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## Introduction

The course *Special Histology* is taught in the third year of the Bachelor's degree in veterinary medicine (BMV3). It consists in studying the microscopic structure of organs in relation to their functions. During practical classes, students observe histological slides on a microscope or via a virtual microscopy device and learn how to describe them, to compare organs with one another and to deduce some diagnostic reasoning from their observations. Summative assessment bases on the identification and complete description of 3 histological slides, including one which has not been studied during practical classes but randomly picked up in a virtual library available circa 1 month before the exam.

The amount and complexity of course contents are much greater than regarding the course *General Histology*, taught in BMV2. In consequence, some students have difficulties in understanding or structuring contents, despite the various resources offered during practical classes. Such difficulties have prompted the creation of a tutored online remedial course as a complement of the main course. The remedial course is based on four main principles: (i) voluntary enrolment, (ii) structured and progressive learning, (iii) individualized guidance and (iv) the opportunity for each student to work at his/her own pace.

The present study aims at determining the learning profiles of participants in the remedial course and at making out the course's effects on each profile in terms of engagement, perceptions and performance.

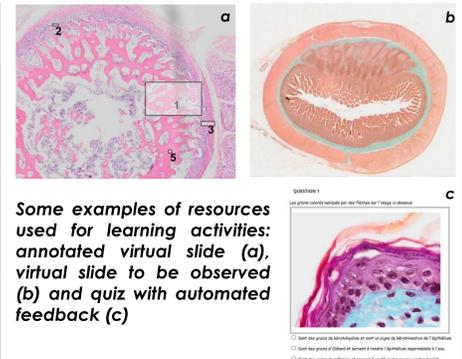
## Description of the remedial course

The online remedial course consists of 12 independent modules. Each module is dedicated to one specific organ system.

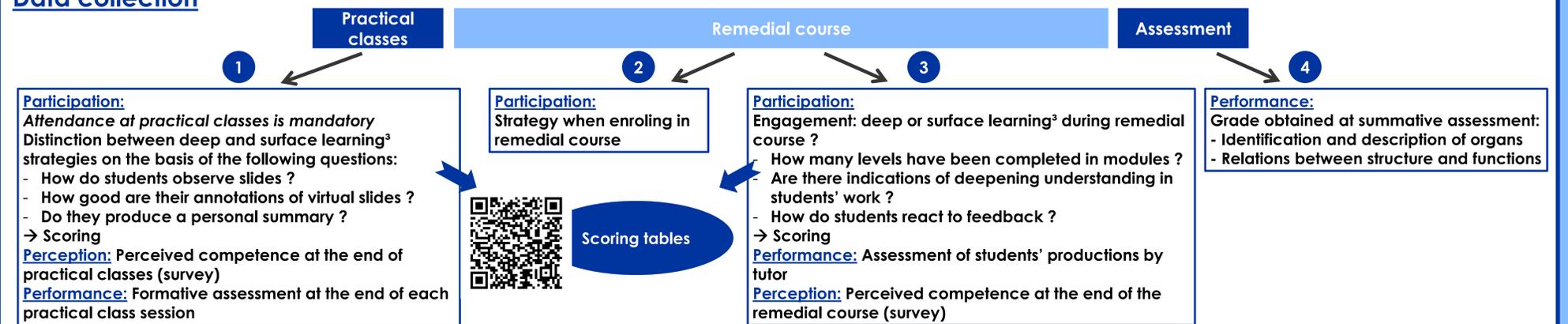
Exercises classified according to 3 difficulty levels were developed by combining the institutional e-learning platform (eCampus) with the virtual microscopy application Cytomine/Shareview<sup>2</sup>.

For each module, completion of level 1 exercises is mandatory to get access to level 2 and so on, in order to facilitate progressive learning.

