these accounts reflect perceived experience, not necessarily what happens in interaction. To move beyond inference, study 4 extends the analysis by coding verbs extracted directly from video data. This shift reveals a more variable landscape: episodes of higher-order reasoning occur, but are interspersed with clarification requests, procedural coordination, and leader-led scaffolding. Cognitive depth therefore appears situational rather than pervasive, dependent on the dynamics of the group and the facilitation choices made moment-to-moment.

Study 5 provides a decisive complement. Through behavioural coding of 41 video-recorded sessions (Observer XT), the study assesses enactment of the four core SI-PASS facilitation technique and 21 guidelines. The pattern is one of moderate fidelity, as these techniques are recognisable but uneven: agenda-setting by students is often abbreviated, speaking time is broadly shared but not consistently used for peer-to-peer explanation, group work is present, and the informal setting format is respected. As Bird notes in leader-training material: *"Breaking people into small groups accomplishes several things: it makes them more accountable, it promotes active processing of material, it encourages participation by everyone. Sounds great, doesn't it? But it is not as simple as it sounds. Most SI leaders quickly learn they are likely to encounter resistance when they ask students in their sessions to break into*

small groups. It turns out that students have other ideas about what an ideal session should be. In students' minds, it would be ideal to simply walk into the session, sit in the back row, not have to say or do anything, and have the SI leader fill their heads with all the information they need to do well in the course. And this will happen…when pigs fly! Until then, the SI leader must find a way to involve SI participants with the material. Cluster groups are a surefire way to do so. The key to making a cluster group work is to be firm. The FIRST time you tell participants to break into smaller groups, you must show resolve. Otherwise you'll encounter resistance each time you ask them to break into groups. Put students into groups." (2019). Leaders thus act as adaptive regulators, negotiating between program intentions and the practical realities of pacing, expectations, and student reassurance.

Taken together, studies 4 and 5 reframe the null result of study 3. Under conditions of partial fidelity and limited sustained attendance, muted or nonsignificant outcome effects are not surprising. This is precisely what implementation theory predicts: impact depends on the activation of core mechanisms, and even small erosions in dosage or fidelity attenuate observable effects (Carroll et al., 2007; Durlak & DuPre, 2008). Methodologically, the turn to video is what makes this diagnosis possible: it preserves temporality, supports repeat inspection, and renders visible micro-interactions (such as the duration of wait-time or the subtlety of redirection) that retrospective accounts systematically miss (Derry et al., 2010). The two studies suggest that the absence of a main effect in study 3 should not be interpreted as evidence against SI-PASS as a model. Rather, it can partly reflect the conditions of its local implementation, and points to where improvement is most likely to yield gains.

1.4. Study 6: Leader motivation, identity, and the role tension of facilitation

Study 6 examines an often-overlooked dimension of peer-learning programs: the leaders themselves. While extensive research exists on benefits for participants (Dawson et al., 2014; Zha et al., 2019), far less attention has been paid to why students choose to become leaders and what they gain from the experience. The interviews conducted in this study highlight motivations that extend beyond simple academic reinforcement: leaders describe SI-PASS as a context for identity building, professional skill development, and the acquisition of relational and communicative competences they transfer into internships, group projects, and later employment opportunities. This aligns with findings in peer-tutoring and near-peer teaching research, which show that the act of facilitating others' learning deepens one's metacognitive awareness and academic self-efficacy (Micari & Pazos, 2020; Stigmar, 2016), in addition, for SI-PASS leaders, to gains in personal mastery of the targeted course (Duran, 2017).

However, study 6 also makes visible a structural tension at the core of SI-PASS facilitation. Leaders are trained to avoid re-teaching and instead prompt reasoning and peer explanation. Yet, under time pressure, uncertainty from students, or expectations that the leader "knows the answer," there is a recurrent drift toward teacher-like explanation which moves the session closer to teacher-led review than to collaborative inquiry. This tension is not a deviation unique to ULiège: it is a well-documented issue in collaborative learning environments, where autonomy and responsibility are distributed but norms of instructional authority remain strong (Ten Cate & Durning, 2007). Thus, the findings do not indicate rejection of SI-PASS principles of facilitation. Rather, leaders actively regulate their facilitation in response to perceived needs: reassurance, efficiency, or clarity. This suggests that leader training should not only transmit techniques, but also explicitly address the

identity negotiation involved in being a peer but also a facilitator. As Chilvers (2013) mentions: *"In PASS leader training at Brighton, there is a great deal of emphasis placed on the role of the leaders as facilitators of the learning process as opposed to reteaching subject material. However this is a fine line to tread, especially when the leaders have experienced the course material themselves, so regular supervision is in place to help leaders to reflect on whether they are getting the right balance. Supplemental Instruction Leaders meet as a group with the Supplemental Instruction Director at least three times during the term for follow-up training, problem-solving, and a collaborative discussion on what techniques work."* In this way, study 6 complements study 5: it explains why fidelity varies. Not because leaders do not know the core techniques, but because they continually arbitrate between ideal practice and real conditions.

1.5. Study 7: Closing the loop

Study 7 brings the dissertation full circle by developing and validating the first standardized scale designed to assess students' perceptions of peer-led learning schemes across several dimensions of program experience. This step responds directly to a limitation highlighted in studies 1 through 6: although participation patterns, implementation fidelity, cognitive processes, and leader perspectives can be described, meaningful comparison and longitudinal improvement require shared measurement standards. Without such tools, each institution evaluates peer-led programs using idiosyncratic surveys, making cross-program or cross-national synthesis extremely difficult (American Educational Research Association, 2011; Kane, 2013).

The PEERS-Q developed in study 7 operationalizes the structural distinction observed throughout this thesis: SI-PASS and PEPPS represent two different models of peer support, shaped by different underlying mechanisms. Whereas

SI-PASS is academically oriented, PEPPS emphasizes social integration, emotional reassurance, and transition into academic life. The validated instrument confirms this differentiation empirically, demonstrating that students experience and value the two programs differently across the dimensions measured. This finding aligns with broader research showing that peer-learning programs vary widely in purpose, and that their effectiveness depends on alignment between program logic and students' needs (Van der Meer & Scott, 2009).

The creation of the scale is theoretically consequential, as it reinforces that peer-learning programs cannot be meaningfully evaluated using a single success criterion such as improved grades. Some schemes aim at performance gains, others aim at belonging, identity security, or persistence; and these outcomes themselves contribute indirectly to academic success (Kahu & Nelson, 2018; Thomas, 2012). The absence of a unified measurement instrument has historically obscured these differences, leading to inconsistent interpretations about whether peer-led schemes work. Study 7 therefore addresses a structural barrier in the literature: the lack of tools to assess what kind of benefit a given program is designed to produce.

Practically, the scale equips higher education institutions with a decision and monitoring tool that can support program selection based on diagnosed student needs (*e.g.*, academic challenge *vs.* transition support), serve as a tool for monitoring program evolution over semesters, enable comparative evaluation across faculties or institutions, and contribute to a shared international evidence base, where effects can finally be aggregated on commensurable terms. Most importantly, it anchors peer-learning evaluation within a cumulative improvement logic: programs can be adjusted, tested, and refined iteratively (Bryk et al., 2015). In this way, study 7 does not merely conclude

the dissertation; it establishes the methodological infrastructure necessary for peer-learning research at ULiège (and beyond) to become systematic, comparable, and developmentally oriented.

2. Local challenges

The dissertation is deliberately structured through a double lens: its seven studies contribute to the international research field while also documenting the concrete conditions under which SI-PASS and PEPPS are organized and sustained at the University of Liège. The results therefore do more than extend existing knowledge about peer learning or point toward abstract design principles: they also illuminate practical implications for governance, promotion, logistics, facilitation support, and program monitoring. What emerges is that the effectiveness of peer-learning schemes at ULiège depends not simply on their formal existence, but on the degree to which the institution creates the practical and symbolic conditions for them to function as intended.

2.1. Organizational conditions of implementation

2.1.1. Promotion of the program

Organizational conditions emerge as a first local challenge. The very access to peer-learning schemes depends not only on student need, but also on the visibility, intelligibility, and institutional salience of the support on offer. This issue is directly connected to the findings of the dissertation: participation varies substantially across faculties (studies 1 and 2), some non-participants report limited awareness or understanding of the schemes, and the conditions of sustained attendance are shaped as much by communication and institutional support as by student motivation alone. At ULiège, promotion is not absent, but it remains unevenly distributed across stakeholders and insufficiently systematized, which means that access to the programs partly

depends on local initiative rather than on a stable university (or faculty)-wide strategy.

At institutional level, both SI-PASS and PEPPS benefit from formal support, most visibly through continued funding and the existence of official university communication channels (ULiège, 2023; 2024). Yet this top-level endorsement does not automatically translate into strong local visibility. The decisive layer appears to be the faculty level, where support varies considerably. In some cases, especially in Applied Sciences, the scheme benefits from explicit and repeated backing by faculty authorities, visible in recruitment messages, follow-up communication, timetable integration, and practical support for room allocation. In other faculties, the programs appear to be tolerated or routinely renewed rather than actively promoted, with little direct involvement from those formally responsible for student-support decisions. This unevenness matters because it shapes not only awareness of the program, but also the symbolic legitimacy granted to it within the local academic culture.

Faculty contacts and program coordinators currently play the most consistent role in operational promotion. In practice, they ensure that students are informed of the scheme, that groups are constituted, and that leaders or buddies can begin their activity. However, this promotional model remains fragile. It depends heavily on individual initiative, is vulnerable to turnover in faculty contacts, and often ends once the initial invitation has been sent. The same can be said of the role of course instructors. Although SI-PASS teachers are formally informed of the presence of the program and encouraged to support it, their degree of visible involvement appears variable (Huang et al., 2013). This variability may matter all the more because some studies suggest that academic staff can hold doubtful or even hostile views toward PASS schemes,

notably when they worry about the academic quality of sessions or about the risk that leaders may end up teaching course content inaccurately (Longfellow et al., 2008). At the same time, the literature also suggests that regular debriefs and observations can help reassure academic staff about these concerns by making leader practices more visible and more accountable: *"Similarly, we have found some academic staff have concerns about leaders teaching course material and potentially being wrong. The regular debriefs and observations that leaders have with PASS Supervisors has provided reassurance to academic staff with this. »* (Chilvers, 2013). Yet local experience suggests that when instructors explicitly endorse the program, mention it repeatedly, or interact with leaders, the program gains both legitimacy and traction. In that sense, promotion at ULiège should not be understood merely as initial advertising, but as a distributed and continuous process of institutional recognition.

All promotional efforts remain essential, as attendance continues to be the "mother of all battles" for student-support interventions (Plumat et al., 2012). Zero-attendance sessions represent one of the main operational nightmares of such schemes and a particular source of stress for leaders, buddies, and supervisors alike. Leaders and buddies may easily internalize these situations as personal failure, even though responsibility rarely lies with them alone, as the systemic perspective developed throughout this dissertation repeatedly suggests. From the supervisors' standpoint, these situations also generate a disproportionate investment of time relative to the broader coordination of more than 200 leaders and buddies. Individual meetings must be arranged with the concerned leader, follow-up actions monitored, and strategies implemented in an attempt to re-engage at least one participant. When this first level of intervention proves insufficient, the faculty liaison may need to step in and, in rarer cases, faculty authorities themselves may be consulted. For potential

beneficiaries, attendance gaps represent a clear pedagogical loss. For the university that funds the schemes, they also imply an incomplete return on investment, not to mention the broader responsibility attached to the public resources that ultimately support the leaders and buddies.

2.1.2. Recruitment issues

A related organizational issue concerns leader recruitment and its uneven local configuration across faculties. Overall, ULiège does not appear to face major difficulties in recruiting leaders for either SI-PASS or PEPPS. In some settings, such as Applied Sciences, the program is sufficiently established to attract more candidates than available positions. In others, however, different forms of imbalance emerge: recurrent reliance on the same leaders over many consecutive semesters, recruitment from more advanced cohorts whose distance from the targeted course experience may be greater, or, in the case of PEPPS, cohorts of buddies that may exceed actual participation needs. These patterns suggest that the local issue is not simply one of recruitment volume, but of recruitment fit: ensuring that the number, profile, and renewal of leaders remain aligned with the pedagogical logic and actual scale of the scheme in each faculty. In this sense, recruitment should be understood not only as an administrative prerequisite, but as part of the broader organizational calibration of peer-learning provision.

A further, often less visible, stakeholder in recruitment and programme functioning is the administration. Given the limited time the supervisor can devote to programme coordination, contractual and payment matters cannot fall within his direct responsibilities. Queries from leaders regarding contracts, remuneration, or payment schedules are therefore systematically redirected to the administrative officer in charge. Yet these procedures are not neutral. The way contracts are drafted and payments are scheduled may influence leaders'

and buddies' satisfaction, as well as more subtle motivational factors linked to institutional recognition and engagement over time. Administrative arrangements may also shape how the schemes are interpreted and managed.

From the perspective of administrative services, programme-related tasks may be experienced less as a core institutional mission than as an additional layer of workload. In such cases, the allocated budget may come to be treated primarily as a resource to distribute, rather than as part of a pedagogically calibrated support system whose operation should remain sensitive to participation patterns and contractual obligations. Local experience suggests that this can generate friction, for example when programme management seeks to link final payment to the completion of required tasks such as the exit survey, which is formally included in leaders' contractual commitments. At the same time, progress has been made. Administration and programme management now appear more aligned on certain key points, notably the compulsory nature of initial training. This evolution is important because it illustrates a broader principle already visible throughout this dissertation: coherent programme governance depends on the extent to which all stakeholders, including administrative services (Carroll VanDerWerf, 2019), faculty contacts, and pedagogical supervisors, act in the same direction.

2.1.3. Official recognition of leaders and buddies

A further organizational implication concerns the gap that may exist between the developmental value of the leader role and the degree to which this value is institutionally recognized. Study 6 indicates that leadership experience can enrich students' broader profile of skills and dispositions. Yet this potential can only be made visible in a meaningful way if faculties or the university already maintain a coherent policy for recognizing extracurricular and co-curricular competences. Otherwise, formal attestations or badges risk

remaining largely symbolic. The issue at stake is therefore broader than recruitment: it concerns whether ULiège is prepared to acknowledge peer-learning leadership as a legitimate component of student development and employability.

2.1.4. Group size ambiguities

Leaders themselves also contribute to promotion, but here too the logic is mixed. They introduce the scheme in class, send repeated invitations, and are expected to maintain contact with all members of their group, including those who never attend (European Centre for SI-PASS, 2018). This promotional role can, in fact, be much more specific than a simple reminder that sessions exist. At the University of Gothenburg, SI-PASS manual states that: "*Pre-advertising agenda items for SI-PASS sessions is crucial. Contrary to intuition, it looks as if this is most successful (in attracting large numbers of clients, and then having a session they say is good) if: The topic is as specific as possible (e.g. not "the cognitive psychology module" but "memory"; not "memory" but "semantic memory"; not "semantic memory" but the question "How do studies of semantic priming contribute to our understanding of the organisation of semantic memory?") Add something of interest to the item. Not just "Essays" but "How to get an A"; not just "Piaget" but "what's the one thing you need to know about Piaget" or "Why do so many researchers spend their effort trying to prove Piaget wrong?". Setting work to be done before coming to a session often seems to increase attendance, not avoidance (perhaps again because it looks specific, business-like, serious).*" (2017). In other words, leaders are not only facilitators once the session begins; they can also act as effective promoters of attendance when they frame upcoming sessions in concrete, attractive, and academically meaningful ways.

At the same time, once a stable core group has formed, the incentive to expand the group may become less obvious, especially if larger numbers are perceived as potentially diluting the quality of interaction. Beneficiaries likely play an additional role through peer-to-peer communication and word of mouth, but this dimension remains insufficiently documented and would merit further analysis in future work.

These observations suggest that program promotion at ULiège should be treated as a substantive implementation issue rather than as a peripheral communication task. A stronger local strategy would require, first, making the schemes more consistently visible across faculties and stakeholders; second, ensuring that promotion is sustained beyond the initial launch of the program and by a "constellation of promotors" reinforcing each other; and third, aligning the content of the message with the specific logic of each scheme. SI-PASS should be promoted as structured, course-linked collaborative support whose benefits depend on regular attendance and active participation; whereas PEPPS should be framed more explicitly as a transition, belonging, and orientation support. In both cases, promotion should become more systematic, more explicit, and more institutionally shared if the university wishes the programs' affordances to be genuinely accessible to those they are intended to support.

