

LEARNING TO LEARN: ASSESSMENT OF METACOGNITIVE COMPETENCIES

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Abstract

Numerous students are having school difficulties linked to the way they learn. Some authors speak of a “metacognitive deficit”. We refer to a “sleeping potential” instead (Frenkel, 2013, in press; Frenkel & Deforge, in press; Frenkel & Nobile, 2013). Be it psychologists, teachers or parents, all wish to develop their skills in order to help these students. This is the case in primary and secondary school.

Metacognitive abilities play a central role in learning (e.g., Frenkel & Deforge, in press; Giasson, 2001; Grangeat, 1997; Hessels & Hessels-Schlatter, 2010b; Lumbelli, 2003; Poissant, Poëllhuber & Falardeau, 1994; Rozencwajg, 2003; Veenman, Kok & Blöte, 2005) and thus in successful school learning (Büchel, 2013a, 2013b; Van der Stel & Veenman, 2010; Wang, Haertel & Walberg, 1994). However, studying them requires that we clarify what is meant by “metacognition” and “metacognitive abilities”.

In this framework, we developed the EDUCA + project which is intended to provide possible solutions.

EDUCA + is based on wide field experience. Its theoretical background is based on a substantial review of the literature. Its objective is to increase the expertise of “front line” field workers by developing specific products such as tools, training courses, services, and a website (Frenkel, in press). This will notably enable them to develop their expertise, detect « sleeping » potential, diagnose, give advice when necessary, intervene (prevention and remediation) and use the tools efficiently.

Two types of tools are being designed. On the one hand, assessment tools (tests allowing to put forward the learner’s strengths and weaknesses as well as the scope of his/her “sleeping potential”). On the other hand, intervention tools (short prevention vs. remediation programs). This also includes training courses and services. The creation of a website also aims to reinforce the actions of EDUCA + (personalized access depending on the internaut’s profile: students, parents, professionals).

The aim of this paper is to present this research project and its main theoretical background.

Keywords: Metacognition, School, Student, Potential, Dynamic Assessment.

1 INTRODUCTION

Facing the rise in requests for consultations related to school learning difficulties as well as requests for tools and additional methods by professional field workers, the EDUCA + project constitutes one of the possible answers. This paper focuses on one of the project’s goals, which is the creation of a Dynamic Assessment (DA) tailored to primary and secondary school learners. In this perspective, a brief introduction to the EDUCA + project will first be given, then, DA itself will be addressed along three lines: a reminder of its main characteristics, a review of the literature on existing tests, and the variables to evaluate. Finally, the planned perspectives will be presented.

In accordance with the principles of cognitive education, the term « **learner** » will be used to refer to any individual in a learning situation, be it the primary or secondary school student, or the higher education student or the adult learner. The term « **mediator** » will be used to refer to any individual carrying out a DA, be it a psychologist, teacher, or educator.

2 EDUCA +

The EDUCA + project is funded by Wallonia (SPW, Belgium) and is being developed at the University of Liège (ULg, Belgium). It started in March 2013. Its main objective is to increase the expertise of “front line” field workers by developing specific products such as tools, training courses, services, and a website (for more details, see Frenkel, in press). This will notably enable them to develop their expertise, detect « sleeping » potential, diagnose learning difficulties, give advice when necessary,

intervene (prevention and remediation) and use the tools efficiently. This paper focuses on one of the tools, the Learning Potential Assessment (LPA) designed for school psychologists.

The target population for the DA we plan to develop is composed of mainstream children in primary and secondary school. The objective is to highlight the strengths and weaknesses in the learner's learning behavior, whether at the cognitive, metacognitive or psycho-affective levels. It is planned to design a tool that will enable to detect « sleeping potential », in a remedial perspective, while doing everything to minimize risks of subjectivity in mediational skills, as pointed out by Haywood and Lidz (2007). This tool should enable the gathering of information in order to define an intervention program tailored to the learner's characteristics. Grounded on solid theoretical background, mainly from Cognitive Psychology, Development Psychology and Cognitive Education, it will be composed of tasks which will have been empirically validated and standardized. It will be built from decontextualized tasks. The length of the DA will be short (in principle less than an hour). Its efficiency will have to be ensured without long and costly training courses for psychologists.