Difficulty level	Learning activities	Learning objectives (Bloom) <sup>1</sup>
1	Revision of basic theoretical notions or prerequisites by means of multiple choice quizzes, drawing annotation, synthesis of histological criteria... → Automated and personalized feedback	Knowledge and comprehension
2	Detailed and guided description of histological slides very similar to those observed during practical classes → Personalized feedback	Knowledge, comprehension and application
3	Autonomous identification and description of unknown histological slides → Personalized feedback	Analysis



## Data collection



## Results

### Identification of student profiles

Despite the small number of participants (n=22), four learning profiles could be determined. Profiles differ from each other essentially in terms of students' strategic choices when entering the course and regarding their engagement in remedial exercises. **Engaged students** successfully completed the 3 levels of the remedial modules they selected, and they resorted to deep learning strategies. **Strategic pragmatic students** always selected one or a few specific modules, and they completed only level 1 and 2. They resorted to strategies situated between deep and surface learning. **Strategic superficial students** did not make a selection at the time of enrolment and requested instead registration for all modules. But they usually completed only level 1 of modules, or a few exercises of level 2, and they resorted to superficial learning strategies. **Abdicating students** enrolled in remedial course, but they did not carry out any activity in all or most selected modules, or never completed level 1. One student did not correspond to any identified profile.

### Performances and learning strategies according to identified profiles

Further analysis of pre- and post-remedial course data showed some other similarities between students sharing the same learning profile in relation to the remedial course, and are summarized in the table below.

	Engaged students (5/22)	Strategic pragmatic students (5/22)	Strategic superficial students (7/22)	Abdicating students (4/22)
<b>1</b> Learning strategy during practical classes	Usually surface	Intermediary	Intermediary or surface	Variable
<b>1</b> Performance at the end of practical class sessions	Good or inconstant	Inconstant	Inconstant or low	Usually inconstant
<b>2</b> Choice of specific modules	Variable	Yes	No	Variable
<b>3</b> Progression in modules	Level 1, 2 and 3	Level 1 and 2	Level 1 (+/- level 2)	No activity, or never completed level 1
<b>3</b> Learning strategy during remedial course	Deep	Intermediary	Surface	/
<b>4</b> Performance at summative assessment and ranking*	5/5 success Q2 (1/5)-Q3 (4/5)	5/5 success Q2 (3/5)-Q3 (1/5)-Q4 (1/5)	4/7 success Q1 (2/7)-Q2 (3/7) Q3 (1/7)-Q4 (1/7)	1/4 success Q1 (2/4)-Q2 (1/4)- Q3 (1/4)

\* Success: grade  $\geq 10/20$

Performances at summative assessment were ranked using quartiles. Q1 = bottom quartile, Q4 = top quartile.

Deeper analysis of performance at summative assessment showed that all engaged students and most strategic pragmatic students (4/5) performed better than the mean of the class in observing histological slides very similar to those observed during practical classes, whether or not those slides were related to a chapter dealt with in remedial course. They performed well regarding a) the description of the slide and b) the understanding of relationships between structure and function. Conversely, their performance in analysing an unknown slide was usually (7/10) lower than the mean of the class.

An opposite trend was observed for strategic superficial students: 6/7 showed a better performance than the mean of the class in analysing an unknown slide, but a lower performance in description and understanding of slides addressed during practical classes.

### Perceptions

Students' perceptions in relation to the remedial course were generally positive, regardless of the learning strategy they adopted. We noticed for all participating students a positive effect of the remedial course on their perceived competence. Increase of perceived competence was related to engagement in remedial activities.

## Discussion and conclusion

The descriptive study of a remedial course enabled us to identify four empirically based student profiles. Remediation seems effective for engaged and strategic pragmatic students, improving success rates and performance in analysing histological slides previously observed during practical classes. However, remedial activities seem quite inefficient in training students to describe without any help an unknown slide. In addition, we observed for engaged students an improvement of learning strategies during participation in the remedial course. Strategic superficial students showed lower success rates at summative assessment and surface learning strategies.

Collected data are limited to a single run of the remedial course and are not meant to be generalized. They have no predictive value: they do not make it possible to determine systematically to which students the remedial course should be assigned, nor to anticipate the behavior of a student from the moment he/she enrolls in the course. However, data could be used to inform students about the benefits that can be derived from the course and about the kind of learning strategy to adopt in order to make the most of it.

Regulation perspectives mainly concern level 3 activities. It would consist in introducing, for the purpose of formative evaluation related to unknown slides, highly detailed rubrics, insofar as more accurate feedback on errors or deficiencies could improve students' readiness to describe unknown slides.