2.2. Logistical conditions of implementation

A second local implication concerns the material and organizational conditions that make peer-learning sessions practically possible. Before any question of pedagogical fidelity, leader adherence to SI-PASS principles, or intrinsic session quality, the programs depend on a more basic condition: the possibility for groups to meet under workable circumstances. Across the local materials mobilized here, difficulties related to schedules and room availability appear

not as marginal inconveniences, but as recurrent implementation barriers capable of undermining attendance, regularity, and overall program coherence.

Time-related constraints are especially consequential (as reported in studies 1 and 2). In several faculties, common slots between leaders and first-year students are difficult to identify and remain vulnerable to frequent timetable changes, additional practical sessions, or clustering of coursework deadlines. As a result, SI-PASS meetings are often pushed into lunchtime slots, which may preserve the informal nature of the scheme but also create a tension for students between taking a break and attending the session. More broadly, fluctuations in student workload appear to compete directly with attendance, as leaders regularly report drops in participation when several assignments or obligations accumulate at the same time. These observations reinforce one of the central findings of the dissertation: if exposure is necessary for benefits to emerge, then all constraints that prevent regular attendance must be treated as core implementation issues rather than secondary logistical details.

Room availability constitutes a second structural difficulty, and faculties are not equally equipped in this respect. In some contexts, such as Applied Sciences and Sciences, suitable rooms with multiple boards are relatively available and administrative support helps leaders secure them. In others, notably Bioengineering and Psychology, leaders may have to search for a space themselves, sometimes with limited access to boards or projection facilities. Yet these features matter for the pedagogy of SI-PASS: collaborative problem-solving and subgroup work are more easily sustained when the physical environment allows students to work in parallel and externalize their reasoning visibly (Ramsay et al., 2017). Material conditions therefore do not

merely affect comfort; they shape the kinds of interaction that can realistically occur during the sessions.

These constraints are also visible in PEPPS, even if they remain less systematically documented. Available feedback suggests that some students are materially prevented from attending because of timetable incompatibilities or practical access difficulties. More generally, the contrast between faculties suggests that structured administrative support can make a substantial difference. Applied Sciences appears here as a particularly informative case, as scheduling assistance, room allocation, and timetable inscription are more actively supported than elsewhere. This does not eliminate all difficulties, but it shows that logistical friction can be reduced when the institution treats these tasks as part of the program infrastructure rather than as problems left to leaders alone.

A further consequence of these constraints is that leaders may be tempted to solve them in ways that partially conflict with the inclusive spirit of the schemes: scheduling meetings outside normal university hours or relocating them to informal spaces when no room is available. Online sessions could in principle offer an alternative in some cases, and this option remains formally authorized. However, local experience suggests that since the COVID period, online formats have largely been perceived as a second-best solution rather than a preferred modality and have rarely been remobilized except exceptionally (studies 1 and 2). The implication is not that flexibility should be ruled out, but that flexible solutions cannot compensate indefinitely for structural weaknesses in the organization of time and space.

Finally, the intended rhythm of SI-PASS itself can be disrupted by timetable design. The program is based on a deliberate alternation between a lecture and

a session devoted to the content of that lecture. In practice, this cadence is frequently disturbed when several course meetings are concentrated within the same week, when sessions must be postponed, or when the targeted course ends earlier than expected in the semester. These disruptions reduce the readability of the program and may generate an accumulation of "catch-up" or broader review sessions toward the end of the term, thereby altering the intended logic of progressive accompaniment. The local implication is therefore straightforward: if peer-learning schemes are to be evaluated fairly, institutions must first ensure that their most basic operating conditions are protected. At ULiège, this means recognizing time and space not as peripheral issues, but as foundational determinants of whether the affordances of SI-PASS and PEPPS can actually be realized.

2.3. Supervisory conditions of implementation

A third local implication concerns the supervisory conditions under which leaders are trained and supported over time. The dissertation repeatedly shows that implementation quality depends not only on the existence of formal principles, but on leaders' capacity to enact them in real situations marked by uncertainty, time pressure, and variable student engagement (studies 4, 5 and 6). In that respect, leader training and follow-up are not peripheral supports: they are part of the implementation conditions that determine whether the pedagogical affordances of SI-PASS can be sustained in practice.

At ULiège, the initial training of SI-PASS leaders is mandatory and devotes substantial attention to a central principle of the program: leaders are not expected to teach, but to facilitate discussion around the content of the most recent course (European Centre for SI-PASS, 2018). The findings of the dissertation suggest that this training likely has real effects, insofar as leaders do not fully dominate session talk and generally remain below a teacher-like

monopolization of the interaction. Although no direct causal demonstration is possible here, this interpretation is broadly compatible with the contrast observed in weaklier structured peer-support formats, where less training appears to be associated with a stronger tendency for buddies to dominate the interaction (Putters, 2025).

At the same time, the results of studies 5 and 6 suggest that initial training alone is not enough to guarantee stable enactment of SI-PASS principles. Local practice at ULiège already includes forms of continued support, notably through reflective activities, mini-cursus sessions, and, in some years, observations by trained supervisors or peers. These initiatives are important because they recognize that facilitation is not a fixed competence acquired in one session, but an evolving practice that requires reflection and recalibration. Yet they also remain limited in intensity and regularity, largely because of resource constraints. In practice, both SI-PASS and PEPPS are coordinated by a single academic staff member whose available time for supervision is necessarily restricted. This means that the issue is not simply pedagogical design, but the institutional capacity to sustain supervision at the level that implementation fidelity may require.

This point becomes clearer when placed in comparative perspective. Available international examples suggest that some universities invest more heavily in follow-up supervision, group debriefing, and recurrent leader support than is currently possible at ULiège (Malm et al., 2024). The same European benchmarking work also indicates that institutions report, on average, 13.3 hours of initial leader training, including 8.8 hours in person, 2.1 hours online synchronous, and 2.4 hours of preparation, homework, or reflection. Relative to this pattern, ULiège appears somewhat below the European average in face-to-face initial training, broadly aligned in the reflective dimension through its

compulsory reflective activity, and less developed in preparatory online modules. This comparison should nevertheless be interpreted cautiously: a longer initial training is not necessarily pedagogically superior if additional hours mainly produce content overload or address elements of limited practical relevance. In the Liège context, the main issue may lie less in the absolute duration of initial training than in the relative fragility of continued support, especially when reflective follow-up, observation, or more intensive feedback become difficult to sustain because of time and staffing constraints.

As a concrete illustration, Chilvers (2013) describes the following supervisory arrangement at the University of Brighton: *"In PASS leader training at Brighton, there is a great deal of emphasis placed on the role of the leaders as facilitators of the learning process as opposed to re-teaching subject material. However, this is a fine line to tread, especially when the leaders have experienced the course material themselves, so regular supervision is in place to help leaders to reflect on whether they are getting the right balance.";* and the SI Leader Manual (2025) specifies that "*The SI Leaders meet as a group with the SI supervisor at least three times during the term for follow-up training, problem-solving, and a collaborative discussion on what techniques work".* Local recommendations calling for early-semester observations, focused coaching on micro-skills, or more regular reflective follow-up are therefore well justified, but they must be read against the practical reality of available personnel and time. In other words, improving implementation quality is not only a matter of knowing what should be done, but of having the supervisory capacity to do it.

A related implication concerns the possible role of more experienced leaders in supporting newer ones. The idea of a second-level peer mentoring structure among leaders appears promising, both as a way of relieving some pressure on

supervision and as a way of capitalizing on experience accumulated within the program. At the same time, such a model would require clear role definition, some degree of formal recognition, and likely contractual adaptation. It therefore represents not an immediate solution, but a plausible avenue for further development, especially if future work can document how similar systems operate elsewhere.

Finally, the local materials also suggest that supervision must be interpreted within the broader ecology of student commitment. Participation in optional follow-up activities remains limited, even when they are explicitly offered, and completion rates for some expected feedback tasks are not total (studies 1 and 2). This should not be read as a moral failure on the part of leaders, but as a reminder that these programs remain person-dependent and unfold within a broader competition of academic, professional, and personal demands. The local implication is therefore double: first, supervision should be strengthened where possible, because it matters for fidelity; second, such strengthening must remain realistic about the time and engagement that can be expected from student leaders within the boundaries of their contracts and their own academic lives.

3. Broader implications

This dissertation also seeks to outline broader implications for the design, evaluation, and positioning of peer-learning schemes in higher education. The following section considers what the findings contribute beyond the local case of ULiège: how they inform international discussions on SI-PASS standards, clarify the complementarity between performance-oriented and socially oriented schemes, refine understanding of who benefits and under what conditions, and highlight the strategic importance of promotion and standardized measurement tools. Taken together, these implications extend the

dissertation from a local evaluation to a more general reflection on how peer-learning programs can be implemented, interpreted, and improved in a rigorous and context-sensitive way.

3.1. International standards and implementation options

A core objective of this dissertation was to situate SI-PASS at the University of Liège within its international frame of reference, rather than evaluating it in isolation. That objective required transversal (across faculties) and longitudinal (across cohorts) monitoring, coupled with process data capable of explaining outcomes. Such an approach responds to repeated calls in the literature to move beyond single-site descriptions and to report standardized indicators (particularly attendance intensity, session organization, and implementation fidelity) so that programs can be interpreted comparatively rather than anecdotally (Bengesai et al., 2023; Carroll et al., 2007; Dawson et al., 2014).

Across both European and North American traditions, SI-PASS is defined by a shared architecture: voluntary small groups attached to challenging courses, structured peer-led facilitation rather than re-teaching, and systematic training and observation to maintain facilitation quality (Arendale, 1994; European Centre for SI-PASS, 2022). Best-practice documents commonly recommend 8 to 12 participants per group, the use of question redirection to peers, wait-time, and checking for understanding. These features align with well-established mechanisms of learning in peer-led environments: cognitive elaboration through explanation, distributed reasoning, and identity-safe participation (O'Donnell & Hmelo-Silver, 2005; Webb et al., 2019). The evidence assembled here places ULiège within the broad pattern reported internationally: participation is substantial, effects depend on exposure, and improvements are conditional rather than universal (Malm et al., 2024). This

aligns with systematic syntheses showing that Supplemental Instruction and formal peer-learning programs are associated on average with higher grades and reduced failure rates on average, but that outcomes vary with exposure, context, and implementation quality (Arendale, 2019; Dawson et al., 2014; Zha et al., 2019). The present work contributes to this literature by adding video-based implementation fidelity, an element repeatedly identified as under-reported yet essential for interpreting impact (Derry et al., 2010).

Beyond these shared principles, international comparison also brings into view a set of implementation parameters on which institutions may differ while still operating within the broader SI-PASS framework. These parameters should not necessarily be understood as departures from the model, but rather as structural options that may shape how the programme is enacted locally. In that sense, they provide useful comparative benchmarks for interpreting the configuration observed at ULiège.

A first parameter concerns leader configuration. At ULiège, SI-PASS sessions are generally facilitated by a single leader, whereas international practice allows both solo and paired facilitation. European guidelines explicitly leave room for both formats, depending on what is locally appropriate (European Centre for SI-PASS, 2022). At the same time, the peer-facilitation literature suggests that co-leadership can reduce cognitive load, support more effective orchestration of group work, and foster more equitable participation, especially in larger groups (Wilson & Varma-Nelson, 2016). Co-facilitation may also reduce the risk of leader overextension and improve adherence to core facilitation techniques under time pressure (Micari & Pazos, 2020). In that sense, the solo configuration currently dominant at ULiège should not be treated as problematic in itself, but it does represent one implementation choice among others, with possible consequences for fidelity and interaction quality.

A second parameter concerns group size and composition (Fredriksson et al., 2020). Internationally, groups of 8 to 12 participants are frequently presented as best practice, although the empirical basis for SI-PASS-specific thresholds remains limited (Gattis, 2002). More broadly, however, robust evidence from small-group and active-learning research shows that participation and conceptual gains tend to decline as groups become too large, unless explicit discussion routines are enacted (Freeman et al., 2014; Springer et al., 1999). For SI-PASS, this matters directly, because the interactional features most predictive of impact (student-to-student talk, wait-time, and elaborated reasoning) are precisely those that tend to erode when groups exceed a manageable size (Webb et al., 2019). The point here is not that ULiège should simply adopt an externally prescribed number, but that group size should be treated as an implementation parameter open to comparative reflection. Structured pilots comparing smaller and larger groups, using video-coded fidelity indicators as primary outcomes, would provide a stronger basis for institutional choice.

A third parameter concerns leader remuneration. At ULiège, leaders are paid, whereas other institutions rely on voluntary arrangements, academic credit, or alternative forms of recognition. Leader interviews in this dissertation indicate that financial compensation was not among the primary motivations for taking on the role, a finding consistent with research showing that leaders often cite identity development, competence-building, and relational growth rather than pay (Malm, 2012; Micari & Pazos, 2020). Still, the effects of compensation on facilitation quality remain under-examined in SI-PASS contexts. Given motivational research pointing both to possible crowding-out effects on intrinsic motivation and to equity concerns associated with unpaid student labour, any change in remuneration policy should be evaluated empirically using the same fidelity indicators identified here (Ryan & Deci, 2020).

Overall, the most credible contemporary syntheses convey a dual message: peer-learning works on average, and it works when it is enacted in ways that activate its mechanisms. The present dissertation advances this shift by pairing outcome data with fine-grained process evidence, thereby enabling interpretation that is cumulative rather than speculative. This is the level of transparency required for meaningful institutional comparison and for moving from isolated case studies toward a shared international evidence base.

3.2. Performance-oriented or social-oriented?

The two peer-learning schemes studied here differ in their primary aims and mechanisms of action. SI-PASS is designed as a course-embedded academic support programme, while PEPPS is structured as a transition and integration support programme. This difference in programme logic has implications for evaluation. In this dissertation's dataset, PEPPS did not produce a measurable course-level performance effect (study 2). This result was expected, as academic outcomes are not the primary target of the scheme. The broader literature confirms that when peer support is not tied to a specific course, grade comparisons risk being underpowered or conceptually misaligned (Arendale, 2019). By contrast, performance-oriented peer-learning schemes such as SI-PASS and Peer-Led Team Learning (PLTL) tend to show improvements in exam performance and reduced failure rates when attendance is sufficient and core collaborative mechanisms are reliably enacted (Bowles et al., 2008; Dawson et al., 2014). These effects are conditional, not universal: exposure, facilitation quality, and fidelity matter.

Meanwhile, social-oriented schemes such as PEPPS address a different determinant of academic success: belonging. A substantial body of research shows that students who feel academically and socially integrated are more likely to persist, especially in the first year (Thomas, 2012; Tinto, 2012).

Belonging predicts retention and engagement, and randomized experiments have demonstrated that brief belonging interventions can influence academic trajectories, particularly among underrepresented students (Walton & Cohen, 2011; Yeager et al., 2016). Thus, while PEPPS may not shift grades in the short term, it plausibly contributes to retention, well-being, and continuation into later years.

Overall, these findings suggest that SI-PASS and PEPPS should be treated as complementary, not competing, interventions. SI-PASS is best evaluated on course-level outcomes (grades, pass rates) and process fidelity. PEPPS is best evaluated on belonging, social integration, and first-year persistence; with academic effects considered indirect spillovers rather than primary endpoints. In this framing, the question is not "Which programme is better?", but rather: "What configuration of academic- and social-oriented supports is best suited to this cohort, in this faculty, at this moment in the academic year?".

From this perspective, the question for faculties is not whether SI-PASS is intrinsically preferable to PEPPS, but which scheme (or combination of schemes) best matches their students' needs, institutional priorities, and available resources. If the main objective is performance in a specific high-risk course, SI-PASS is likely to be the more appropriate choice. If the priority is transition support, belonging, and early academic-social adjustment, PEPPS may be the more relevant option. In other cases, maintaining both schemes may offer the most coherent support ecology, though this depends on staffing, funding, and implementation capacity. There is therefore no single optimal model in the abstract: the appropriate choice depends on what a faculty is trying to achieve, at what cost, and under what local conditions.

3.3. High-performers and weaker students

A recurring assumption in higher education is that academic support schemes often benefit the "wrong" students: those who are already relatively strong, proactive, and self-regulated, while the students who might need such support most are less likely to attend. This commonplace view is not entirely devoid of empirical plausibility, and the present dissertation provides an opportunity to examine it more closely in relation to the two peer-learning schemes studied here. In the case of SI-PASS, the issue emerges directly from the contrast between experimental and semi-experimental results; in the case of PEPPS, it appears more indirectly through questions of participation, self-selection, and the uneven uptake of support.

