NEW PERSPECTIVES ON LEARNING AND INSTRUCTION

Learning Patterns in Higher Education

Dimensions and research perspectives

Edited by David Gijbels, Vincent Donche, John T. E. Richardson and Jan D. Vermunt

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ROUTLEDGE

Learning Patterns in Higher Education

Learning Patterns in Higher Education brings together a cutting edge international team of contributors to critically review our current understanding of how students and adults learn, how differences and changes in the way students learn can be measured in a valid and reliable way, and how the quality of student learning may be enhanced.

There is substantial evidence that students in higher education have a characteristic way of learning, sometimes called their learning orientation (Biggs 1988), learning style (Evans et al. 2010) or learning pattern (Vermunt and Vermetten 2004). However, recent research in the field of student learning has resulted in multifaceted and sometimes contradictory results which may reflect conceptual differences and differences in measurement of student learning in each of the studies. This book deals with the need for further clarification of how students learn in higher education in the 21st century and to what extent the measurements often used in learning pattern studies are still up to date or can be advanced with present methodological and statistical insights to capture the most important differences and changes in student learning.

The contributions in the book are organized in two parts: a first conceptual and psychological part in which the dimensions of student learning in the 21st century are discussed and a second empirical part in which questions related to how students' learning can be measured and how it develops are considered.

Areas covered include:

- Cultural influences on learning patterns
- Predicting learning outcomes
- Student centred learning environments and self-directed learning
- Mathematics learning.

This indispensable book covers multiple conceptual perspectives on how learning patterns can be described and effects and developments can be measured, and will not only be helpful for 'learning researchers' as such but also for educational researchers from the broad domains of educational psychology, motivation psychology and instructional sciences who are interested in student motivation, self-regulated learning, effectiveness of innovative learning environments, as well as assessment and evaluation of student characteristics and learning process variables.

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Chapter 1

Students' learning patterns in higher education and beyond

Moving forward

David Gijbels, Vincent Donche, John T. E. Richardson and Jan D. Vermunt

The idea for this book originated at the first meeting of the 'learning patterns in transition' network in December 2011 in Antwerp. This research network sponsored by the Scientific Research Network of the Research Foundation Flanders (FWO) enables 12 international research units to foster a collaborative network and develop a joint research agenda of which the first results are presented in this book. For the name of the network and also for the title of the book, we have deliberately chosen for the term 'learning patterns' to include the wide range of theoretical perspectives that describe individual differences in student learning (e.g. Biggs 1993; Entwistle and McCune 2004; Meyer, 1995; Prosser and Trigwell 1999; Rayner and Cools 2010; Richardson 2011; Sadler-Smith 1996; Vermunt 2005).

The term *learning patterns* refers broadly to students' habitual ways of learning described in terms of how students cognitively process information and/or the metacognitive, motivational and affective strategies they use (Vermunt and Vermetten, 2004). Research has indicated that a large number of person- and environment-related factors are linked to students' learning patterns. In the past decade a multitude of empirical studies have shown that how students cope with learning in specific learning situations is not solely determined by their general preferences but is the result of an interaction between their perceptions of the learning context, their disposition and other learner characteristics (Baeten et al. 2010; Entwistle et al. 2003; Vermunt and Vermetten 2004). Research has also shown that some learning pattern characteristics are to some degree variable across course contexts and throughout time in higher education settings (Donche et al. 2010; Vermetten et al. 1999). Inducing changes within students' learning patterns has, however, proven to be difficult in studies that took place in learning environments designed for that aim (Gijbels and Dochy 2006; Vermunt and Minnaert 2003). Part of the explanation for conflicting results in this latter domain of research may be generated by the conceptual base and measurement of student learning in these studies (Dinsmore and Alexander 2012; Donche and Gijbels 2013). Recent empirical contributions in the domain of learning pattern research stress the need for further clarification of vital components of students' learning patterns such as

learning conceptions (Richardson 2011) and learning strategies (Vermunt and Endedijk 2011) and how these patterns develop in higher education in the 21st century (Vanthournout et al. 2011). This also brings in important questions concerning how differences and changes in student learning can be validly measured (Coertjens et al. 2013) and which future research perspectives are needed to increase our present understanding of student learning and development (Richardson 2013).