3 THEORETICAL BACKGROUND

3.1 Dynamic assessment

A DA, or LPA, implies active intervention from the mediator and an evaluation of the learner's response after mediation (Haywood & Lidz, 2007; Hessels & Hessels-Schlatter, 2010a; Tzuriel, 2013). Changes in performance in this test situation are considered as indicators of the person's learning potential (Murphy, 2011; Tzuriel, 2011). This assessment allows not only to identify the learner's strengths and weaknesses but also the acquired cognitive and metacognitive tools, and mostly, unexploited potential (*i.e.*, the learner's learning capacity), (Büchel & Paour, 1990; Swanson, 2009). DA and "sleeping potential" are two concepts which bring a positive approach to the individual as they are based on his/ her potential and not on his/her weaknesses.

Two central theoretical assumptions of Cognitive Education are also present in the foundations of DA, those of modifiability and re-educability of thought functioning through mediated learning experience (Falik & Feuerstein, 2005; Feuerstein, Rand, Hoffman & Miller, 1980).

Although there are various types of DA approaches, their common denominator is the existence of a gap between efficiency observed in usual standard conditions and efficiency obtained with the mediator's help (Paour, Jaume & de Robillard, 1995).

3.2 A literature review on dynamic assessment tests

3.2.1 Test selection criteria

Based on the above-mentioned goals, we limited ourselves to the selection of DA tests explicitly presented as such by their authors and whose objectives fall within the educational settings. Thus, we focused this review of literature on tools assessing main abilities in school learning, be it at domain-general (24 tests selected) or domain-specific levels (7 tests selected). Our selection also centered on tests aiming at a population mainly composed of children and/or teenagers. Tests particularly focused on adults (including university students) have thus been ruled out. Similarly, child psychopathology has also been left out (*e.g.*, AnimaLogica; Resing, Stevenson & Bosma, 2012). Finally, we have only kept the tests for which our research has enabled us to collect enough information (*i.e.*, author(s), date of creation, name, target population, type of tasks used and aspects assessed).

3.2.2 Test classification criteria

Several classifications of DA approaches have been carried out (*e.g.*, Caffrey, Fuchs & Fuchs, 2008; Grigorenko & Sternberg, 1998; Haywood & Lidz, 2007; Hessels & Hessels-Schlatter, 2010a; Kaniell, 2010; Paour *et al.*, 1995; Pasquier, 1997; Sternberg & Grigorenko, 2002; Swanson & Lussier, 2001). Several among these authors have presented a classification similar to that defended in 1998 by Grigorenko and Sternberg (Hessels & Hessels-Schlatter, 2010a; Pasquier, 1997; Swanson & Lussier, 2001). The classification we propose enables us to analyze existing tests according to their characteristics. Our objective here is mainly a pragmatic one and it represents a crucial step in the development of our test, in parallel with the justification and the operationalization of the measured variables.

Our first classification criterion relates to the target population. Although Haywood and Lidz (2007) do not take it into account, this criterion is used by Grigorenko and Sternberg (1998) and it seems of primary importance to us given our objectives. Therefore, referenced tests are first divided into three categories depending on the level of development of the main target population: *Preschool* (CA or DA ≤ 5 years old), *Preschool and School* (CA or DA ≤ 18 years old) and *School* ($6 \leq$ CA or DA ≤ 18 years old). The *Preschool and School* category gathers the tools that were built, since the beginning, in order to be used with both age categories.

Our second classification criterion is linked to the characteristics of the test's target population. Indeed, in referenced tests, some are intended for regular students, others are intended for particular groups, that is, which are grouped according to characteristics such as, for example, socio-cultural background (family characteristics) or the presence of intellectual deficiency (individual characteristics). We have formalized this by distinguishing three sub-categories: *Mainstream*, *Mainstream and Specific*, and, *Specific*. When the available data on the test do not indicate the specific character or the target population, the *Mainstream* category has been chosen (e.g., Children's Conceptual and Perceptual Analogical Modifiability (CCPAM); Tzuriel & Galinka, 2000). The same principle applies to tests aimed at children with learning difficulties without any intellectual deficiency (e.g., EPA2000; De Clercq, Desoete & Roeyers, 2000).