A central observation in this dissertation is that the RCT yielded no average performance effect of assignment to SI-PASS (an intent-to-treat estimate), whereas a semi-experimental contrast (attenders *vs.* non-attenders) showed higher performance among attendees (study 3 or Puttaert et al., 2025). Interpreting this divergence requires separating exposure from assignment and acknowledging self-selection and heterogeneous treatment effects as first-order issues in peer-learning evaluation. In other words, random assignment may not move outcomes if actual attendance is low or enactment uneven, while observational contrasts can overstate benefits if academically stronger or more motivated students disproportionately choose to attend. These challenges, and the need to analyse exposure explicitly, are widely noted in the SI-PASS literature and its syntheses (Allen et al., 2021; Dawson et al., 2014; Paloyo et al., 2016).

Two (partly compatible) hypotheses can help organize the evidence. The first one holds that SI-PASS attracts high achievers, who then reap further gains. Participation is often correlated with self-regulatory skill and proactive help-

seeking, traits linked to stronger academic outcomes (*e.g.*, setting goals, monitoring understanding, strategic effort) (Pintrich, 2004; Zimmerman, 2002). Students with these profiles use peer-learning to refine understanding and stay ahead, which is consistent with broader research on self-regulated learning and peer learning. Meta-analytic and review work on SI-PASS also reports monotonic exposure-response patterns: more sessions are associated with higher grades and pass rates, even after adjusting for observed covariates, although effect sizes vary by context and design (Dawson et al., 2014; Zha et al., 2019).

On the other hand, the second hypothesis posits that SI-PASS disproportionately helps lower-prepared students when they attend enough. In a first-year engineering mathematics context, Malm (2011) showed that weak, average, and strong students all benefited from SI, with failure rates among lower-prepared students who attended frequently approaching those of stronger peers. More generally, in adjacent literatures on active and collaborative learning, randomized and quasi-experimental evidence indicates that collaborative structures not only improve performance on average but can reduce achievement gaps for students historically underserved in STEM precisely when interactional mechanisms are enacted with fidelity (Chi & Wylie, 2014; Haak et al., 2011; Theobald et al., 2020).

These hypotheses are not mutually exclusive. In many cohorts, higher-achieving students over-represent among attenders (selection), while lower-prepared students realize larger relative gains when they reach a sufficient exposure (Malm et al., 2011; Paloyo et al., 2016). Hence, an intent-to-treat estimate can be null if exposure is low, while treatment-on-the-treated contrasts can be positive yet confounded without credible strategies for handling selection. One credible approach is encouragement-design

randomization: in an economics course PASS study, Paloyo et al. (2016) used an encouragement instrument to show that increasing attendance caused higher grades, illustrating how exposure can be identified causally even when assignment to the program *per se* shows small average effects.

Within this dissertation, the pattern is exactly of that type: the randomized phase shows that assignment alone did not raise course grades, whereas the semi-experimental phase shows participation correlating with better performance (study 3 or Puttaert et al., 2025). Read alongside the process evidence (video-based fidelity and the variable enactment of core techniques), the most consistent interpretation is that effects depend on exposure and fidelity rather than on mere availability of SI-PASS. This is also the conclusion of leading reviews: SI-PASS is positively associated with academic outcomes on average, but effects vary with exposure and implementation (Dawson et al., 2014; Topping, 2005).

In short, the weight of evidence suggests that both profiles are present: higher-achieving, self-regulated students often self-select into SI-PASS and benefit at modest exposure rates; lower-prepared students can benefit substantially when sessions are accessible, enacted with interactional fidelity, and attended frequently. The practical question for the institution is therefore less "Which students is SI-PASS for?" and more "Under what conditions (exposure, timing, fidelity) can diverse students benefit?".

3.4. Scheme promotion

Interviews with SI-PASS leaders consistently highlight transferable skill gains, including communication, facilitation, leadership confidence, and the ability to manage group dynamics over time (study 6). These experiences are described as influential not only for academic development, but for later

internship and employment contexts, where leaders report drawing directly on the relational and organizational abilities cultivated in the role (study 6). These findings align with published research showing that peer-leader positions contribute to identity construction, metacognitive awareness, and the internalization of professional competencies (Lockie & van Lanen, 2008; Micari & Pazos, 2019; Stigmar, 2016). They also resonate with broader employability literature demonstrating that employers value teamwork, communication, initiative, and problem-solving as much as disciplinary expertise (Andrews & Higson, 2008; Knight & Yorke, 2003). Yet, despite this alignment, such benefits remain underemphasized in program promotion, where messaging often centres on academic outcomes alone.

The results of this dissertation caution against such performance-exclusive framing. The randomized trial did not detect a main effect of assignment to SI-PASS on course grades (study 3 or Puttaert et al., 2025), and video analyses revealed moderate fidelity rather than uniform enactment of the core collaborative learning principles (study 5). Moreover, survey evidence indicates that students attach substantial value to social and motivational affordances: reassurance, shared effort, and structured study time (studies 1, 2, & 7). A promotional narrative focused exclusively on improving grades may therefore misrepresent what SI-PASS reliably delivers and may fail to connect with students who are less grade-anxious but strongly motivated by belonging, orientation, and peer interaction during the transition to university.

A more accurate and effective strategy is to differentiate value propositions according to the underlying mechanisms of each peer-learning scheme. SI-PASS should be presented as mastery-oriented course support, where benefits emerge under transparent conditions: regular attendance, active participation in student-to-student reasoning, and sessions that enact core facilitation

techniques such as redirection, wait-time, and checks for understanding. In contrast, PEPPS should be framed as a transition and belonging support program, where the primary expected outcomes concern confidence, university navigation, and the building of peer networks. This distinction reflects strong and convergent research evidence: collaborative learning reliably improves academic performance when interactional mechanisms are enacted (Freeman et al., 2014), while belonging and social integration are critical determinants of first-year persistence (Hausmann et al., 2007; Thomas, 2012) and, under some conditions, can causally improve achievement trajectories (Walton & Cohen, 2011).

The promotional approach should thus foreground multiple forms of value simultaneously: academic mastery where relevant, early-semester belonging and adjustment, and leadership or employability-relevant competencies for those who progress to facilitation roles. Making these benefits visible would allow students to claim and communicate the outcomes of their engagement more effectively. This is particularly relevant given evidence that participation and attendance are shaped at least as much by structural and logistical conditions (session scheduling, friction of access) as by motivational messaging alone (Castleman & Page, 2015). In many contexts, protected time slots and integrated scheduling have stronger effects on uptake than persuasive appeals (Kuh, 2008).

A related strategic question concerns the scope of deployment of peer-learning schemes within the institution. If SI-PASS and PEPPS are understood not as marginal add-ons but as potentially meaningful supports for student success, then it becomes legitimate to ask why their availability remains uneven across courses and faculties. At present, the faculty of Sciences benefits from both schemes, while others have access to only one or to neither. Likewise, SI-PASS

is attached to a limited number of high-risk courses, even though other courses may also concentrate failure, disengagement, or transition-related difficulties: "*While the model generally advocates SI for courses in which the class size is large and the rate of Ds, Fs, and withdrawals exceeds 30% (Martin & Arendale, 1994), sometimes, courses in which the failure/withdrawal rates may not sound any alarms might still be good candidates for SI. (…) In addition to determining whether a course is high-risk (e.g., a DFW rate of 30% or greater), it is also helpful to know as much background information as possible about the course."* (Wilcox in Arendale, 1994, pp. 24-25). The findings of this dissertation do not justify a simple call for generalized expansion, since any extension would need to remain compatible with available resources, leader recruitment capacity, and sufficient implementation quality. However, they do support opening the question institutionally: on what basis should some courses or faculties benefit from peer-learning support while others do not? Framed this way, the issue is not only whether SI-PASS or PEPPS should be extended, but according to which pedagogical, organizational, and equity-related criteria such extension ought to be considered. This also suggests that continuation and expansion may rest on different logics: the schemes may be sufficiently legitimate to be maintained where they already exist, without yet being sufficiently central to trigger broader extension across courses or faculties.

Finally, promotion itself can become a site of evidence-based improvement, through routine testing of message frames (academic-focused, belonging-focused, skills-focused), variation in delivery channels (*myuliege* announcements, email, ambassador presentations), and structural pilots such as co-facilitation or competency-recognition schemes. The broader implication is that SI-PASS and PEPPS should not be positioned as competing or interchangeable, but as complementary supports within a coherent student-

success ecosystem; each linked to outcomes aligned with its core mechanisms, and each promoted in a way that reflects what students actually value and what the programs demonstrably deliver.

3.5. Standardized tool

One of the most consequential outcomes of this dissertation is not a single result but an infrastructure: a shared measurement instrument that allows peer-learning schemes, despite their institutional and terminological diversity, to be understood and compared using a common language (study 7). This point is particularly important in a field where peer-support provision takes many forms across institutions, from PASS and peer tutoring to buddy systems, ambassadors, and other near-peer support models (Chilvers, 2025), and where the nomenclature itself has long been identified as inconsistent and in need of clarification (Olaussen et al., 2016). Historically, monitoring in SI-PASS and related programs has relied on attendance data, course outcomes, and locally developed surveys (Malm et al., 2024). These indicators are useful, but difficult to interpret across time and across institutions (Bengesai et al., 2023; Dawson et al., 2014). A reusable, construct-valid instrument changes the evaluative frame from "Does it work here?" to "What exactly is happening, for whom, and under what enabling conditions?". It allows institutions to shift from episodic evaluation to continuous, evidence-guided improvement (Bryk et al., 2015). The value of such a tool is thus strategic rather than merely technical. First, it supports fit-for-purpose program design. Peer-learning schemes differ in mechanism: some aim primarily at mastery of demanding content (*e.g.,* SI-PASS, PLTL), others at belonging and transition (*e.g.,* PEPPS, peer-mentoring schemes). A standardized tool allows institutions to determine which need is most salient for a given cohort and to monitor whether the program selected is delivering on that need (Kuh, 2008; Thomas, 2012). In

this sense, measurement becomes a compass for program portfolio design, not a ranking device.

Second, the tool links outcomes (study 3), mechanisms of cognitive engagement (study 4), and implementation fidelity (study 5). Debates in the SI-PASS literature often confuse the model with its enactment (Carroll et al., 2007). However, implementation science shows that educational effects depend on the activation of core processes in real time, and that even modest erosion of those processes reduces observable impact (Carroll et al., 2007; Durlak & DuPre, 2008). When a standardized scale is used alongside brief observational feedback (including periodic video-based fidelity checks), it becomes possible to say not only "whether the program worked," but why by identifying which interactional mechanisms were present, weak, or missing (Derry et al., 2010).

Third, the tool enables equity-minded improvement by making participation and interaction patterns visible. Aggregate performance outcomes can obscure the experiences of students who speak less, feel less entitled to claim space, or disengage silently. Research in cooperative and peer-mediated learning repeatedly shows that without explicit routines, talk time and task ownership concentrate among confident students (Cohen, 2014; Webb et al., 2019). When measurement captures perceived voice, belonging, and access to peer explanation (not only attendance); programs can detect patterned non-participation and adjust structures (*e.g.*, group size, co-facilitation, opening routines) accordingly (Fredricks et al., 2004; Thomas, 2012).

There is also a cultural dividend. Instruments that are co-developed and iteratively refined with students and leaders tend to be perceived as more legitimate and trustworthy, which in turn increases both the accuracy of

responses and the willingness to act on findings (Bovill et al., 2011). In that sense, the scale can also be situated within broader pedagogical movements that emphasize students as partners in educational design and the importance of relationship-rich forms of higher education (Felten & Lambert, 2020). When used in this way, the scale functions not as surveillance but as shared pedagogical feedback: leaders gain actionable insight into how their facilitation is experienced, supervisors can target coaching to specific moves such as redirecting questions, extending wait-time, or checking for understanding, and coordinators can evaluate whether design adjustments (*e.g.,* longer session slots, pairing leaders, stable group membership) translate into lived changes in the room. One design caution follows: data should be used to improve systems rather than evaluate individuals. The unit of change in peer-learning is the session structure and the supports around leaders, not the personality of a single facilitator.

Finally, a standardized tool is an invitation to build a cumulative field rather than a collection of isolated cases. When multiple universities use compatible measures, they can test whether patterns hold across disciplines, languages, facilitation models, and institutional cultures. This is how the field can generate portable design principles. For example: how large a group can become before peer-to-peer talk erodes, whether co-facilitation reliably protects student voice, when socio-affective supports should be front-loaded, or which interactional routines most reliably produce deeper reasoning (Freeman et al., 2014; Gafney & Varma-Nelson, 2008). None of these insights can be inferred from course grades alone, all become visible when schemes share process-aware, comparable measures.

In short, the scale is a practical bridge between theory and implementation. It allows institutions to choose well (fit programs to needs), enact well (protect

the mechanisms that make peer-learning effective), and learn well (improve iteratively across semesters and contexts). In a domain where effects are conditional and context matters, this shared measurement infrastructure is precisely what durable progress requires.

4. Limitations

Like any field-based dissertation, the present work has several limitations related to context, participation, time frame, and measurement. These stem in part from the realities of studying authentic educational interventions as they unfold in natural settings: voluntary participation, uneven exposure, context-specific implementation, and the difficulty of linking complex peer-learning processes to a limited set of outcomes. These limitations are, however, the counterpart of an effort to examine peer-learning schemes from multiple angles (participation, perception, performance, process, leadership, and measurement) through a combination of experimental, observational, qualitative, and psychometric approaches. The following section therefore discusses the main limits of the work while also clarifying the scope and rigor of the evidence produced.

4.1. Performance

A first limitation of the dissertation concerns the interpretation of SI-PASS effects on academic performance. As discussed earlier, improvements were detected only in semi-experimental comparisons, where SI-PASS attenders were contrasted with non-attenders enrolled in the same course (study 3 or Puttaert et al., 2025). While informative, such comparisons are inherently vulnerable to self-selection bias, as students who choose to attend peer-learning sessions often differ from non-attenders in motivation, self-regulation, prior academic achievement, or time availability (Guarcello et al. 2017; Zimmerman, 2002). To support causal attribution and reduce the influence of

pre-existing student characteristics, randomized assignment remains the strongest design. Quasi-experimental designs can also provide valuable evidence, but their inferential strength depends more heavily on the quality of comparison groups and the plausibility of the assumptions underlying the design.

The third study of this dissertation implemented a randomized controlled trial (RCT) within a single high-risk psychology course (study 3 or Puttaert et al., 2025). Although this constitutes a strong test of the causal effect of assignment to SI-PASS, conclusions remain limited due to scope (one course, one faculty) and cohort specificity, both of which constrain generalizability. The peer-learning literature shows that effect sizes and even direction of effects can vary substantially across disciplines, course formats, and institutional cultures (Bengesai et al. 2023; Dawson et al., 2014). Therefore, a more robust evidence base would require multi-cohort, multi-faculty replications of the RCT design, ideally conducted over several academic years and across different disciplinary clusters.

Moreover, interpreting the null effect of assignment in study 3 requires consideration of exposure and fidelity. Field experiments in education frequently produce small effect sizes (Kraft, 2020), and null effects are particularly difficult to interpret in the absence of sufficient exposure or consistent enactment of the intended mechanisms (Carroll et al., 2007; Durlak & DuPre, 2008). Study 5 in this dissertation demonstrated that SI-PASS sessions at ULiège were delivered with moderate fidelity to the student-led collaborative model. Under these conditions, muted or non-significant performance effects are theoretically expected (Malm et al., 2011; Paloyo et al., 2016). Thus, the observed RCT result should not be read as evidence against the SI-PASS model, but as an indication that implementation quality

and sustained attendance must be treated as causal moderators, not incidental variables.

A second limitation relates to the scope of performance measurement. SI-PASS is attached to a specific high-risk course; but the learning strategies, self-regulatory habits, and peer collaborative practices developed in these sessions may transfer beyond the targeted module. Research on transfer of learning suggests that students can and do generalize strategies across tasks and contexts when these strategies are practiced with reflection and explicit scaffolding (Bransford et al., 2000; Hattie & Donoghue, 2016). However, such transfer cannot be assumed, it must be empirically verified. To date, no longitudinal work at ULiège has examined whether SI-PASS participation predicts performance across other courses, cumulative credit accumulation, or progression to second year, all of which are meaningful indicators of academic success in the first-year transition (Bowles et al., 2008; Tinto, 2012).

Addressing this limitation would require a longitudinal, multi-course RCT or quasi-experimental design, following students across semesters and capturing both academic and behavioural trajectories (*e.g.*, persistence, study routines). Given expected small-to-moderate effect sizes, such research must be powered accordingly and possibly stratified by subgroup to detect heterogeneous treatment effects among lower-prepared or structurally disadvantaged students, for whom benefits may be largest when exposure is sufficient (Bloom & Michalopoulos, 2013).