Against this background, the aim of this book is twofold: to further deepen our current understanding of (1) the dimensionality of student learning patterns in higher education and (2) how differences and changes within learning patterns can be measured in a valid and reliable way. The chapters in the first part of the book, 'Dimensions of learning patterns', provide theoretical perspectives aiming to broaden, deepen and integrate the present knowledge base on dimensions and patterns of student learning. The second part of the book, 'Measuring learning patterns and development', provides a range of research perspectives to further examine core measurement issues raised in previous learning pattern research regarding the nature or construct of a learning pattern and its development in higher education contexts and beyond.

We have to acknowledge that not all of the included chapters put emphasis on only one of these two vital research perspectives. Some chapters could be classified in both parts as research took place on important junctions (for instance, studies aiming to increase more conceptual understanding through using alternative measurement analysis techniques). To ensure that this book is intended not only for researchers but also for practitioners interested in student learning and enhancement, all authors were encouraged to pay attention to the relevance of the empirical research or developed theories for educational practice in their chapter. In the rest of this introduction we will briefly introduce the two parts that structure the book and the chapters within each part.

Part I: Dimensions of learning patterns

The first perspective concerns the quality of the learning pattern constructs under study and recent research is detailed in Chapters 2–6. Over the last few decades, a lot of research effort has been invested in exploring the ways in which students learn in higher education (Vermunt and Vermetten 2004). This research stems from a variety of research traditions and has evolved in different directions. A large number of studies have been carried out in diverse areas, such as: cognitive aspects of learning (Sadler-Smith 1996); learning conceptions or beliefs about learning and teaching (Säljö 1979); specific learning strategies (Marton and Säljö 1976); aspects of self-regulation (Boekaerts 1997); metacognition (Flavell 1987); and motivational aspects (Entwistle 1988). A shared feature of many of these studies is the search for relationships between various aspects of learning and an attempt to arrive at integrative models of student learning. In the domain of research on students' approaches to learning and learning patterns, models

developed by researchers such as Biggs, Entwistle and Vermunt stress various key components and dimensions of student learning which show to some extent conceptual similarities but also point to different views on how components such as student motivation and processing strategies are situated and further elaborated in different sub-dimensions.

As the grounding knowledge base was developed two decades ago, there is a need to revise the theoretical components, especially against the background of 21st-century learning environments and learning demands in higher education. In particular, as new developments have been demonstrated within the fields of cognitive psychology, motivation psychology and educational sciences on the level of regulative aspects of learning, conceptions and motivation, theoretical and empirical validation studies are needed to investigate the possibilities of integration of these advanced theoretical perspectives within more fine-grained models of student learning patterns. This not only requires more in-depth research into the dimensions of student learning and interrelationships but also the relationship with the contexts and cultures in which student learning is investigated. In the following five chapters of Part I, this is thoroughly discussed.

In Chapter 2 the need for more theoretical and empirical investigation of dimensions of student learning is further addressed by Vanthournout, Donche, Gijbels and Van Petegem. In the first part of their chapter central theoretical concepts in two main theoretical models are clarified and compared: the concepts in the approaches to learning model (e.g. Biggs 2003; Entwistle et al. 2003) and the learning pattern model as developed by Vermunt (2005). In the second part of the chapter two alternative empirical research perspectives are explored: (1) a person-oriented perspective aimed at identifying subgroups of students with similar learning profiles, and (2) a longitudinal perspective interested in the complex growth trajectories in student learning in higher education.