Considering our goals, the contents of the tasks used are an essential criterion. This element of classification has also been used by Grigorenko and Sternberg (1998)¹. Thus, we distinguish two categories: *Decontextualized* including the tests using decontextualized tasks (i.e., whose contents are not school-oriented) and *Contextualized* including those using contextualized tasks (i.e., whose contents are school-oriented and look similar to school tasks). We would like to point out here the distinction we make between the tests classified as being *Contextualized* and those Haywood and Lidz (2007) call "Curriculum-based dynamic assessment". These authors include in the latter tests which, at the school level « can incorporate virtually any specific content or relate to any domain » (p. 177). Thus they include in this category both the tests whose contents are of school-type and the tests which can be linked to a school subject but whose contents are in themselves not especially academic (e.g., CAS/GDA; Lidz & Greenberg, 1997). Concerning our categorization, in accordance with the type of task, we classify this test under the *Decontextualized* category.

3.2.3 Test classification

Table 1 presents the 31 tests selected (on the basis of the 43 tests analyzed) and classified according to the above-mentioned criteria.

Table 1. Classification of dynamic assessment in an educational setting according to target population and task characteristics

PRE-SCHOOL	Mainstream	CCPAM (Tzuriel & Galinka, 2000) <u>Sequence of Sets Test</u> (Guthke, 1983)
	Mainstream and Specific	ACFS (Lidz & Jepsen, 1999) <u>CATM</u> (Tzuriel & Klein, 1985) CITM (Tzuriel, 1989) <u>CSTM</u> (Tzuriel, 1995b)
	Specific	<u>Raven Short-Term Learning Test</u> (Frohriep, 1978, as cited in Guthke & Wingenfeld, 1992)
PRE-SCHOOL AND SCHOOL	Mainstream	Auditory Analysis Test (Tissink, Hamers & Van Luit, 1993, as cited in Haywood & Lidz, 2007) CMB (Tzuriel, 1995a) Prerequisites for Arithmetics Test (Tissink <i>et al.</i> , 1993, as cited in Haywood & Lidz, 2007)
	Mainstream and Specific	<u>HART</u> (Berger, Bosson & Hessels, 2004)
	Specific	<u>LEM</u> (Hamers, Hessels & Van Luit, 1991) Test d'Apprentissage pour les enfants étrangers en Suisse (Hessels & Schlatter, 1999)

¹ Grigorenko and Sternberg (1998) speak in terms of "nature of materials" (i.e., they categorize DA approaches depending on the fact that it is artificial, that the testing concerns specific domains or that the approach is oriented in a psychometric manner).

SCHOOL	Mainstream	<u>ACIL</u> (Guthke, Beckmann, Stein, Vahle & Rittner, 1995, as cited in Sternberg & Grigorenko, 2002) Lerntestbatterie Schlussfolgerndes Denken (Guthke, Jäger & Schmidt, 1983) <u>Seria-Think Instrument</u> (Tzuriel, 2000) EPA2000 (De Clercq <i>et al.</i> , 2000) MATHPLAN (Warren, 2002, as cited in Haywood & Lidz, 2007) STOPV-DA (Berman, 2001) Dynamath (Gerber, Semmel & Semmel, 1994) TEDE 6 (Pasquier, 2003)
	Mainstream and Specific	CAS/GDA (Lidz & Greenberg, 1997) LPAD-Standard (Feuerstein, 1968; Falik & Feuerstein, 2005) <u>Raven Progressive Matrices Potential Learning Test</u> (Budoff & Corman, 1976)
	Specific	S-CPT (Swanson, 1995) <u>ARLT</u> (Büchel, Schlatter & Scharnhorst, 1997) <u>Dynamic Master Mind</u> (Saldaña, 2004b) <u>Dynamic version of the Kohs Block Design Test</u> (Budoff & Friedman, 1964) <u>Interactive “Where’s Wally?” task²</u> (Saldaña, 2004a) <u>Series Learning Potential Test</u> (Babad & Budoff, 1974) <u>TAPA</u> (Büchel, Schlatter, Kipfer & Bosshard, 2009)

Note: We distinguish first the tests built on decontextualized tasks (underlined test name) and those built on contextualized material (non-underlined test name). In each category we then distinguish the tests which include only one task (non bold test name) and those which can be labeled as battery because they include several tasks (bold test name).