Another limitation concerns the scope of outcome measures. The present dissertation primarily assessed course-specific academic performance, which is appropriate given the course-embedded structure of SI-PASS. However, peer-learning literatures emphasize that the most consequential effects of peer-

learning schemes may manifest not at the level of single-course grades, but in longitudinal indicators such as cumulative credit completion, continuation to second year, and degree attainment (Bowles et al., 2008; Ogden et al., 2003). Belonging- and transition-oriented programs tend to influence persistence and academic self-efficacy before measurable grade changes occur (Hausmann et al., 2007; Thomas, 2012). As such, the absence of longitudinal tracking in this dissertation limits the capacity to assess whether SI-PASS or PEPPS contributed to reduced dropout risk, improved credit accumulation, or smoother progression through the curriculum. Future research should therefore link participation data to institutional progression records across multiple semesters, allowing examination of whether early engagement in peer-learning translates into durable academic trajectories and reduced attrition. This would align evaluation with the broader theory of student success, in which academic performance and retention are treated as distinct but interdependent outcomes.

A further limitation concerns the absence of longitudinal retention and progression indicators. Both SI-PASS and PEPPS aim to support students during the first-year transition, a period where the risk of withdrawal is highest. Research in student success consistently shows that early belonging, academic self-efficacy, and access to supportive peer networks predict not only course performance but persistence to the second year and cumulative credit accumulation (Thomas, 2012; Tinto, 2012; Zhao & Kuh, 2004). Because the present dissertation assessed outcomes at the level of single-course performance, it is not yet possible to determine whether participation in SI-PASS or PEPPS influences longer-term academic trajectories, degree momentum, or dropout risk. Future research should therefore link program participation data to institutional longitudinal records over multiple semesters, allowing the examination of whether early engagement in peer-learning contributes to sustained progression and reduced attrition. Such analyses

would align evaluation with the broader theoretical framing of student success and provide a more complete understanding of the schemes' institutional impact.

4.2. Participation

A further limitation concerns how participation in SI-PASS and PEPPS was operationalized and measured. Attendance records provide a useful indication of exposure to the program, yet they do not capture the qualitative dimensions of engagement within sessions. Research in the learning sciences has repeatedly shown that the benefits of active and collaborative learning depend not only on presence but on the nature of cognitive involvement: questioning, explaining, reasoning aloud, and co-constructing understanding with peers (Chi & Wylie, 2014; Freeman et al., 2014). Two students marked as attending may therefore encounter very different learning experiences depending on group dynamics, facilitation practices, and their own confidence or willingness to participate.

Moreover, the voluntary nature of SI-PASS and PEPPS participation introduces systematic selection effects. Students who choose to attend regularly often possess stronger self-regulation and more proactive help-seeking orientations, both of which independently predict higher academic success (Guarcello et al., 2017; Karabenick, 2003; Zimmerman, 2002). As a result, the very students who could benefit most (those experiencing academic difficulty or social disconnection) are often underrepresented in attendance patterns. Comparable concerns have been raised in the broader Supplemental Instruction literature, where participation tends to be skewed towards academically engaged students, unless explicit outreach and belonging-building efforts are made (Bowles et al., 2008; Dawson et al., 2014).

Within the data examined in this dissertation, intensity of attendance emerged as a strong determinant of academic outcomes (study 1). Students who attended regularly (typically five or more sessions) demonstrated notably better performance than those who attended sporadically (study 1, Table 7). This pattern aligns with previous studies showing non-linear exposure-response curves in SI-PASS: benefits accumulate when routines, familiarity, and shared norms of collaborative work develop over time (Malm et al., 2011; Van der Meer & Scott, 2009). Brief or occasional attendance rarely activates the mechanisms that underlie peer-learning gains, such as elaborative explanation, distributed problem-solving, or metacognitive reflection (Chi & Wylie, 2014; Rosenshine & Meister, 1994).

The observed variability in participation between faculties suggests that contextual factors (disciplinary culture, course difficulty, timetable coordination, perceptions of support services, and even room availability) shape not only overall attendance levels but also patterns of persistence or disengagement. This finding echoes work in transition-to-university research showing that engagement in academic support activities is influenced not solely by need but by perceived legitimacy, ease of access, and early experiences of belonging (Kahu, 2013; Thomas, 2012).

Overall, these observations reinforce a broader point already visible throughout this dissertation: peer-learning schemes cannot be judged on the basis of a single indicator. Attendance alone is insufficient, because presence does not reveal the depth or quality of engagement. Performance alone is insufficient, because outcomes depend on exposure, implementation, and the specific aims of the scheme. Perception alone is insufficient, because positive experience does not guarantee that the core learning mechanisms are actually activated. Price alone is insufficient, because financial cost can only be

interpreted in relation to the type of support provided and the range of outcomes considered. What this dissertation therefore supports is a triangulated approach, in which participation, outcomes, perceptions, process evidence, and resource investment are interpreted together rather than in isolation.

4.3. Context

A further limitation concerns the context-specific nature of the SI-PASS and PEPPS implementations examined in this dissertation. Both schemes are embedded in the institutional culture of French-speaking Belgian higher education, where first-year teaching is often lecture-based, academic expectations are high, and help-seeking is shaped by norms of student autonomy (De Clercq et al., 2023). Research in student engagement and implementation science indicates that peer-learning outcomes are not inherent properties of the model but depend strongly on contextual features such as disciplinary epistemologies, institutional structures of support, and the local meanings attached to collaborative learning (Carroll et al., 2007; Kahu, 2013). As such, the patterns documented here (moderate implementation fidelity, attendance threshold effects, and the socio-academic contrast between SI-PASS and PEPPS) cannot be assumed to generalize to settings where, for example, SI is compulsory rather than voluntary, leaders are volunteers rather than paid, or disciplinary cultures promote more explicit collaborative learning.

Additionally, part of the data was collected during the post-COVID transition, a period characterized by disrupted peer networks, reduced informal contact, and heightened uncertainty regarding academic norms (Aristovnik et al., 2020). Studies show that post-pandemic cohorts display reduced spontaneous help-seeking and increased anxiety in collaborative learning environments,

which likely shaped both participation patterns and interactional dynamics during SI-PASS and PEPPS sessions (Raaper & Brown, 2020; Son et al., 2020). These temporal and cultural contingencies suggest that the effects observed should be interpreted as contextually moderated, rather than universally characteristic of SI-PASS.

To strengthen external validity, future research should adopt multi-site or cross-institutional designs, allowing direct comparison across languages, institutional types, and disciplinary contexts. This aligns with recent calls for peer-learning research to move beyond single-site case studies and toward cumulative, transferable knowledge based on shared measurement frameworks and process-level evaluation (Bengesai et al., 2023; Longfellow et al., 2008).

4.4. Perception

A further limitation concerns the interpretation of perception-based data in this dissertation. Self-report measures were central to studies 1, 2, 4, and 7 because they capture students' and leaders' subjective experiences: motivation, perceived usefulness, confidence, belonging, and cognitive engagement. Yet, as is widely recognized in educational research, self-reports are vulnerable to biases such as social desirability, memory reconstruction, and inaccuracies in self-assessment (Podsakoff et al., 2003). In peer-learning contexts specifically, participants often evaluate sessions in terms of how comfortable, supported, or socially connected they felt, which may not always correlate with the cognitive work actually accomplished (Deslauriers et al., 2019; Topping, 2005). Thus, perception data should be interpreted as meaningful, but not sufficient on their own.

This issue became particularly visible in study 4, which replicated Malm's (2021a) analysis of action verbs describing cognitive processes during SI-

PASS sessions. The replication of the self-reported pattern was reassuring, as students at ULiège described their engagement in ways broadly consistent with SI-PASS literature elsewhere, citing verbs associated with deeper learning processes when interpreted through the SOLO taxonomy (Biggs & Tang, 2011). However, when observational data from video-recorded sessions were examined, a more complex picture emerged. The verbs that actually appeared in interaction sequences included not only higher-order reasoning, but also frequent clarification moves, procedural talk, and leader-supplied explanations. In other words, what students believed they were doing and what they were recorded doing did not always align.

This divergence raises a broader methodological reflection. Replicative studies based on self-reports can confirm the stability of perceived experiences across institutions as useful tools for establishing the generalizability of program cultures and identity (Dawson et al., 2014; Smith & MacGregor, 2009; Stigmar, 2016). However, replication alone cannot confirm whether the underlying cognitive mechanisms associated with learning are being activated in practice. As research on peer and collaborative learning has shown, observed behaviours (such as the presence of elaborated explanations, distributed reasoning, and wait-time) are stronger predictors of learning gains than perceived effort or perceived understanding (Chi & Wylie, 2014; Rosenshine & Meister, 1994). This limitation also applies to the apparently simple category of "group discussion," which can easily be treated as a homogeneous indicator when in fact it depends heavily on how interaction is initiated and structured. As Frith et al. (2017) observe, *"Group discussion is probably the most common activity associated with collaborative learning. As such, we may take it for granted and rarely give much thought to the dynamics of facilitating a successful group discussion. However, even slight changes in the way we approach a group discussion can make an important difference in the manner*

in which group members elect to involve themselves. For instance, note that in the material you just discussed, you were NOT asked to simply read and discuss it. Sometimes the LEAST effective way to start a group discussion is to throw out a question and wait for a response." This is precisely why apparent similar discussion episodes may differ substantially in their pedagogical value.

The tension, therefore, is not between replication and novelty, but between self-perceived engagement and demonstrated engagement. Mixed-method approaches, where self-reports are systematically triangulated with interactional or performance evidence, offer a more robust basis for claims about program effectiveness (Johnson & Onwuegbuzie, 2004). This is especially critical in peer-learning environments, where the mechanisms of learning are enacted socially and distributed across group interactions, rather than through individual introspection.

The findings in this dissertation illustrate the value of such triangulation: perception measures captured stable positive attitudes toward SI-PASS (study 1) and PEPPS (study 2), suggesting cross-institutional generalizability of program experience; the video analyses (study 5), however, revealed uneven fidelity in the enactment of collaborative learning mechanisms, clarifying why outcomes may vary even when perceptions are positive. This underscores a key point in implementation and learning sciences alike: positive perception is necessary for participation and sustained engagement, but it does not guarantee the presence of learning-conducive interactional structures (Carroll et al., 2007; Durlak & DuPre, 2008). Future work should therefore continue to pair perception measures with direct evidence of interactional processes (*e.g.*, talk-time markers, redirections, elaborated explanations) to capture both the experiential meaning and the cognitive functioning of peer-led sessions. Doing so will support a more nuanced understanding of how students learn with and

from one another, and under what conditions perception and performance meaningfully converge.

4.5. Price

A further limitation concerns the financial and structural sustainability of SI-PASS and PEPPS. Peer-led learning schemes require ongoing investment in leader recruitment, initial and continuous training, coordination time, meeting spaces, and administrative monitoring. At ULiège, institutional accounting records indicate that €78,921.54 was allocated in 2023 to support SI-PASS and PEPPS combined, including student compensation for leaders and buddies (RADIUS figures). While this expenditure reflects the institution's commitment to student-centred support, it also raises a more strategic question: what would happen if faculties were required to arbitrate more explicitly between these schemes and other possible uses of limited resources? Such a situation would represent a revealing test of institutional priorities. The point here is not to resolve that question, but to note that financial pressure can force choices that remain less visible when resources are still sufficient to sustain multiple initiatives simultaneously. These yearly costs are substantial, but the financial dimension also deserves to be put into perspective: at ULiège, this amount is roughly equivalent to the annual salary of one teaching assistant, while supporting interactions among 2616 students. Whether this investment is worth the cost is ultimately for the institution and, more broadly, for the public authorities funding higher education to determine.

The tension between educational benefit and program cost is well documented. Peer-led and Supplemental Instruction models are consistently more resource-intensive than traditional lecture-based support, largely because they require human facilitation rather than technological automation or passive materials (Arendale, 2019; Tinto, 2012). Studies evaluating SI and peer mentoring

programs note that leader training and supervision represent the largest recurring expenses, followed by compensation schemes when leaders are paid (Arendale, 2019; Crisp & Cruz, 2009). Institutions that successfully scale peer support often do so not by removing these components, but by redesigning implementation: reducing group size variability, reconfiguring meeting schedules, or shifting to hybrid delivery models (Dawson et al., 2014).

Financial sustainability also intersects with equity and participation. Payment for leaders reduces barriers for students who cannot afford unpaid extracurricular work, and tends to diversify the leader pool (Bowman, 2013; Couchman, 2009). Removing payment risks restricting leadership to already-advantaged students and undermining the developmental and representational goals of peer-learning (Terrion & Leonard, 2007). Conversely, maintaining paid leadership at larger scale may require reallocating funds, integrating programs into departmental budgets, or adopting cost-sharing arrangements across academic units.

These dynamics underscore the need for cost-effectiveness evaluation, rather than cost-cutting alone. The question is not simply whether SI-PASS and PEPPS are expensive, but whether the educational, social, and retention-related outcomes justify the investment. Evidence from retention and transition literature suggests that supports improving first-year belonging and academic engagement can significantly reduce dropout risk, producing institutional savings that offset program costs (Thomas, 2012; Tinto, 2012). However, such benefits must be demonstrated locally, preferably using longitudinal outcome tracking linked to program exposure. In other words, while SI-PASS and PEPPS have demonstrated value, their financial sustainability remains contingent on institutional prioritization and strategic design. Future work should include formal cost-benefit analyses, scenario modelling for scaling,

and pilot testing of adaptations such as co-leadership, hybrid modalities, or protected scheduling blocks that may reduce administrative burden. The goal is not to reduce cost at the expense of quality, but to align investment with demonstrated mechanisms of action and measurable educational value.

4.6. Leaders

Patterns observed in studies 4 and 5 must be interpreted in light of the broader question of how students approach learning. Research in higher education consistently shows that students often adopt strategic or surface approaches (focusing on efficiency and exam performance) rather than deeper conceptual engagement, especially under assessment pressure (Briggs et al., 2012; Entwistle & McCune, 2004). In this sense, it is unsurprising that SI-PASS sessions sometimes shift toward clarification and procedural guidance rather than extended reasoning dialogues: leaders and participants share the same assessment ecology. Strategic learning is not a failure of motivation, but an adaptation to perceived academic demands. As Topping notes: *"Leaders might become impatient and just tell their tutee the right answer, or do the task for them, in which case the tutee will learn very little"* (2000, p. 7).

The quality of peer-learning implementation is therefore closely tied to the role and preparation of leaders. Although leaders in this dissertation generally demonstrated solid facilitation skills, variability in adherence to SI-PASS core practices was evident in the observational coding (study 5). This variation aligns with prior research showing that peer facilitators require ongoing feedback, not only initial training, to maintain collaborative techniques such as redirecting questions, encouraging wait-time, and encourage student-to-student explanation (Micari & Pazos, 2020; Stigmar, 2016). Leaders themselves expressed a desire for more structured, dialogic feedback cycles, suggesting that the training should be reconceptualized not as a one-time

threshold but as a continuing professional development process (Kolb, 2015). However, monitoring leader practice is complicated by reactivity to observation. The Hawthorne effect (changes in behaviour when individuals know they are being observed) poses a well-documented challenge in naturalistic educational research (McCambridge et al., 2014). In the present dissertation, leaders and participants were aware of upcoming video-recorded sessions, which may have prompted greater adherence to recommended techniques during observation than during routine sessions. Ethical constraints prevent covert recording, meaning that session authenticity remains partially inferential. Thus, fidelity estimates presented here should be treated as upper-bound indicators rather than default practice.

A further dimension concerns contextual variation. SI-PASS originated in the United States in the mid-1970s at the University of Missouri-Kansas City and has since been implemented across more than 30 countries (Malm et al., 2024). Over decades, institutions have adapted the model to their disciplinary cultures, student populations, scheduling constraints, and educational norms (Arendale, 2019). It is therefore plausible that localized variants of SI-PASS have emerged, particularly in universities where the program has operated for many years. Study 5 already indicates adaptation at the level of facilitation practice, exploring whether systematic cultural or disciplinary patterns exist would require coordinated multi-site video or observation studies. The aim of such work would not be to enforce uniformity but to understand how peer learning evolves over time and context, and to identify which adaptations preserve or erode the core mechanisms of action.

In short, leader practice is both a strength and a structural vulnerability of peer-learning schemes. Leaders bring authenticity, relatability, and the capacity to build trust; yet their facilitation is shaped by training, context, expectations,

assessment culture, and the practical constraints of time and group dynamics. Future research and implementation work should therefore emphasize iterative training, structured feedback loops, and cross-institution collaboration to support consistent enactment without diminishing the adaptive, student-centred spirit that defines SI-PASS.