In Chapter 3, Vermunt, Bronkhorst and Martínez-Fernández compare students' learning patterns from various countries and continents around the globe, and present empirical evidence from studies in different cultures using the same research instrument. Six underlying dimensions of learning patterns could be identified, representing an important extension compared to previous studies. They argue that research in this domain should go beyond Western countries only, and that universities should develop induction measures to help international students adapt to foreign learning cultures.

In Chapter 4, Price presents a heuristic model of student learning based on four other theoretical models: Dunkin and Biddle's (1974) model, Biggs' (1987) Presage-Process-Product model, Prosser and Trigwell's (1999) research on teaching and Price and Richardson's (2004) 4P model. The latter has four main groups of factors: presage, perceptions, process and product.

In Chapter 5, Raemdonck, Meurant, Balasse, Jacot and Frenay stress the need for a theory to understand learning patterns across the lifespan. Since characteristics of adult learning patterns have been connected with self-directedness

in learning, the paper describes the concept of self-directedness in learning from the adult education research area.

Chapter 6 by Endedijk, Donche and Oosterheert closes the first research perspective on dimensions of learning patterns. Based on the results of a series of studies using the Inventory Learning to Teach Process (ILTP) a theoretical framework is provided on student teachers' learning patterns in relationship with personal, contextual and time-related variables.

Part II: Measuring learning patterns and development

In the second part of this volume, we present a selection of research perspectives to further examine core measurement issues often raised in the literature but scarcely investigated in the context of student learning in higher education, in particular regarding the nature or 'construct' of a learning pattern and development in higher education contexts and beyond. As we will illustrate below, several chapters explicitly deal with the question of how student learning patterns can be measured through self-report questionnaires and to what extent student learning patterns are related with personal and contextual variables as well as attainment or academic achievement in various educational contexts. Another important issue concerns the development of learning patterns and the need for more attention to change or development within and between crucial transitional phases in students' study career, such as the entry phase into higher education and the transition phase from higher education to work or transitions during professional life as an adult. Several chapters in this part also aim to increase our understanding of the flexibility and/or adaptability of learning patterns in educational contexts in and beyond higher education.

In Chapter 7, Richardson and Remedios administered two questionnaires, the Achievement Goal Questionnaire (AGQ) and the AGQ-Revised, in two separate studies to adult learners taking courses by distance education. The results showed that the achievement-goal framework is appropriate for understanding influences on attainment in adult learners. The chapter argues that the notion of 'learning patterns' might usefully be extended to include students' achievement goals and other indicators of motivation.

In Chapter 8, de Clercq, Galand and Frenay investigate the impact of motivational and cognitive processes on students' achievement. The results highlighted that final examination scores are essentially modulated by motivational factors, whereas the performance on the test is related to cognitive factors. The chapter discusses the results in the light of the relation between learning processes and academic achievement.

Chapter 9 by Cano and Berbén further explores the interplay between achievement goals and students' approaches to learning by detecting, using clustering procedures of acknowledged validity, patterns of motivation and learning constituted by the core variables of each of these research perspectives.

The chapter argues that students' approaches to learning and achievement goals are intertwined with aspects of students' experience of learning at university and should both be included in comprehensive models of how students learn.

In Chapter 10, Evans uses a phenomenological approach to explore the relationship between individual-difference and contextual variables in order to better understand the factors affecting a student's adoption of a deep approach. Evans argues that in the context of learning to teach it is important to consider approaches to learning in more complex and broader ways that acknowledge the relational dimensions of a deep approach.

In Chapter 11, Donche, Coertjens, van Daal, De Maeyer and Van Petegem present a study that explored the explanatory value of an integrated research perspective to understand differences in student learning and academic achievement in first year higher education. Two cohorts of first-year students from eight different professional bachelor programmes of a university college participated. Structural equation modelling reveals that, after control for students' socio-economic and linguistic ethnic background, having more academic self-confidence as well as being more autonomously motivated seems to be an important lever for more academic performance in terms of more active use of learning strategies as well as higher academic achievement.