Concerning variables measured in these DA procedures, more than half of these include one or more tasks analyzing the general reasoning abilities: ACIL, ARLT, CATM, CCPAM, CITM, CMB, CSTM, dynamic version of the Kohs Block Design Test, HART, LEM, Lerntestbatterie Schlussfolgerndes Denken, LPAD-Standard, Raven Progressive Matrices Learning Potential Test, Raven Short-Term Learning Test, Sequence of Sets Test, Series Learning Potential Test, TAPA, Test d’Apprentissage pour enfants étrangers en Suisse. A small proportion includes one or several tasks assessing the information processing abilities: ACFS, CAS/GDA, CMB, LEM, LPAD-Standard, S-CPT, Test d’Apprentissage pour enfants étrangers en Suisse. Besides, less than one third of the tests have been designed to assess the skills linked more particularly to one or several academic domains: ACFS, Auditory Analysis Test, Dynamath, EPA2000, MATHPLAN, Prerequisites for Arithmetics Test, Sequence of Sets Test, Seria-Think Instrument, STOPV-DA. Although it is an important component of school learning, only 4 tests are mentioned as assessing metacognitive abilities: ACFS, Dynamic Master Mind, EPA2000, Interactive “Where’s Wally?” task. For only 2 tests do the authors declare that their first objective is to assess cognitive modifiability in a more general way: LPAD-Standard and TEDE6. Besides, several tests can be placed in different categories: ACFS, CMB, EPA2000, LEM, LPAD Standard, Sequence of Sets Test, Test d’Apprentissage pour enfants étrangers en Suisse.

If we consider again the goals to be reached when creating this test, in the light of available data on referenced tests, 24 tests concern a school-age public of which 15 are suitable for mainstream children. Among these, 9 tests are based on decontextualized tasks. Our objective being to assess the strengths and weaknesses of the pupil in school learning at a domain-general level, we can rule out the tests assessing a particular aspect of intellectual functioning, such as, for example, analogical reasoning: HART and Raven Progressive Matrices Learning Potential Test. We do the same with tests falling within a specific academic domain: Auditory Analysis Test and Seria-Think Instrument. Thus there are 5 tools left: ACIL, CAS/GDA, CMB, Lerntestbatterie Schlussfolgerndes Denken, LPAD-Standard. The CAS/GDA is administered to groups. It consists more particularly in a « screening procedure » than a diagnostic test (Haywood & Lidz, 2007). Among the 4 other DA procedures, only the LPAD-Standard covers primary and secondary school periods. Although it is a useful tool, it remains too time-consuming: between 9 and 15 hours (Falik & Feuerstein, 2005). Moreover, it implies a complex scoring and interpretation process and requires substantial training from the mediator (Sternberg & Grigorenko, 2002). Our conclusion is that, at the present time, none of the existing DA procedures can provide an assessment of metacognitive knowledge *and* metacognitive strategies – as

² Saldaña (2004a) does not give his test a precise name. The name of the game’s character on which the test is based is Wally in Spain and Great Britain, Waldo in the USA, and Charlie in France.

defined below – suitable for both primary and secondary schools in a time usually necessary for psychological assessment (e.g., time necessary for an IQ test).

3.3 Variables to assess

Even if cognitive and metacognitive functions could be interchangeable in the sense that the same strategy can serve both cognitive and metacognitive goals (Brown, 1987), it is important to distinguish these two levels in learning. Based on the writings of the main authors on metacognition, more particularly those of Büchel and other members of his team (e.g., Büchel, 2007, 2013a; Büchel & Büchel, 2009), we think that metacognitive knowledge is at the basis of metacognitive strategies which lead and coordinate cognitive strategies (external memory strategies, chunking, rehearsal, etc.) as well as cognitive processes (for more details, see Frenkel & Deforge, in press).