Recommendations

As Huang et al. note: *"... although positive PASS program experiences are well recognised in the literature, the successful implementation of the PASS program cannot be taken for granted."* (2013, p. 121). The results of the present dissertation suggest that the two peer-led programs implemented at ULiège are no exception. Rather, they lend themselves particularly well to an affordance-based understanding of educational interventions (Gibson, 1977).

The concept of affordance refers to the possibilities for action that an environment offers to an agent. These possibilities are neither purely objective properties of the environment nor purely subjective interpretations; rather, they emerge relationally, through the interaction between environmental structures and the capacities of actors. In that sense, SI-PASS and PEPPS do not escape affordance theory: they exemplify it. Both schemes create structured opportunities for engagement, learning, and development, yet these opportunities only materialize under specific contextual and relational conditions. Like any student-support initiative, their effects depend not only on their formal existence, but also on their perceived usability and on the extent to which stakeholders are able to recognize and actualize the possibilities embedded in the program.

The findings of this dissertation therefore confirm and deepen the idea that both programs implemented at ULiège do carry genuine potential, but that this potential should be understood as an affordance rather than a guarantee. In other words, these schemes create possibilities for collaborative learning, belonging, and facilitation, yet such possibilities are only actualized under supportive organizational, interactional, and institutional conditions. The recommendations that follow therefore concern the design of participation

environments, facilitation support, program positioning, and continuous-improvement infrastructure.

The recommendations developed below emerge from several forms of dialogue that have structured this dissertation from the beginning. They draw, first, on a dialogue between the different studies themselves and, second, on a dialogue between the findings produced here and the broader literature on peer learning. But they also stem from a more local and practice-oriented dialogue: between my role as researcher and my direct involvement in the programs as SI-PASS supervisor and trainer, as well as from ongoing exchanges with the co-promotor involved in their day-to-day coordination. Finally, this section also stages a dialogue between present findings and future action, as the recommendations aim to translate evidence into possible directions for institutional improvement. In this way, the two ambitions of the dissertation are maintained here as well: contributing to the international field while also providing a precise, locally grounded understanding of the situation at ULiège.

1. Strengthen program visibility and differentiate messaging according to purpose

Studies 1, 2, and 7 demonstrated that SI-PASS and PEPPS occupy distinct positions on the academic-social support continuum. Although these differences are already recognized and generally communicated at ULiège, the findings suggest that they should remain explicitly foregrounded in both promotion and implementation. More broadly, the visibility of both schemes still depends on uneven institutional support across faculties and stakeholders. The recommendation therefore concerns both the sustained visibility of the programs and the continued clarification of their specific purposes. This is consistent with institutional guides that define faculty support as an integral part of SI implementation. As the University of Guelph exemplifies: *"Faculty*

Members Professors with SI assigned to their courses are asked to: 1. Allow the SI Leader to make weekly announcements in class regarding SI sessions. 2. Send e-mails to students enrolled in the course to promote SI session attendance. 3. Post SI session schedules in classroom and on Blackboard. 4. Communicate with the SI Leader about class content." (Canadian National Centre for Supplemental Instruction, 2014).

- Ensure that program promotion is sustained across multiple institutional levels, including faculty authorities, faculty contacts, and course instructors, rather than relying only on initial communication.
- Encourage visible endorsement from faculty and teaching staff, as local evidence suggests that repeated institutional support strengthens both legitimacy and participation.
- Present SI-PASS as structured, collaborative mastery support, with explicit transparency regarding the conditions required for benefit (regular attendance, active engagement, peer explanation).
- Frame PEPPS as belonging, transition, and community-building support; especially important in the first semester.

2. Protect and optimize conditions for attendance

Given the clear exposure-response pattern observed in studies 1, 2, and 3, sustained attendance is a prerequisite for the activation of SI-PASS mechanisms. This aligns with multivariable and meta-analytic evidence showing that performance gains strengthen with repeated participation (Allen et al., 2021; Dawson et al., 2014). However, attendance is strongly shaped by structural conditions such as timetable clashes, room availability, and awareness of sessions: *"We have also found putting PASS on students' timetables subtly communicates to students that PASS is part of the course culture and all students are expected to benefit from engaging with it."*

(Chilvers, 2013). These measures are particularly important for students who do not naturally seek help and are therefore at greater risk of disengagement.

- Embed protected time slots within the official timetable to reduce friction and increase accessibility. Beyond practical convenience, this also signals that SI-PASS and PEPPS are legitimate parts of the course or faculty support culture rather than optional extras left entirely to student initiative.
- Ensure visible academic endorsement of the schemes, for instance by integrating them into course *syllabi*, mentioning them in class, and linking them more explicitly to the pedagogical life of the course. Such endorsement can strengthen both legitimacy and attendance, especially in contexts where staff support is otherwise weak or indifferent.
- Integrate the program more fully into the university's digital environment, through automated reminders, calendar synchronization, and clear session location visibility (*e.g.,* through official scheduling tools such as CELCAT), to reduce decision-making barriers associated with voluntary engagement.
- Communicate early and repeatedly during the first six weeks of the semester is critical, as this is when belonging and study habits are most malleable.
- Share testimonials from successful participants and peer leaders via social media, email campaigns, and on the ULiège website, so that the value of the schemes become more concrete and relatable to prospective students.
- Create more opportunities for collective and informal social moments around the schemes, whether within groups or across groups, in order to reinforce peer bonds and make participation more meaningful and

attractive. This could include small convivial activities, shared meals, or occasional collective events bringing several groups together.

- Consider light forms of recognition for regular participation, such as certificates, small academic recognition, or other symbolic incentives, while remaining attentive to local feasibility and to the risk of shifting the meaning of participation too strongly toward reward-seeking.

3. Reinforce facilitation fidelity through light, ongoing support

Study 5 revealed moderate but uneven fidelity in the enactment of core SI-PASS facilitation techniques. This echoes implementation science findings that outcomes depend not only on program presence but on the quality of enactment (Carroll et al., 2007; Durlak & DuPre, 2008). Such support should help maintain collaborative inquiry under real constraints, reinforcing the facilitator identity documented in study 6 rather than allowing drift toward re-teaching. At the same time, any recommendation in this area must remain compatible with the institution's actual supervisory and financial capacity. Rather than expanding initial training volume indiscriminately, evidence suggests that brief, iterative, and targeted feedback cycles are among the most effective and scalable means to support facilitation (Darling-Hammond et al., 2017).

- If materially possible, conduct a single early-semester observation, followed by short, structured coaching focused on one or two micro-skills (*e.g.*, increasing wait-time to more than 3 seconds, or prompting explanation before confirming correctness).
- Prefer brief, structured, and where necessary mandatory reflective moments over optional enrichment formats, as local experience suggests that voluntary follow-up initiatives tend to attract limited participation.

- Provide practical tools for managing group dynamics, facilitation dilemmas, and relational challenges within sessions, while recognizing that additional support mechanisms require time, supervision, and possibly compensation.
- Develop, where feasible, a light mentoring structure in which more experienced peer leaders support newer ones, sharing best practices and strategies for engaging participants effectively. In the Liège context, this appears both logical and potentially valuable: expanding the schemes also increases the number of seasoned leaders who could support newer ones. Such a system could partly compensate for the current relatively low level of continuous supervision, although it would also require administrative recognition and a realistic allocation of time.
- Consider, if supervisory capacity allows, asking leaders to submit brief session plans or outlines in advance, as practiced in some institutions. Such a device could strengthen preparation, training, and session quality, but its usefulness would depend on the possibility of reading these plans and providing feedback in return.

4. Use co-leadership strategically to sustain interactional quality

Co-leadership should not be treated as a universal solution. While some studies suggest that paired facilitation can, in certain conditions, support interactional regulation and reduce the cognitive load placed on a single leader (Wilson & Varma-Nelson, 2016), the local situation at ULiège calls for greater caution. Solo facilitation is not merely a default constraint: it is also aligned with pragmatic considerations and with a conception of SI-PASS in which leaders retain clear personal responsibility for the session. Moreover, local observations and related work suggest that co-leadership does not automatically improve interactional quality: in some cases, it may simply

produce an uneven division of labour or even increase total leader talk. For that reason, the recommendation is not to generalize co-leadership, but to test it selectively in contexts where it might plausibly offer an advantage.

- Use co-leadership only in selected contexts where its added value seems plausible, for example in unusually large groups, conceptually dense courses, or situations where interactional regulation is especially demanding.
- Treat co-leadership as a hypothesis to be tested rather than as an intrinsically superior format and compare it with solo facilitation using indicators such as student talk, leader talk, participation balance, and fidelity to core SI-PASS techniques.
- Clarify the division of roles and responsibilities whenever co-leadership is implemented, in order to avoid passive duplication, uneven commitment, or increased leader dominance within the session.
- Take into account the practical costs of paired facilitation, including financial implications, administrative complexity, and the possible weakening of individual responsibility for preparation and session quality.

5. Make transferable skill gains visible and recognized

Leader interviews in study 6 highlighted development of communication, facilitation, conflict navigation, and leadership identity. Similar outcomes have been documented in near-peer and Supplemental Instruction research, which shows increased confidence, interpersonal competence, and professional development among student leaders (Micari & Pazos, 2020; Stigmar, 2016). Such recognition aligns the programs with employability frameworks increasingly valued by universities and employers.

- Reconsider, rather than introduce from scratch, forms of formal recognition for leader and buddy engagement, such as attestations, honour lists, or other visible markers of contribution. Local experience shows that this issue has already been explored, but with limited uptake; the point is therefore not to assume its automatic relevance, but to reassess under what form, and for whom, such recognition would now be meaningful.
- When formal recognition is used, state explicitly that the role constitutes a favourable context for the development of transferable skills, including communication, facilitation, leadership, and relational competence.
- Revise the wording used in recruitment and program communication so that the developmental and professional value of the role is more clearly visible to potential leaders, faculties, and the institution.
- Avoid resource-intensive recognition devices unless additional supervisory capacity is available, particularly individualized feedback summaries or formalized competence-based validation procedures.
- Build on the reflective structures that already exist rather than adding new parallel devices, notably the two mandatory hours of reflective activity included in the SI-PASS leaders' workload and, in PEPPS, the two reflective questions embedded in each intermediate questionnaire.
- Connect, where relevant, leader experience to existing faculty- or university-level portfolio logics, but only in contexts where extracurricular engagement is already formally recognized.

6. Integrate the standardized scale as a learning tool, not only as evaluation

Building on the exit surveys administered since the first iteration of both programs, study 7 produced an instrument capable of comparing peer-learning schemes across contexts and over time.

- Use the scale primarily in its original function as an end-of-program or end-of-semester perception tool, in line with the logic in which it was developed and validated.
- Integrate discussion of the scale results into existing reflective structures rather than creating entirely new ones, for instance within the mandatory reflective activity already required in SI-PASS.
- Position the scale in articulation with existing monitoring tools rather than as a replacement for them, especially in PEPPS, where intermediate questionnaires already provide earlier feedback on how the scheme unfolds.
- Use the scale results as a structured basis for communication with faculties and program stakeholders, so that recurring issues can be identified more clearly and discussed on comparable terms across cohorts and implementations.
- Mobilize the results to support targeted local adjustments where resources permit, *e.g.* regarding group organization, session openings, facilitation support, or the broader structuring of the schemes.
- Recognize, however, that the systematic treatment of these data and the implementation of subsequent regulation require time and personnel resources that are not automatically available, meaning that the development of a true continuous-improvement cycle remains conditional on institutional support.

This shifts SI-PASS and PEPPS from programs to systems designed for continuous improvement, in line with Plan-Do-Study-Act cycles used in educational implementation research (Langley, 2009).

7. Strengthen existing cross-institutional collaboration

This dissertation suggests that cross-institutional collaboration should not be understood as an optional add-on, but as one of the conditions for cumulative progress in peer-learning research and practice. SI-PASS and related schemes already circulate internationally through a growing network of exchanges, reports, meetings, and professional events. What the present work adds is not the idea of collaboration itself, but two complementary tools that could make such collaboration more systematic: first, a structured set of transversal metrics for documenting participation, implementation, and outcomes; and second, a standardized scale capable of comparing students' perceptions across schemes and contexts. Together, these instruments can help move international dialogue from informal exchange toward more cumulative and evidence-informed comparison.

- Intensify regular exchanges with other universities implementing SI-PASS or comparable peer-learning schemes, particularly those with long-standing practice. Such collaboration should be reciprocal: initiatives such as FIKAs and international conferences should be disseminated more systematically among ULiège supervisors, leaders, and stakeholders, while the expertise developed at ULiège should be more actively integrated into joint implementation, training, and research activities within the wider network.
- Treat international collaboration as a mutual improvement system, rather than a benchmarking competition; with the aim of mutual refinement, exchange of practice, and cumulative understanding of what works, for whom and under what conditions.
- Use the standardized scale, metrics, and any well-defined transversal indicator as a common measurement frame; allowing programs to

compare perceived value, orientation (academic *vs.* social), and implementation patterns across sites.

- Encourage cross-institutional comparison of process data, not only performance outcomes, since this dissertation shows that implementation fidelity and session dynamics are essential for interpreting results and should be part of international discussion alongside grades and pass rates.
- Develop longitudinal follow-up in collaboration with partner institutions, enabling analysis of outcomes that exceed a single semester.
- Explore the possibility of an Erasmus+ or similar capacity-building project that would consolidate the network already taking shape across institutions.
- Broaden international discussion beyond outcomes to include the comparative value of different global management parameters (*e.g.,* paid/volunteer leader, solo/co-facilitation, duration and content of initial training, modes of promotion, the level of institutional resources invested, etc.)

In this model, SI-PASS and PEPPS become part of a living, continuously improving peer-learning ecosystem, rather than fixed programs reproduced identically across contexts. Cross-institutional collaboration acts as the facilitating element that allows this ecosystem to accumulate knowledge over time and refine practice in responsive, evidence-grounded ways.

8. Continue and expand data analysis

This dissertation covers only the first three years of SI-PASS and PEPPS. Since neither programme has been interrupted, a substantial body of additional data has accumulated and remains available for systematic analysis. The

standardized metrics and validated instruments established in this thesis provide a strong basis for continuing this work in a structured way, in line with a plan-do-study-act logic of ongoing monitoring and improvement.

- Continue analysing attendance and performance data longitudinally, in order to determine whether the main patterns identified in this dissertation remain stable across later cohorts and implementation cycles.
- Extend the analysis of perception data beyond the items selected for the present studies, so as to make fuller use of the survey material already collected.
- Mobilize the reflective activities completed by SI-PASS leaders as a qualitative data source, since these documents offer valuable insight into how leaders understand, experience, and regulate their role over time.
- Compare first-time and seasoned leaders more systematically, in order to clarify how role conception, confidence, facilitation style, and perceived difficulties evolve across repeated engagements.
- Build on the framework developed in study 7 to examine the longitudinal development of facilitation and professional skills, especially across multiple semesters of participation.
- Analyse the PEPPS intermediate questionnaires more systematically, as they provide underused information on session content, perceived dynamics, and leaders' comfort or discomfort during the semester.
- Engage current and former leaders, where feasible, in the interpretation of accumulated data, so as to extend the student-as-partner logic into the continuous improvement of the programmes.

Conclusion

This dissertation set out to examine how two peer-learning schemes, SI-PASS and PEPPS, actually function at the University of Liège. Across seven studies, one conclusion emerges with clarity: the value of peer-learning cannot be reduced to the presence or absence of immediate performance gains. What these schemes make possible depends on their aims, the contexts in which they are implemented, the mechanisms they activate in practice, and the conditions that allow participation to endure long enough for those mechanisms to matter.

The first major result of this work is that SI-PASS and PEPPS are not interchangeable. They belong to the same broad family of support measures, yet they do not address the same dimensions of student experience with the same logic. SI-PASS is primarily oriented toward the collaborative mastery of demanding course content. PEPPS, by contrast, is more directly concerned with transition, belonging, and the first forms of anchoring in university life. This difference is not secondary. It means that no single model can be declared universally preferable in the abstract. The relevant choice between SI-PASS, PEPPS, or a combination of both depends on student needs, faculty priorities, and the organizational conditions under which support can realistically be sustained.

The randomized controlled trial showed that assignment to SI-PASS alone did not produce a main performance effect. But the rest of the dissertation makes clear why such a result cannot be read in a flat or definitive way. The video-based studies opened the black box of implementation and showed that the core mechanisms of SI-PASS were indeed present, though unevenly enacted. Study 6 then made part of this variability intelligible by showing how leaders constantly arbitrate between facilitation principles, perceived expectations,

time pressure, and the need to reassure participants. Study 7, finally, turned this cumulative work into a more durable infrastructure by developing a standardized perception scale capable of supporting comparison, monitoring, and progressive refinement across cohorts and institutions.