In Chapter 12, Lindblom-Ylänne, Parpala and Postareff explore the stable versus contextual and dynamic nature of students' approaches to learning and studying by using a multi-method research design. Analyses took place of follow-up inventory data on the development of approaches to learning and studying of bioscience and veterinary medicine students. The results presented in the chapter warrant that quantitative group-level analyses should be critically evaluated and complemented by qualitative methods in order to identify students' individual learning paths.

In Chapter 13, Kyndt, Dochy and Cascallar report on the findings of a series of studies focusing on contextual and personal factors that are related to how students' approach their learning within higher education. More specifically, perceived workload and task complexity, motivation, working memory capacity and attention are examined. The chapter shows that students with a high working memory capacity and average motivation use less desirable approaches to learning than students who are autonomously motivated and possess an average working memory capacity.

In Chapter 14, Baeten, Struyven and Dochy compare students' approaches to learning, motivation and achievement in four learning environments: a lecture-based learning environment, a case-based learning environment, an alternated learning environment consisting of lectures and case-based learning, and a gradually implemented learning environment in which lectures gradually made way for case-based learning. The results of the study indicate that it is difficult to enhance the deep approach to learning and that students' motivational and learning profiles matter in explaining their perceptions of the learning environment.

We acknowledge that not all new or ongoing research perspectives have been taken into account, but we have selected research perspectives that are, at the time of writing, at the core of our research network. In this way, we are convinced that this book offers an important slice of the ongoing body of research that is being carried out in the field. The chapters in this book also provide further insights into issues regarding the dimensionality and understanding of learning pattern development that have also been recently raised in other contributions regarding student learning in higher education (e.g. Donche and Gijbels 2013; Endedijk and Vermunt 2013; Richardson 2013).

In the final chapter of this book, we as editors critically look back and forward and present our challenges for the field. We hope in this way to inspire new or senior researchers in how further advances in learning pattern research can be made by considering these research perspectives and further developments.

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Part I

Dimensions of learning patterns

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Chapter 2

(Dis)similarities in research on learning approaches and learning patterns

Gert Vanthournout, Vincent Donche, David Gijbels and Peter Van Petegem

The students' approaches to learning tradition

Over the last few decades, a lot of research effort has been invested in exploring the ways in which students learn in higher education. This research stems from a variety of research traditions (Lonka et al., 2004; Richardson, 2007b) and has evolved in different directions. A large number of studies have been carried out in diverse areas, such as: cognitive aspects of learning (Moskvina and Kozhevnikov, 2011); learning styles (Kolb, 1984); intellectual styles (Zhang and Sternberg, 2005); learning conceptions (Van Rossum and Schenk, 1984), approaches to learning (Marton and Säljö, 1997); aspects of self-regulation (Boekaerts et al., 2000); study orientations (Nieminen et al., 2004; Richardson, 1997); meta-cognition (Flavell, 1987); and motivational aspects of learning (Boekaerts and Martens, 2006). A shared feature of many of these studies is the search for relationships between various aspects of learning and an attempt to arrive at integrative models of learning (Biggs, 1993; Entwistle and McCune, 2004; Meyer, 1998; Vermunt and Vermetten, 2004).

One of the research traditions interested in student learning in higher education is the Students' Approaches to Learning tradition (the SAL tradition; Lonka et al., 2004). It is founded on the phenomenographical studies by Marton and Säljö in the 1970s (Marton and Säljö, 1976). Research in this tradition generally focuses on the different ways students engage in learning or handle learning tasks as reported by the students themselves (Biggs, 2001; Entwistle et al., 2006; Schmeck, 1988). Representatives of this tradition mostly concur on the viewpoint that there are qualitatively different ways in which students go about learning and that these differences in learning approaches are associated with qualitatively different learning outcomes (Biggs, 1979; Entwistle et al., 1991; Richardson, 1997; Vermunt, 2005). How students approach their learning is viewed as being influenced by factors in the learning environment, students' perceptions of these factors and student characteristics (Figure 2.1) (Baeten et al., 2010; Biggs, 2003; Donche and Van Petegem, 2006; Vermunt, 2005).