In accordance with Flavell's taxonomy (1979) and the points brought by Berger and Büchel (2013), metacognitive knowledge includes: (a) knowledge about people (relating to motivations, emotions, cognitions, etc.), (b) tasks (pre-knowledge of contents, difficulty level, reasons for the difficulty level, etc.) and (c) cognitive and metacognitive strategies (declarative knowledge, procedural knowledge, conditional knowledge, etc.). Concerning metacognitive strategies, self-regulatory mechanisms of cognitive functioning, we distinguish the processes of learning preparation (anticipation and planning) and supervision of learning (continuous control *and* final control), (for more details, see Frenkel & Deforge, in press).

Psycho-affective variables play a central role in learning. More particularly, we underline the role played by perceived self-efficacy (Bandura, 2003), causal attributions (Weiner, 1985), motivational drives (see Berger & Büchel, 2012 *and* Sarrazin & Trouilloud, 2006), achievement goals (Dweck, 1986; Elliot & McGregor, 2001; Urdan, 1997), frustration management, or style of responding to failure (Abramson, Seligman & Teasdale, 1978; Berger, 2008; Cullen, 1985; Moè & De Beni, 2001) and self-handicapping strategies (Midgley, Arunkumar & Urdan, 1996). Thus, our works come within the framework of self-regulated learning; a concept which finds its sources in the works of Bandura, Borkowski, Boekarts, Pintrich, Winne and Zimmerman and their respective teams (see Cosnefroy, 2011; Efklides, 2011).

4 CONCLUSION

Compared with the static test approach, DA is reported as being a “more accurate and useful approach for measuring individual's cognitive abilities and relating them to various educational and intervention variables” (Tzuriel, 2001, p. 487). Traditional standardized tests (*i.e.*, static tests) often present the risk of under evaluating the potential level of performance (Brown & Campione, 1986). They do not measure the process, but the result of the cognitive activity. DA is an alternative to traditional tools for measuring and diagnosing intelligence (Paour *et al.*, 1995). Our objective is not to replace a type of assessment by another one, but to propose an alternative solution when the situation requires it, notably in order to identify and specify the pupils' learning difficulties linked to ways of learning.

Our choice is to design a DA based on the DELV³ (Büchel & Büchel, 2011). The DELV has been used both at the *Atelier d'Apprentissage*⁴ of the University of Genève (Unige, Switzerland) and at that of the University of Liège (ULg, Belgium) since their creation (respectively in 1996 and in 2009), (for more details, see Büchel, 2013a; Frenkel, in press). This intervention program is also used as a DA test during the first interview at the *Atelier d'Apprentissage*. The use of some school tasks allows to define the specific or general character of variables observed. More precisely, it helps define the pupil's learning potential and to specify future remedial objectives. Any task can be used in order to administer a DA if the evaluator mediates, explains and interacts (Kaniel, 2010). However, the analysis will be deeper and more precise if the mediator uses material designed with this explicit goal. Hence the creation of an LPA test including adapted exercises from the DELF (Büchel & Büchel, 1995) and DELV (Büchel & Büchel, 2011).

³ “DELV: Understanding one's own learning” is a 165-page metacognitive intervention program. It includes 8 types of decontextualized exercises which notably allow to develop the learner's metacognitive abilities and strategies. They also make it possible to work on the above-mentioned psycho-affective aspects. Transfer can thus be better developed. See www.delv.ch.

⁴ Part of the Psychological and Speech therapy consultation Center (CPLU, ULg), the *Learning Workshop* intended for pupils with temporary school learning difficulties. See www.cplu.ulg.ac.be.

Generally, DA tests are longer than static tests. They also require more experience and expertise on the part of the mediator (for more details, see Tzurriel 2001, 2013). However, clinical experience within the *Ateliers d'Apprentissage* (Unige and ULg) shows that the first step for a quality LPA can be carried out in 20 to 30 minutes by an experienced mediator with a mainstream child in primary or secondary school. Our ambition is to formalize and standardize this practice.

This type of tool will allow to identify more easily learning difficulties linked to ways of learning. This will also make it possible to propose cognitive remediation with a metacognitive approach which, notably based on the principles of Feuerstein's mediated learning, will enable the learner to become aware of his or her learning behavior (cognitive, metacognitive, and psycho-affective levels) and to develop efficiency from it.

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