What emerges from all this is that peer-learning schemes are not fixed interventions with automatic effects. They are dynamic socio-cognitive environments. Their value lies less in the formal existence of a programme than in the quality of the conditions that sustain it: accessible scheduling, clarity of purpose, institutional recognition, room for leaders to grow into their role, and continuous attention to what actually happens in sessions. In that sense, the main contribution of this dissertation is not simply to say whether these schemes "work," but to show that the question itself must be reformulated. The real question is not only whether they work, but how, for whom, under what conditions, and with what degree of fidelity they are enacted.

More broadly, this dissertation argues against two equally misleading simplifications: treating peer-learning either as an educational slogan or as a self-evidently beneficial practice. It should be treated instead as a complex institutional reality, one that requires methodological rigor, interpretive nuance, and constant triangulation between participation, performance, perception, process, and implementation conditions. That is the level at which meaningful judgments become possible. It is also the level at which institutions can begin not merely to maintain support schemes, but to understand, adjust, and improve them.

The horizon opened by this work also extends beyond local evaluation. It suggests that peer-learning can be situated within a broader pedagogical shift

that sees students not only as recipients of support, but also as contributors to the educational life of the university. In this respect, the perspective offered by the student-as-partner movement and by the idea of a relationship-rich education is especially fruitful (Huart et al., 2023). More broadly, this perspective also aligns with recent calls for whole-institution approaches to student success, in which responsibility for student development is shared across leadership, faculty, administration, support services, and students themselves, as well as with the longstanding idea of seamless learning environments, where academic, social, and support structures are articulated more coherently around students' differentiated needs (Chilvers, 2025; Kuh, 1996). In a university increasingly shaped by artificial intelligence, technological mediation, and the risk of relational thinning, the strengthening of meaningful human ties may prove not secondary, but essential. On that point, SI-PASS and PEPPS are more than support schemes. They are concrete ways of making university life more relational, more participatory, and more human.

Finally, beyond their uneven effects, practical limits, and implementation tensions, both programmes appear throughout this dissertation as genuinely valuable parts of university life. They do not solve everything. They do not work automatically. They do not benefit everyone in the same way or under the same conditions. But they do create something real: opportunities for understanding, reassurance, belonging, confidence, and engagement. That is already a great deal. And perhaps that is the most important conclusion of all: in a university that so often rewards autonomy while leaving students alone with its demands, these programmes create places where support is not an exception, but an organized possibility. They remind us that success in higher education is never only a matter of individual merit; it is also a matter of the environments, relationships, and structures that make learning liveable. For

that reason, SI-PASS and PEPPS deserve not only to be studied and refined, but to be maintained, supported, and fully recognized as meaningful components of student life at ULiège.

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Appendices

1a. SI-PASS Exit Survey (Leaders and Participants) - French Version

1. Je connais mon matricule « s ».
2. Mon matricule « s » est...
3. Ne connaissant pas mon matricule « s » ou n'en étant pas sûr·e, voici mon PRENOM...
4. Ne connaissant pas mon matricule « s » ou n'en étant pas sûr·e, voici mon NOM...
5. Je fais partie de...
6. Je fais partie de la catégorie suivante :

Leaders

7. Une douzaine de rencontres formaient officiellement le dispositif de parrainage. En pratique, j'en ai organisé :
8. En moyenne, les rencontres que j'ai organisées ont duré :
9. J'estime mon temps moyen de préparation d'une rencontre SI-PASS :
10. Dans la liste ci-dessous, je surligne les cinq verbes qui, selon moi, décrivent le mieux ce que les participants font au cours de mes rencontres SI-PASS.
11. Pour deux des cinq verbes choisis, je donne une explication dans le contexte de mes rencontres SI-PASS (merci de bien recopier le verbe auquel se rapporte l'explication !).
12. J'ajoute un verbe à la liste si j'estime qu'elle pourrait être complétée.
13. Au terme du dispositif, je me sens un leader SI-PASS :
14. Voici ce que j'ai préféré dans mon expérience de leader SI-PASS...
15. Voici ce que j'ai moins apprécié dans mon expérience de leader SI-PASS...
16. Voici ce qui m'a le plus surpris dans mon expérience de leader SI-PASS...
17. Grâce au dispositif SI-PASS, mes filleul·es ont mieux perçu l'intérêt du cours particulièrement travaillé.
18. Grâce au dispositif SI-PASS, mes filleul·es ont eu envie de s'engager davantage dans le cours que nous avons particulièrement travaillé.
19. Grâce au dispositif SI-PASS, mes filleul·es ont abordé le cours particulièrement travaillé avec plus de confiance.
20. Le dispositif SI-PASS a offert à mes filleul·es des occasions de clarifier des concepts difficiles liés au cours que nous avons particulièrement travaillé.
21. Le dispositif SI-PASS a permis de diminuer le stress de mes filleul·es par rapport au cours particulièrement travaillé.

22. Le dispositif SI-PASS a offert à mes filleul·es de nombreuses occasions d'apprentissage au sujet du cours particulièrement travaillé.
23. Grâce au dispositif SI-PASS, mes filleul·es ont pu mieux gérer la charge de travail relative au cours particulièrement travaillé.
24. Grâce au dispositif SI-PASS, mes filleul·es ont renforcé leur sentiment de responsabilité par rapport au cours particulièrement travaillé.
25. Le dispositif SI-PASS a incité mes filleul·es à assister aux séances du cours particulièrement travaillé.
26. Grâce au dispositif SI-PASS, mes filleul·es ont mieux compris les exigences du titulaire du cours particulièrement travaillé.
27. Le dispositif SI-PASS a soutenu la persévérance de mes filleul·es dans le cours particulièrement travaillé, malgré les difficultés.
28. Le dispositif SI-PASS contribuera à ce que mes filleul·es réussissent l'examen du cours particulièrement travaillé.
29. Être leader SI-PASS a augmenté mon intérêt pour le cours que nous avons particulièrement travaillé.
30. Être leader SI-PASS m'a permis de faire le point sur mes connaissances passées et présentes en lien avec le cours que nous avons particulièrement travaillé.
31. Par rapport aux échanges qui ont pris place dans mon groupe, et aux difficultés qui s'y sont exprimées, je suggérerais ceci au titulaire du cours particulièrement travaillé :
32. Le dispositif SI-PASS a permis à mes filleul·es de renforcer leurs liens.
33. Le dispositif SI-PASS a apporté des informations utiles à mes filleul·es sur la façon dont d'autres travaillent leurs cours.
34. Grâce au dispositif SI-PASS, au moins un·e de mes filleul·es a renoncé à abandonner ses études.
35. Le dispositif SI-PASS a apporté des informations utiles à mes filleul.e.s sur la façon dont d'autres préparent leurs examens.
36. Le dispositif SI-PASS a aidé mes filleul.e.s à mieux négocier la transition de l'enseignement secondaire vers l'enseignement supérieur.
37. Grâce au dispositif SI-PASS, mes filleul.e.s ont développé leur sentiment d'appartenance à l'Université de Liège.
38. Le dispositif SI-PASS a contribué à conforter mes filleul.e.s dans le choix de leurs études.
39. Le dispositif SI-PASS a aidé mes filleul.e.s à gérer des inquiétudes relatives à la vie universitaire.
40. Le dispositif SI-PASS a montré à mes filleul.e.s qu'ils font partie d'une université qui se soucie de leur réussite.
41. Le dispositif SI-PASS a contré le sentiment de mes filleul.e.s qu'à l'université « ils ne sont qu'un numéro ».
42. Le Q2 de l'année académique 2020-2021 était ma :

43. Les deux principales motivations qui m'ont poussé·e à (re-)devenir leader dans le cadre du SI-PASS sont : - Motivation 1
44. Les deux principales motivations qui m'ont poussé·e à (re-)devenir leader dans le cadre du SI-PASS sont : - Motivation 2
45. Par rapport à mon expérience préalable de Leader SI-PASS, voici ce qui a changé quand j'ai repris ce rôle ce Q2 :
46. Sur base de mon expérience, je compte « rempiler » dans le rôle de leader si l'occasion se présente.
47. Parce que...
48. Que je sois rémunéré comme job d'étudiant pour mon travail de Leader SI-PASS est pour moi :
49. Mon rôle de leader SI-PASS a été plus difficile que ce à quoi je m'attendais.
50. J'ai été remis·e en cause en tant que leader SI-PASS
51. Dans mon rôle de leader SI-PASS, j'ai éprouvé un sentiment d'impuissance
52. En tant que leader SI-PASS, je me suis senti·e légitime.
53. En tant que leader SI-PASS, j'ai été content·e de mes parrainé·e·s
54. En tant que leader SI-PASS, je me suis senti·e bien à ma place
55. Par rapport à la recommandation formelle faite aux leaders SI-PASS de « ne pas enseigner », je me suis senti·e :
56. Mon expérience de leader SI-PASS m'a fait voir le parrainage comme une manière intéressante d'apprendre avec d'autres.
57. Mon expérience de leader SI-PASS a renforcé ma motivation pour mes études.
58. Mon expérience de leader SI-PASS m'a permis une fréquentation accrue du personnel de l'université.
59. Mon expérience de leader SI-PASS a renforcé ma confiance en moi.
60. Mon expérience de leader SI-PASS a renforcé mon sentiment d'appartenance à l'Université de Liège.
61. Mon rôle de leader SI-PASS m'a permis, à mon avis, d'entrainer les compétences suivantes :
62. Ce que cette expérience de leader SI-PASS m'a appris sur moi-même...
63. Pour être un Leader SI-PASS encore plus performant, j'aurais eu besoin de...
64. Quand j'étais en première année, j'aurais voulu pouvoir bénéficier d'un tel dispositif SI-PASS.
65. Je recommanderai à d'autres l'expérience de leader.
66. Je garde un bon souvenir des deux demi-journées de formation initiale.
67. La formation donnée en début de dispositif était utile.

68. J'ai participé à un des mini-cursus (rencontres en ligne d'une heure permettant un débriefing collectif des sessions + un approfondissement de divers points du parrainage SI-PASS) organisés ce Q2.
69. Voilà ce que j'en ai pensé...
70. Voici pourquoi je n'ai pas participé...
71. Que ce soit au Q1 ou au Q2, une de mes rencontres SI-PASS/GETS a fait l'objet d'une observation.
72. Voici comment j'ai vécu cette observation et ce que j'en ai retiré...
73. Je recommanderai aux étudiant·e·s de première année de participer au dispositif SI-PASS.
74. Je serais partant·e pour être leader SI-PASS sur un autre cours difficile.
75. La gestion de mon contrat et de ma rémunération a été traitée de manière efficace.
76. J'ai apprécié l'aide facultaire sur le plan pratique.
77. J'ai apprécié le soutien du titulaire du cours au dispositif SI-PASS.
78. J'ai le sentiment que le dispositif SI-PASS fait double-emploi avec d'autres propositions liées au cours (répétitions, permanences, travaux pratiques, remédiations...)
79. Voici ce que je recommanderais aux coordinateurs du dispositif SI-PASS...
80. Je voudrais encore ajouter...

Participants

81. Une douzaine de rencontres formaient le dispositif SI-PASS. En pratique, j'ai participé à :
82. En moyenne, ces rencontres duraient :
83. Voici ce qui m'a motivé·e à participer : - Motivation 1
84. Voici ce qui m'a motivé·e à participer : - Motivation 2
85. Pour que je participe à plus de rencontres, il aurait fallu...
86. Dans la liste ci-dessous, je surligne les cinq verbes qui, selon moi, décrivent le mieux ce que moi-même et les autres participants faisons lors des rencontres SI-PASS.
87. Pour deux des verbes choisis, je donne une explication dans le contexte des rencontres que j'ai vécues (merci de bien préciser à quel verbe se rapporte l'explication !).
88. J'ajoute un verbe à la liste si j'estime qu'elle pourrait être complétée.
89. En dehors des rencontres « officielles », il m'est arrivé de discuter (oralement, par mél, par les réseaux sociaux, etc.) avec le/la leader de mon groupe.
90. En dehors des rencontres « officielles », il m'est arrivé de discuter (oralement, par mél, par les réseaux sociaux, etc.) avec d'autres membres de mon groupe.

91. Ce que j'ai le mieux aimé comme participant·e SI-PASS...
92. Ce qui m'a moins plu dans mon expérience de participant·e SI-PASS...
93. Au terme du dispositif parrainage SI-PASS, je me sens un·e participant·e SI-PASS heureux·se.
94. Grâce au SI-PASS, j'ai mieux compris l'intérêt du cours particulièrement travaillé.
95. Grâce au SI-PASS, j'ai eu envie de m'engager davantage le cours particulièrement travaillé.
96. Grâce au SI-PASS, j'ai abordé le cours particulièrement travaillé avec plus de confiance.
97. Le SI-PASS m'a donné des occasions de clarifier des concepts difficiles liés au cours particulièrement travaillé.
98. Le SI-PASS a diminué mon stress par rapport au cours particulièrement travaillé.
99. Le SI-PASS m'a fourni de nombreuses occasions d'apprentissage au sujet du cours particulièrement travaillé.
100. Grâce au SI-PASS, j'ai pu mieux gérer la charge de travail liée au cours particulièrement travaillé
101. Grâce au SI-PASS, j'ai renforcé mon sentiment de responsabilité par rapport au cours particulièrement travaillé.
102. Le SI-PASS m'a incité à assister aux séances présentielles ou à distance de l'enseignant du cours particulièrement travaillé.
103. Le SI-PASS m'a permis de mieux comprendre les exigences de l'enseignant du cours particulièrement travaillé.
104. Le SI-PASS a renforcé ma persévérance dans le cours particulièrement travaillé, malgré les difficultés.
105. Le SI-PASS va contribuer à ma réussite à l'examen du cours particulièrement travaillé.
106. Le SI-PASS m'a permis de développer des relations avec d'autres étudiants.
107. Le SI-PASS m'a apporté des informations utiles pour travailler mes cours.
108. Ces informations utiles m'ont été apportées par :
109. Grâce au SI-PASS , au moins un·e étudiant·e de première que je connais a renoncé à abandonner ses études.
110. Le SI-PASS m'a apporté des informations utiles sur la manière de préparer mes examens.
111. Ces informations utiles m'ont été apportées par :
112. Le SI-PASS m'a apporté des informations utiles pour créer le plan ou la table des matières d'un cours.
113. Ces informations utiles m'ont été apportées par :

114. Le SI-PASS m'a aidé·e à négocier la transition de l'enseignement secondaire vers l'enseignement supérieur.
115. Le SI-PASS a développé mon sentiment d'appartenance à l'Université de Liège.
116. Le SI-PASS m'a conforté·e dans le choix de mes études.
117. Le SI-PASS m'a aidé·e à gérer des inquiétudes relatives à la vie universitaire.
118. Le SI-PASS m'a montré que je fais partie d'une université qui se soucie de ma réussite.
119. Grâce au SI-PASS, j'ai moins l'impression de n'être, à l'université, qu'un « numéro ».
120. Les rencontres SI-PASS ont été plus utiles que ce à quoi je m'attendais.
121. En tant que participant·e SI-PASS, j'ai été content·e de mon/ma responsable de groupe.
122. Mon expérience du SI-PASS m'a fait voir celui-ci comme une méthode intéressante pour apprendre avec d'autres.
123. J'ai trouvé intéressant de rencontrer un·e étudiant·e qui a réussi sa première année d'université.
124. Je trouve que, en raison de leur complexité, le(s) cours de Bac1 suivants devrai(en)t pouvoir bénéficier d'un dispositif SI-PASS :
125. Je trouve que le SI-PASS fait « double-emploi » avec d'autres propositions pédagogiques (permanences, remédiations, séances de répétition...)
126. Étudiant-moniteur ou Leader SI-PASS : je ne vois pas de différence.
127. J'ai senti que le titulaire du cours soutenait le dispositif SI-PASS.
128. J'ai senti que ma faculté soutenait le dispositif SI-PASS.
129. Après avoir vécu l'expérience comme participant·e cette année, je me vois bien responsable d'un groupe SI-PASS l'an prochain.
130. Je recommanderai à d'autres étudiant·e·s de première année de participer au projet SI-PASS .
131. Aux organisateurs du projet SI-PASS, je voudrais donner le conseil suivant :
132. Je voudrais encore ajouter...
133. Voici pourquoi je ne suis pas ou quasi pas entré·e dans le dispositif SI-PASS...
134. Même si je n'y ai pas ou quasi pas participé, j'ai bien été informé·e par mon/ma leader SI-PASS de la date et du lieu de chaque rencontre SI-PASS.