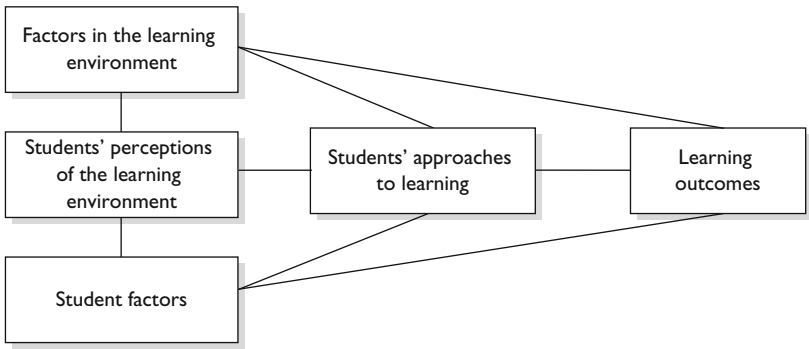

Figure 2.1 General model of the SAL tradition

Source: Based on Baeten et al., 2010; Biggs, 2003; Vermunt, 2005.

Exemplary models within the SAL tradition

Despite a general agreement on the basic assumptions mentioned above, a multitude of models can be discerned within the SAL tradition, placing emphasis on different aspects of learning, using a variety of different but related concepts, and using a multitude of self-report questionnaires to empirically measure their concepts (Coffield et al., 2004; Entwistle and McCune, 2004; Richardson, 2000). The field encloses frameworks and inventories by, amongst others, Schmeck and colleagues (Revised Inventory of Learning Processes (ILP-R); Schmeck et al., 1991), Weinstein and colleagues (Learning and Study Strategy Inventory (LASSI); Weinstein et al., 1987) or Meyer and colleagues (Reflections on Learning Inventory (RoLI); Meyer and Boulton-Lewis, 1999).

In this chapter we discuss two acclaimed and frequently used models within this tradition, namely the student approaches to learning model, albeit in two variants, and the learning pattern model (Desmedt and Valcke, 2004; Entwistle and McCune, 2004; Richardson, 2000). The first models were simultaneously and independently developed by John Biggs and colleagues in Australasia (Biggs, 1987, 2003) and by Noel Entwistle and colleagues in the United Kingdom (Entwistle et al., 2006; Entwistle and Ramsden, 1983). Their respective models were operationalized in two inventories, the Study Process Questionnaire (SPQ; most recent version R-SPQ-2F) (Biggs et al., 2001) and the Approaches to Studying Inventory (ASI; most recent version ALSI) (Entwistle et al., 2003). The learning pattern model was more recently devised by Jan Vermunt and colleagues in The Netherlands. As will be demonstrated during this chapter, it builds on the models mentioned above, but also expands them by incorporating additional components and contemporary insights from educational psychology (Vermunt and Vermetten, 2004). Vermunt and colleagues developed

the Inventory of Learning Styles (ILS) (Vermunt, 1992; Vermunt and Van Rijswijk, 1988) to measure their model. The conceptual framework of each of these models is explained in more detail in the subsequent sections.

SAL models

The theoretical approaches to learning models generally distinguish between a deep and a surface approach to learning (Biggs, 2001; Entwistle et al., 2001). An approach is in each case conceived as the combination of a specific motive (Biggs, 1993) or intention (Entwistle, 1988b) and congruent learning strategies (Biggs, 1993) or learning and study processes (Biggs, 1993; Entwistle, 1988b). Therefore an approach is said to combine and integrate both a motivational and a strategy component (Entwistle, 1988a). A deep approach to learning is associated with students' intentions to understand and to appropriately engage in meaningful learning, focusing on the main themes and principles and using strategies that are appropriate for creating such meaning. The surface approach to learning, on the other hand, refers to students selectively memorizing, based on motives or intentions that are extrinsic to the real purpose of the task, such as fear of failure or keeping out of trouble.