135. Cette information de mon/ma leader de groupe m'est arrivée (plusieurs réponses possibles) :
136. Cette information de mon/ma leader de groupe m'est arrivée (plusieurs réponses possibles) : - par d'autres moyens (préciser svp ci-dessous)
137. J'ai appris l'existence du SI-PASS pour la première fois...
138. Je voudrais encore ajouter...

1b. SI-PASS Exit Survey (Leaders and Participants) - English Version

1. I know my student ID number(s).
2. My student ID number(s) is/are…
3. If I do not know my student ID number(s) or am unsure, my FIRST NAME is…
4. If I do not know my student ID number(s) or am unsure, my LAST NAME is…
5. I belong to…
6. I belong to the following category:

Leaders

7. Approximately twelve meetings officially formed the mentoring program. In practice, I organized:
8. On average, the meetings I organized lasted:
9. I estimate my average preparation time for an SI-PASS meeting:
10. From the list below, I highlight the five verbs that, in my opinion, best describe what participants do during my SI-PASS meetings.
11. For two of the five selected verbs, I provide an explanation in the context of my SI-PASS meetings (please copy the verb to which the explanation refers).
12. I add a verb to the list if I believe it could be completed.
13. At the end of the program, I feel like an SI-PASS leader:
14. Here is what I liked most about my experience as an SI-PASS leader…
15. Here is what I liked least about my experience as an SI-PASS leader…
16. Here is what surprised me most about my experience as an SI-PASS leader…
17. Thanks to the SI-PASS program, my mentees better understood the relevance of the course that was particularly addressed.
18. Thanks to the SI-PASS program, my mentees were more motivated to engage in the course that we particularly addressed.
19. Thanks to the SI-PASS program, my mentees approached the course that was particularly addressed with greater confidence.
20. The SI-PASS program provided my mentees with opportunities to clarify difficult concepts related to the course that we particularly addressed.
21. The SI-PASS program reduced my mentees' stress regarding the course that was particularly addressed.
22. The SI-PASS program provided my mentees with numerous learning opportunities related to the course that was particularly addressed.
23. Thanks to the SI-PASS program, my mentees were able to better manage the workload related to the course that was particularly addressed.

24. Thanks to the SI-PASS program, my mentees strengthened their sense of responsibility regarding the course that was particularly addressed.
25. The SI-PASS program encouraged my mentees to attend the sessions of the course that was particularly addressed.
26. Thanks to the SI-PASS program, my mentees better understood the instructor's expectations for the course that was particularly addressed.
27. The SI-PASS program supported my mentees' persistence in the course that was particularly addressed, despite difficulties.
28. The SI-PASS program will contribute to my mentees' success in the exam for the course that was particularly addressed.
29. Being an SI-PASS leader increased my interest in the course that we particularly addressed.
30. Being an SI-PASS leader allowed me to review my knowledge past and present related to the course that we particularly addressed.
31. Based on the discussions that took place in my group and the difficulties expressed, I would suggest the following to the instructor of the course that we particularly addressed:
32. The SI-PASS program helped my mentees strengthen their relationships.
33. The SI-PASS program provided my mentees with useful information about how others study their courses.
34. Thanks to the SI-PASS program, at least one of my mentees reconsidered dropping out of their studies.
35. The SI-PASS program provided my mentees with useful information about how others prepare for exams.
36. The SI-PASS program helped my mentees better manage the transition from secondary to higher education.
37. Thanks to the SI-PASS program, my mentees developed their sense of belonging to the University of Liège.
38. The SI-PASS program helped reinforce my mentees in their choice of studies.
39. The SI-PASS program helped my mentees manage concerns related to university life.
40. The SI-PASS program showed my mentees that they belong to a university that cares about their success.
41. The SI-PASS program countered my mentees' feeling that at university "they are just a number."
42. During Q2 of the 2020-2021 academic year, I was:
43. The two main motivations that led me to (re)become an SI-PASS leader were: - Motivation 1
44. The two main motivations that led me to (re)become an SI-PASS leader were: - Motivation 2

45. Compared to my previous experience as an SI-PASS leader, here is what changed when I resumed this role in Q2:
46. Based on my experience, I intend to take on the SI-PASS leader role again if the opportunity arises.
47. Because…
48. Being paid as a student job for my work as an SI-PASS leader is for me:
49. My role as an SI-PASS leader was more difficult than I expected.
50. I was challenged in my role as an SI-PASS leader
51. In my role as an SI-PASS leader, I experienced a feeling of helplessness
52. As an SI-PASS leader, I felt legitimate
53. As an SI-PASS leader, I was satisfied with my mentees
54. As an SI-PASS leader, I felt comfortable in my role
55. Regarding the formal recommendation to SI-PASS leaders "not to teach," I felt:
56. My experience as an SI-PASS leader made me see mentoring as an interesting way to learn with others
57. My experience as an SI-PASS leader strengthened my motivation for my studies
58. My experience as an SI-PASS leader allowed me to interact more with university staff
59. My experience as an SI-PASS leader strengthened my self-confidence
60. My experience as an SI-PASS leader strengthened my sense of belonging to the University of Liège
61. My role as an SI-PASS leader allowed me, in my opinion, to develop the following skills:
62. What this SI-PASS leader experience taught me about myself…
63. To be an even more effective SI-PASS leader, I would have needed…
64. When I was in my first year, I would have liked to benefit from such an SI-PASS program
65. I would recommend the leader experience to others
66. I have positive memories of the two half-days of initial training
67. The training provided at the beginning of the program was useful
68. I participated in one of the mini courses organized during Q2
69. Here is what I thought about it…
70. Here is why I did not participate…
71. One of my SI-PASS/GETS meetings was observed
72. Here is how I experienced this observation and what I gained from it…
73. I would recommend first-year students to participate in the SI-PASS program
74. I would be willing to be an SI-PASS leader for another difficult course

75. The management of my contract and remuneration was handled efficiently
76. I appreciated the faculty's practical support
77. I appreciated the instructor's support for the SI-PASS program
78. I feel that the SI-PASS program duplicates other course-related support
79. Here is what I would recommend to the SI-PASS coordinators…
80. I would like to add…

Participants

81. Approximately twelve meetings formed the SI-PASS program. In practice, I attended:
82. On average, these meetings lasted:
83. Here is what motivated me to participate: - Motivation 1
84. Here is what motivated me to participate: - Motivation 2
85. For me to attend more meetings, it would have required…
86. From the list below, I highlight the five verbs that, in my opinion, best describe what I and the other participants do during SI-PASS meetings.
87. For two of the selected verbs, I provide an explanation in the context of the meetings I attended (please specify which verb the explanation refers to).
88. I add a verb to the list if I believe it could be completed.
89. Outside the "official" meetings, I sometimes discussed (orally, by email, via social networks, etc.) with the leader of my group.
90. Outside the "official" meetings, I sometimes discussed (orally, by email, via social networks, etc.) with other members of my group.
91. What I liked most as an SI-PASS participant…
92. What I liked least in my experience as an SI-PASS participant…
93. At the end of the SI-PASS mentoring program, I feel like a happy SI-PASS participant.
94. Thanks to SI-PASS, I better understood the relevance of the course particularly addressed.
95. Thanks to SI-PASS, I felt more motivated to engage in the course particularly addressed.
96. Thanks to SI-PASS, I approached the course particularly addressed with greater confidence.
97. SI-PASS gave me opportunities to clarify difficult concepts related to the course particularly addressed.
98. SI-PASS reduced my stress regarding the course particularly addressed.
99. SI-PASS provided me with numerous learning opportunities related to the course particularly addressed.

100. Thanks to SI-PASS, I was able to better manage the workload related to the course particularly addressed.
101. Thanks to SI-PASS, I strengthened my sense of responsibility regarding the course particularly addressed.
102. SI-PASS encouraged me to attend the in-person or online sessions of the course particularly addressed.
103. SI-PASS helped me better understand the instructor's expectations for the course particularly addressed.
104. SI-PASS strengthened my persistence in the course particularly addressed, despite difficulties.
105. SI-PASS will contribute to my success in the exam for the course particularly addressed.
106. SI-PASS helped me develop relationships with other students.
107. SI-PASS provided me with useful information for studying my courses.
108. These useful pieces of information were provided by:
109. Thanks to SI-PASS, at least one first-year student I know reconsidered dropping out.
110. SI-PASS provided me with useful information about how to prepare my exams.
111. These useful pieces of information were provided by:
112. SI-PASS provided me with useful information for creating a course outline or table of contents.
113. These useful pieces of information were provided by:
114. SI-PASS helped me manage the transition from secondary to higher education.
115. SI-PASS strengthened my sense of belonging to the University of Liège.
116. SI-PASS reinforced my choice of studies.
117. SI-PASS helped me manage concerns related to university life.
118. SI-PASS showed me that I belong to a university that cares about my success.
119. Thanks to SI-PASS, I felt less like "just a number" at university.
120. SI-PASS meetings were more useful than I expected.
121. As an SI-PASS participant, I was satisfied with my group leader.
122. My experience of SI-PASS made me see it as an interesting way to learn with others.
123. I found it interesting to meet a student who successfully completed their first year.
124. I believe that, due to their complexity, the following first-year courses should benefit from an SI-PASS program:

125. I think SI-PASS duplicates other pedagogical support (office hours, remedial sessions, revision sessions, etc.).
126. Student-monitor or SI-PASS leader: I do not see any difference.
127. I felt that the course instructor supported the SI-PASS program.
128. I felt that my faculty supported the SI-PASS program.
129. After experiencing SI-PASS as a participant this year, I could see myself leading an SI-PASS group next year.
130. I would recommend first-year students to participate in the SI-PASS program.
131. To the organizers of the SI-PASS program, I would give the following advice:
132. I would like to add…
133. Here is why I did not or barely participate in the SI-PASS program…
134. Even though I did not or barely participate, I was informed by my SI-PASS leader of the date and location of each meeting.
135. This information from my group leader reached me (multiple answers possible):
136. This information from my group leader reached me (multiple answers possible): - through other means (please specify below)
137. I first learned about SI-PASS…
138. I would like to add…

2a. PEPPS Exit Survey (Buddies) - French Version

1. Je m'appelle...
2. Mon matricule « s » est le suivant...
3. Je fais partie de la faculté de(s)...
4. 5 ou 6 rencontres formaient le dispositif de parrainage. En pratique, j'en ai organisé :
5. Pour que plus de rencontres aient pu avoir lieu, il aurait fallu...
6. J'ai rempli le questionnaire intermédiaire prévu après chaque rencontre que j'ai organisée.
7. Parce que...
8. Les responsables du dispositif de parrainage avaient proposé un thème de référence pour chacune des 5 rencontres centrales du dispositif (acronyme « PEPPS »). En pratique, j'ai géré ces thèmes ainsi : - Rencontre 1 - Comment je Perçois ce(s) cours ?
9. Rencontre 2 - Comment j'Établis le plan/la table des matières de ce(s) cours ?
10. Rencontre 3 - Comment je Progresse vers la maitrise du/des cours ?
11. Rencontre 4 - Comment je me Prépare aux exigences des enseignants et à l'examen ?
12. Rencontre 5 - Comment j'aborde efficacement ma Session d'examens ?
13. Dans les rencontres que j'ai organisées, les thèmes qui ont le plus occupé les discussions sont (par ordre d'importance) : - Thème 1
14. Thème 2
15. Thème 3
16. Thème 4
17. Thème 5
18. Dans la liste ci-dessous, je surligne les cinq verbes qui, selon moi, décrivent le mieux ce que moi-même et les autres participants font lors des rencontres SI-PASS.
19. J'ajoute un verbe/des verbes à la liste si j'estime qu'elle pourrait être complétée.
20. En plus des rencontres « officielles », il m'est arrivé de discuter avec mes filleul·es (oralement, par mél, par les réseaux sociaux, etc.)
21. Pour que plus de rencontres aient pu avoir lieu, il aurait fallu...
22. Pendant la durée du dispositif de parrainage, il m'est arrivé de discuter (oralement, par mél, par les réseaux sociaux, etc.) avec d'autres parrains/marraines
23. Au terme du dispositif Parrainage, je me sens un parrain :
24. Grâce au parrainage, mes filleul·es ont mieux compris l'intérêt de leurs cours.
25. Grâce au parrainage, mes filleul·es ont eu envie de s'engager davantage dans leurs cours.

26. Grâce au parrainage, mes filleul·es ont abordé leurs cours avec plus de confiance.
27. Le parrainage a donné à mes filleul·es des occasions de clarifier des concepts difficiles liés à leurs cours.
28. L'influence du parrainage sur le stress de mes filleul·es par rapport à leurs cours a été positive.
29. Le parrainage a fourni à mes filleul·es de nombreuses occasions d'apprentissage.
30. Grâce au parrainage, mes filleul·es ont pu mieux gérer leur charge de travail.
31. Le parrainage a renforcé chez mes filleul·es le sentiment de responsabilité par rapport à leurs études.
32. Le parrainage a incité mes filleul·es à assister aux cours.
33. Le parrainage a permis à mes filleul·es de mieux comprendre les exigences des enseignants.
34. Le parrainage a soutenu la persévérance de mes filleul·es dans leurs cours, malgré les difficultés.
35. Le parrainage contribuera à ce que mes filleul·es réussissent leurs examens.
36. Être parrain / marraine a augmenté mon intérêt pour les cours dont nous avons discuté.
37. Être parrain / marraine m'a permis de faire le point sur mes connaissances passées et présentes en lien avec les cours dont nous avons discuté.
38. Le parrainage a permis à mes filleul·es de développer des relations avec d'autres étudiants.
39. Le parrainage a fourni des informations utiles à mes filleuls sur la façon dont d'autres travaillent leurs cours.
40. Grâce au parrainage, au moins un·e de mes filleul·es a renoncé à abandonner ses études.
41. Le parrainage a fourni des informations utiles à mes filleuls sur la façon dont d'autres préparent leurs examens.
42. Le parrainage a aidé mes filleul·es à mieux négocier la transition de l'enseignement secondaire vers l'enseignement supérieur.
43. Grâce au parrainage, mes filleul·es ont développé leur sentiment d'appartenance à l'Université de Liège.
44. Grâce au parrainage, mes filleul·es se sont davantage engagé.es dans leurs études.
45. Le parrainage a conforté mes filleul·es dans le choix de leurs études.
46. Le parrainage a aidé mes filleul·es à gérer les inquiétudes relatives à la vie universitaire.

47. Le parrainage a montré à mes filleul·es qu'ils font partie d'une université qui se soucie de leur réussite.
48. Le parrainage a contré le sentiment de mes filleul·es qu'à l'université « ils ne sont qu'un numéro ».
49. Cette année académique 2020-2021 était ma :
50. Les deux principales motivations qui m'ont poussé·e à devenir ou à redevenir parrain/marraine sont : - Motivation 1
51. Motivation 2
52. Que mon travail de parrain/marraine soit rémunéré comme un job d'étudiant est pour moi :
53. Pratiquer un parrainage « en ligne/à distance » m'a plu parce que...
54. Pratiquer un parrainage « en ligne/à distance » m'a déplu parce que...
55. Mon rôle de parrain-marraine a été plus difficile que ce à quoi je m'attendais.
56. J'ai été remis·e en cause en tant que parrain / marraine
57. Dans mon rôle de parrain / marraine, j'ai éprouvé un sentiment d'impuissance
58. En tant que parrain / marraine, je me suis senti·e légitime.
59. En tant que parrain / marraine, j'ai été content·e de mes parrainé·es
60. En tant que parrain / marraine, je me suis senti·e bien à ma place
61. Mon expérience de parrain / marraine m'a fait voir le parrainage comme une manière intéressante pour apprendre avec d'autres.
62. Mon expérience de parrain / marraine a renforcé ma motivation personnelle pour mes études.
63. Mon expérience de parrain / marraine m'a permis une fréquentation accrue du personnel de l'université.
64. Mon expérience de parrain / marraine a renforcé mon sentiment d'appartenance à l'Université de Liège.
65. Ce que cette expérience de parrainage m'a appris sur moi-même...
66. Quand j'étais en première année, j'aurais voulu pouvoir bénéficier d'un tel parrainage.
67. Je recommanderai à d'autres l'expérience de parrain / marraine.
68. Je garde un bon souvenir de la journée de formation.
69. La formation donnée en début de dispositif était utile.
70. Je recommande aux étudiants de première année de participer au dispositif de parrainage.
71. La gestion de mon contrat et de ma rémunération a été traitée de manière efficace.
72. J'ai apprécié l'aide de ma référente facultaire.
73. Je voudrais encore ajouter...