Initially the models also incorporated a third approach, called a strategic approach (Entwistle and Ramsden, 1983) or an achieving approach (Biggs, 1987). Students adopting the latter approach try to maximize their grades by effectively using space and time. However, a conceptual difference separates the deep and surface approach from the achieving/strategic approach. Whereas the first two approaches describe ways in which students engage in learning, the latter deals with how students organize their learning (Kember et al., 1999). In addition, researchers have put question marks as to its validity as a separate construct. For instance Richardson (1994), based on a literature review on the cultural specificity of learning approaches, stated that there is no unambiguous evidence for the existence of a separate achieving approach, whereas there is ample evidence of the existence of a deep and surface approach across various research contexts. He proposed viewing the achieving approach as being part of a deep approach to learning (Richardson, 2000). Research on the underlying structure of the SPQ (Biggs, 1987), an inventory aimed at measuring the three approaches to learning, also demonstrated that a model in which the achieving subscales were incorporated as indicators of the deep and surface approach fitted the data better than a model in which the achieving approach was conceived as a separate factor (Kember and Leung, 1998; Zeegers, 2002). Similarly, Entwistle and McCune (2004) also did not incorporate a separate strategic approach in the most recent version of their questionnaire, although they retained some of the ideas behind this approach in two separate scales, namely organized studying and effort management. Overall, however, following both conceptual and empirical arguments, the most recent theoretical models in approaches to learning distinguish only between a deep and a surface approach.

The learning pattern model

The learning pattern model, originally called the learning style model, was developed in the early 1990s in an attempt to provide a more comprehensive and integrated account of learning by bringing together four different learning components, namely: cognitive processing strategies, regulation strategies, conceptions of learning, and orientations to learning (Vermunt, 1996; Vermunt and Vermetten, 2004). Processing strategies refer to those thinking strategies and study skills that students possess and apply to process subject matter. Regulation strategies are those activities students use to steer their cognitive processing. The combination of processing and regulation strategies is sometimes referred to as learning strategies (Vermunt, 1998). Students' conceptions of learning can be defined as their beliefs with regard to what learning is, while students' orientations to learning can be conceived as their personal goals, intentions, motives, expectations, attitudes, concerns and doubts with regard to their studies. Each learning component encompasses several learning dimensions as Table 2.1 shows. The learning pattern model theorizes that some aspects of learning, such as learning conceptions and learning orientations, are more resilient to change, and partially influence or regulate the more changeable learning strategies (Vermunt, 1998, 2005).

Using factor analysis, Vermunt (1992) identified four recurring patterns based on students' scores on each of the learning components. He labeled these patterns as 'learning styles' distinguishing between an undirected style, a reproduction-directed style, a meaning-directed style, and an application-directed style (see Table 2.2). He theorized that these styles represented students' general preferences in learning for a specific period of time (Vermunt, 1996). However, as the notion of learning styles is mostly associated with invariant personality characteristics and a more trait-like view on learning, Vermunt and his colleagues recently suggested the use of the more neutral term 'learning patterns' in order to take the modifiability of students' learning into account (Vermunt, 2003; Vermunt and Minnaert, 2003; Vermunt and Vermetten, 2004). In accordance with this, the term 'learning patterns' will be used throughout this chapter.

(Dis)similarities in learning approaches and learning patterns

It can be argued that, to a degree, the learning pattern model builds on the historical heritage from the original studies by Marton and Säljö (1976) and the approaches to learning models (Biggs, 1987; Entwistle and Ramsden, 1983). However, the framework also expands, refines and updates these models in various ways.

Similar to approaches to learning, learning patterns include and integrate motivational and cognitive aspects of learning, in the form of learning orientations and cognitive processing strategies. However, the latter model also adds additional learning components to the mixture that are not included in

Table 2.1 Learning components, learning dimensions and their meaning in the learning pattern model

Learning component	*Learning dimension*	*Meaning*
Processing strategies	Deep processing	
	– Relating and structuring	The extent to which students actively relate aspects of the content
	– Critical processing	The extent to which students adopt a critical angle
	Stepwise processing	
	– Analyzing	The extent to which students methodically process the learning content
	– Memorizing	The extent to which students memorize the learning content
	Concrete processing	The extent to which students attempt to apply the content to concrete situations
Regulation strategies	Self-regulation	The extent to which students actively steer their own learning process
	External regulation	The extent to which students rely on teaching staff or the learning material to steer their learning process
	Lack of regulation	Lack of clarity on how to steer their learning process
Conceptions of learning	Intake of knowledge	The extent to which students regard learning as the absorption of knowledge
	Construction of knowledge	The extent to which students see learning as the construction of knowledge
	Use of knowledge	The extent to which students see learning as the application of knowledge
	Cooperative learning	The extent to which students see learning as a cooperative process
	Stimulating education	The extent to which students see learning as being stimulated by teachers or the learning environment
Orientations to learning	Personally interested	The extent to which students are intrinsically motivated to learn
	Self-test oriented	The extent to which students are motivated to learn by a drive to prove themselves
	Certificate oriented	The extent to which students are motivated to learn by a desire to test themselves or acquire a certificate
	Vocation oriented	The extent to which students are motivated to learn by a profession
	Ambivalent	The extent to which students experience problems with motivation

Table 2.2 Learning patterns and their constituting learning dimensions

Learning component	*Learning pattern*			
	Undirected	*Reproduction oriented*	*Meaning oriented*	*Application oriented*
Processing strategies	Hardly any processing	Stepwise processing	Deep processing	Concrete processing
Regulation strategies	Lack of regulation	External regulation	Self-regulation	Both external and self-regulated
Learning conceptions	Cooperation and being stimulated	Intake of knowledge	Construction of knowledge	Use of knowledge
Learning orientations	Ambivalent	Certificate or self-test oriented	Personally interested	Vocation oriented

Source: Based on Vermunt, 1996.

the original approaches to learning models, such as meta-cognitive regulation strategies and learning conceptions (Entwistle and McCune, 2004; Vermunt and Vermetten, 2004). Although the importance of meta-cognition is generally acknowledged by authors of the original approaches to learning models (Biggs, 1987; Entwistle et al., 2003), the component was not included by Biggs and colleagues, according to them to keep the amount of items and constructs in their instrument limited as its primary aim was to provide a quick diagnostic tool (Biggs et al., 2001). Entwistle and colleagues (2003) did not add a separate meta-cognitive component to their concept of approaches to learning for reasons of clarity of concepts and simplicity. However, they did include a separate scale that describes meta-cognitive aspects of learning, called monitoring study effectiveness, in the final version of their instrument. They conceive this scale as being distinct from, but related to, a deep approach to learning (Entwistle and McCune, 2004).

However, more recently, studies in the field have increasingly acknowledged the importance of regulatory strategies in contemporary higher education and have described them as crucial strategies for being successful in education and the working life (Gijbels et al., 2010; Lonka et al., 2004). Therefore studies have started investigating these strategies in unison with traditional approaches to learning models (e.g. Heikkilä and Lonka, 2006; Lonka and Lindblom-Ylänne, 1996).

A similar tendency is noticeable for learning conceptions, where research has provided evidence that indicates that 'how students conceive learning' is related to 'the way they actually engage in learning' (Edmunds and Richardson, 2009; Lindblom-Ylänne and Lonka, 1999; Meyer and Boulton-Lewis, 1999; Nieminen et al., 2004). Therefore, it has been argued that students' learning