2b. PEPPS Exit Survey (Buddies) - English Version

1. My name is…
2. My student ID number(s) is/are…
3. I belong to the faculty of…
4. Five or six meetings formed the mentoring program. In practice, I organized:
5. For more meetings to have taken place, it would have required…
6. I completed the intermediate questionnaire provided after each meeting I organized.
7. Because…
8. The mentoring coordinators proposed a reference theme for each of the five central meetings of the program (acronym "PEPPS"). In practice, I managed these themes as follows: - Meeting 1 - How do I **Perceive** this/these course(s)?
9. Meeting 2 - How do I **Establish** the plan/table of contents for this/these course(s)?
10. Meeting 3 - How do I **Progress** toward mastering the course(s)?
11. Meeting 4 - How do I **Prepare** for instructors' expectations and the exam?
12. Meeting 5 - How do I **Successfully approach** my exam session?
13. In the meetings I organized, the themes that occupied discussions the most (in order of importance) were: - Theme 1
14. Theme 2
15. Theme 3
16. Theme 4
17. Theme 5
18. From the list below, I highlight the five verbs that, in my opinion, best describe what I and the other participants do during the mentoring meetings.
19. I add one or more verbs to the list if I believe it could be completed.
20. In addition to the "official" meetings, I sometimes discussed with the participants (orally, by email, via social networks, etc.).
21. For more meetings to have taken place, it would have required…
22. During the mentoring program, I sometimes discussed (orally, by email, via social networks, etc.) with other buddies.
23. At the end of the mentoring program, I feel like a "..." buddy:
24. Thanks to mentoring, my mentees better understood the relevance of their courses.
25. Thanks to mentoring, my mentees were more motivated to engage in their courses.
26. Thanks to mentoring, my mentees approached their courses with greater confidence.

27. Mentoring provided my mentees with opportunities to clarify difficult concepts related to their courses.
28. The influence of mentoring on my mentees' stress regarding their courses was positive.
29. Mentoring provided my mentees with numerous learning opportunities.
30. Thanks to mentoring, my mentees were able to better manage their workload.
31. Mentoring strengthened my mentees' sense of responsibility toward their studies.
32. Mentoring encouraged my mentees to attend classes.
33. Mentoring helped my mentees better understand instructors' expectations.
34. Mentoring supported my mentees' persistence in their courses despite difficulties.
35. Mentoring will contribute to my mentees' success in their exams.
36. Being a buddy increased my interest in the courses we discussed.
37. Being a buddy allowed me to review my past and present knowledge related to the courses we discussed.
38. Mentoring helped my mentees develop relationships with other students.
39. Mentoring provided useful information to my mentees about how others study their courses.
40. Thanks to mentoring, at least one of my mentees reconsidered dropping out.
41. Mentoring provided useful information to my mentees about how others prepare for exams.
42. Mentoring helped my mentees better manage the transition from secondary to higher education.
43. Thanks to mentoring, my mentees developed their sense of belonging to the University of Liège.
44. Thanks to mentoring, my mentees became more engaged in their studies.
45. Mentoring reinforced my mentees' choice of studies.
46. Mentoring helped my mentees manage concerns related to university life.
47. Mentoring showed my mentees that they belong to a university that cares about their success.
48. Mentoring countered my mentees' feeling that at university "they are just a number."
49. During the 2020-2021 academic year, I was:
50. The two main motivations that led me to become or become again a buddy were: - Motivation 1

51. Motivation 2
52. Being paid as a student job for my mentoring work is for me:
53. Conducting mentoring “online/at a distance” appealed to me because…
54. Conducting mentoring “online/at a distance” did not appeal to me because…
55. My role as a buddy was more difficult than I expected.
56. I was challenged in my role as buddy
57. In my role as buddy, I experienced a feeling of helplessness
58. As a buddy, I felt legitimate
59. As a buddy, I was satisfied with my mentees
60. As a buddy, I felt comfortable in my role
61. My mentoring experience made me see mentoring as an interesting way to learn with others.
62. My mentoring experience strengthened my personal motivation for my studies.
63. My mentoring experience allowed me to interact more with university staff.
64. My mentoring experience strengthened my sense of belonging to the University of Liège.
65. What this mentoring experience taught me about myself…
66. When I was in my first year, I would have liked to benefit from such mentoring.
67. I would recommend the mentoring experience to others.
68. I have positive memories of the training day.
69. The training provided at the beginning of the program was useful.
70. I recommend that first-year students participate in the mentoring program.
71. The management of my contract and remuneration was handled efficiently.
72. I appreciated the support of my faculty contact person.
73. I would like to add…

3a. PEPPS Exit Survey (Participants) - French Version

1. Je m'appelle...
2. Mon matricule « s » est le suivant :
3. Je fais partie de la Faculté de(s)...
4. Plusieurs rencontres formaient le dispositif de parrainage, étalées entre septembre et février. En pratique, j'ai participé à :
5. Pour que je participe à plus de rencontres, il aurait fallu...
6. Voici les principales motivations qui m'ont poussé·e à participer à ces rencontres parrainage : - Motivation 1
7. Motivation 2
8. Motivation 3
9. Dans la/les rencontre(s) que j'ai vécue(s), les thèmes qui ont le plus occupé les discussions sont : - Thème 1
10. Thème 2
11. Thème 3
12. Dans la liste ci-dessous, je surligne les cinq verbes qui, selon moi, décrivent le mieux ce que moi-même et les autres participants font lors des rencontres SI-PASS.
13. J'ajoute un verbe/des verbes à la liste si j'estime qu'elle pourrait être complétée.
14. En dehors des rencontres « officielles », il m'est arrivé de discuter (oralement, par mél, par les réseaux sociaux, etc.) avec mon parrain/ma marraine.
15. Pour que des échanges supplémentaires aient pu avoir lieu, il aurait fallu...
16. En dehors des rencontres « officielles », il m'est arrivé de discuter (oralement, par mél, par les réseaux sociaux, etc.) avec des membres de mon groupe de Parrainage PEPPS.
17. Pour que plus des échanges supplémentaires aient pu avoir lieu, il aurait fallu...
18. Ce que j'ai le mieux aimé comme parrainé·e...
19. Ce qui m'a moins plu dans mon expérience de parrainé·e...
20. Au terme du dispositif Parrainage, je me sens un·e filleul·e heureux·se.
21. Voici pourquoi je ne suis pas entré·e dans le projet parrainage...
22. Même si je n'y ai pas participé, j'ai bien été informé·e par mon parrain/ma marraine de la date et du lieu de chaque rencontre-parrainage.
23. Cette information m'est arrivée (plusieurs réponses possibles) :
24. Cette information m'est arrivée (plusieurs réponses possibles) : - par d'autres moyens (préciser svp ci-dessous)
25. Voici où j'ai entendu parler du Parrainage PEPPS pour la première fois :

26. Je voudrais encore ajouter...
27. Grâce au parrainage, j'ai mieux compris l'intérêt de mes cours.
28. Grâce au parrainage, j'ai eu envie de m'engager davantage dans mes cours.
29. Grâce au parrainage, j'ai pu aborder le premier quadrimestre avec plus de confiance.
30. Le parrainage m'a donné des occasions de clarifier des concepts difficiles liés à mes cours.
31. L'influence du parrainage sur mon stress par rapport aux cours a été positive.
32. Le parrainage m'a fourni à de nombreuses occasions d'apprentissage par rapport à mes cours.
33. Le parrainage m'a fourni à de nombreuses occasions d'apprentissage par rapport aux façons d'étudier à l'université.
34. Grâce au parrainage, j'ai pu mieux gérer la charge de travail liée à mes cours.
35. Grâce au parrainage, j'ai renforcé mon sentiment de responsabilité par rapport à mes études.
36. Le parrainage m'a incité à assister aux cours (en présentiel et/ou distanciel).
37. Le parrainage m'a permis de mieux comprendre les exigences des enseignants.
38. Le parrainage a soutenu ma persévérance dans mes études, malgré les difficultés.
39. Le parrainage a contribué à ma réussite aux examens de janvier.
40. Le parrainage m'a permis de développer des relations avec d'autres étudiants.
41. Le parrainage m'a apporté des informations utiles pour travailler mes cours.
42. Ces informations utiles m'ont été apportées par :
43. Grâce au parrainage, au moins un étudiant de première que je connais a renoncé à abandonner ses études.
44. Le parrainage m'a apporté des informations utiles sur la manière de préparer mes examens.
45. Ces informations utiles m'ont été apportées par :
46. Le parrainage m'a apporté des informations utiles pour créer le plan ou la table des matières d'un cours.
47. Ces informations utiles m'ont été apportées par :
48. Le parrainage m'a aidé·e à négocier la transition de l'enseignement secondaire vers l'enseignement supérieur.
49. Le parrainage a développé mon sentiment d'appartenance à l'Université de Liège.

50. Le parrainage m'a conforté·e dans le choix de mes études.
51. Le parrainage m'a aidé·e à gérer des inquiétudes relatives à la vie universitaire.
52. Dans des circonstances Covid où les liens ne pouvaient pas se faire naturellement sur le campus et dans les auditoires, les rencontres Parrainage étaient les bienvenues sur le plan relationnel.
53. Le parrainage m'a montré que je fais partie d'une université qui se soucie de ma réussite.
54. Le parrainage a contré mon sentiment qu'à l'université « je ne suis qu'un numéro ».
55. Les rencontres-parrainage ont été plus utiles que ce à quoi je m'attendais.
56. En tant que parrainé·e, j'ai été content·e de mon parrain/ma marraine.
57. Mon expérience du parrainage m'a fait voir celui-ci comme une méthode intéressante pour apprendre avec d'autres.
58. J'aurais préféré vivre un Parrainage PEPPS en face-à-face plutôt qu'à distance.
59. J'ai trouvé intéressant de rencontrer un·e étudiant·e qui a réussi sa première année d'université.
60. Il m'est arrivé de changer de groupe de parrainage.
61. Après avoir vécu l'expérience comme parrainé·e cette année, je me vois bien parrain/marraine l'an prochain.
62. Je recommanderai à d'autres étudiant·e·s de première année de participer au projet-parrainage.
63. Aux organisateurs du projet parrainage, je voudrais donner le conseil suivant :
64. Je voudrais encore ajouter...

3b. PEPPS Exit Survey (Participants) - English Version

1. My name is…
2. My student ID number(s) is/are…
3. I belong to the faculty of…
4. Several meetings formed the mentoring program, spread between September and February. In practice, I attended:
5. For me to attend more meetings, it would have required…
6. Here are the main motivations that led me to participate in the mentoring meetings: - Motivation 1
7. Motivation 2
8. Motivation 3
9. In the meeting(s) I attended, the themes that occupied discussions the most were: - Theme 1
10. Theme 2
11. Theme 3
12. From the list below, I highlight the five verbs that, in my opinion, best describe what I and the other participants do during the mentoring meetings.
13. I add one or more verbs to the list if I believe it could be completed.
14. Outside the "official" meetings, I sometimes discussed (orally, by email, via social networks, etc.) with my buddy.
15. For additional exchanges to have taken place, it would have required…
16. Outside the "official" meetings, I sometimes discussed (orally, by email, via social networks, etc.) with members of my PEPPS mentoring group.
17. For more additional exchanges to have taken place, it would have required…
18. What I liked most as a participant…
19. What I liked least in my experience as a participant…
20. At the end of the mentoring program, I feel happy as a participant.
21. Here is why I did not participate in the mentoring project…
22. Even if I did not participate, I was informed by my buddy of the date and location of each mentoring meeting.
23. This information reached me (multiple answers possible):
24. This information reached me (multiple answers possible): - through other means (please specify below)
25. Here is where I first heard about the PEPPS mentoring program:
26. I would like to add…
27. Thanks to mentoring, I better understood the relevance of my courses.
28. Thanks to mentoring, I was more motivated to engage in my courses.
29. Thanks to mentoring, I approached the first semester with greater confidence.

30. Mentoring gave me opportunities to clarify difficult concepts related to my courses.
31. The influence of mentoring on my stress regarding courses was positive.
32. Mentoring provided me with numerous learning opportunities related to my courses.
33. Mentoring provided me with numerous learning opportunities regarding how to study at university.
34. Thanks to mentoring, I was able to better manage the workload related to my courses.
35. Thanks to mentoring, I strengthened my sense of responsibility regarding my studies.
36. Mentoring encouraged me to attend classes (in person and/or online).
37. Mentoring helped me better understand teachers' expectations.
38. Mentoring supported my persistence in my studies, despite difficulties.
39. Mentoring contributed to my success in the January exams.
40. Mentoring helped me develop relationships with other students.
41. Mentoring provided me with useful information for studying my courses.
42. These useful pieces of information were provided by:
43. Thanks to mentoring, at least one first-year student I know reconsidered dropping out.
44. Mentoring provided me with useful information about how to prepare my exams.
45. These useful pieces of information were provided by:
46. Mentoring provided me with useful information for creating a course outline or table of contents.
47. These useful pieces of information were provided by:
48. Mentoring helped me manage the transition from secondary to higher education.
49. Mentoring strengthened my sense of belonging to the University of Liège.
50. Mentoring reinforced my choice of studies.
51. Mentoring helped me manage concerns related to university life.
52. In COVID circumstances where relationships could not naturally develop on campus and in lecture halls, mentoring meetings were welcome from a relational perspective.
53. Mentoring showed me that I belong to a university that cares about my success.
54. Mentoring countered my feeling that at university "I am just a number."
55. Mentoring meetings were more useful than I expected.
56. As a participant, I was satisfied with my buddy.

57. My mentoring experience made me see mentoring as an interesting way to learn with others.
58. I would have preferred to experience PEPPS mentoring face-to-face rather than remotely.
59. I found it interesting to meet a student who successfully completed their first year.
60. I changed mentoring groups at some point.
61. After experiencing mentoring as a mentee this year, I could see myself becoming a buddy next year.
62. I would recommend first-year students to participate in the mentoring project.
63. To the organizers of the mentoring project, I would give the following advice:
64. I would like to add…

4a. PEPPS Exit Survey (Attendance) - French Version

1. Mon prénom est...
2. Mon nom est...
3. J'exerce mon rôle dans le cadre du parrainage en faculté de...
4. Merci d'indiquer les noms (NOM + PRENOM) des participant·e·s à votre rencontre de parrainage. Ces données resteront confidentielles et visent à :
    1) pouvoir évaluer la participation au dispositif de parrainage;
    2) établir des corrélations entre participation au dispositif de parrainage et profil des filleul·e·s. - Participant·e 1
5. Participant·e 2
6. Participant·e 3
7. Participant·e 4
8. Participant·e 5
9. Participant·e 6
10. Participant·e 7
11. Participant·e 8
12. Participant·e 9
13. Participant·e 10
14. Participant·e 11
15. Participant·e 12
16. Participant·e 13
17. Participant·e 14
18. Participant·e 15
19. Je me suis senti·e à l'aise au cours de la rencontre...
20. Cette rencontre a duré...
21. J'ai préparé cette rencontre pendant...
22. Voici les trois thèmes qui ont suscité le plus de discussion pendant cette rencontre : - Thème 1
23. Thème 2
24. Thème 3
25. Ce qui m'a surpris·e positivement au cours de cette rencontre est...
26. Ce qui m'a surpris·e négativement au cours de cette rencontre est...
27. J’ai consulté les ressources du site parrainage pour préparer ma rencontre...
28. Je voudrais ajouter...

4b. PEPPS Exit Survey (Attendance) - English Version

1. My first name is…
2. My last name is…
3. I carry out my mentoring role within the faculty of…
4. Please indicate the names (LAST NAME + FIRST NAME) of the participants in your mentoring meeting. These data will remain confidential and aim to:
    1. evaluate participation in the mentoring program;
    2. establish correlations between participation in the mentoring program and mentee profiles. - Participant 1
5. Participant 2
6. Participant 3
7. Participant 4
8. Participant 5
9. Participant 6
10. Participant 7
11. Participant 8
12. Participant 9
13. Participant 10
14. Participant 11
15. Participant 12
16. Participant 13
17. Participant 14
18. Participant 15
19. I felt comfortable during the meeting…
20. This meeting lasted…
21. I prepared this meeting for…
22. The three themes that generated the most discussion during this meeting were: - Theme 1
23. Theme 2
24. Theme 3
25. What positively surprised me during this meeting was…
26. What negatively surprised me during this meeting was…
27. I consulted the mentoring website resources to prepare my meeting…
28. I would like to add…