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Patterns in Student Learning: Relationships Between Learning Strategies, Conceptions of Learning, and Learning Orientations

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This paper reviews the research conducted in the last decade on patterns in student learning, mostly in higher education. More specifically, the review focuses on a series of studies that have in common (a) the use of the Inventory of Learning Styles *(ILS), an instrument aimed at measuring several components of student learning, namely, cognitive processing strategies, metacognitive regulation strategies, conceptions of learning, and learning orientations; and/or (b) an integrative learning theory focussing on the interplay between self-regulation and external regulation of learning processes as a theoretical framework. Aspects a and b are closely connected, because the development of the instrument was based on the theory. The review covers the following themes: The theoretical framework and conceptualization of student learning; a description of the instrument; the internal structure of learning strategies, conceptions, and orientations in different educational contexts; developments in learning patterns during the school career; consistency and variability in students' use of learning strategies; dissonance in students' regulation of learning processes; relations between learning patterns and personal and contextual factors; relations between learning patterns and learning outcomes; and process-oriented instruction.*

KEY WORDS: learning patterns; learning strategies; conceptions of learning; Learning orientations; learning styles.

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INTRODUCTION

Until about two decades ago, the majority of student learning research and conceptualizations mainly focussed on cognitive processing strategies and motivation. For example, Pask (1988) identified a serialist and holist strategy that students may employ in achieving understanding. Marton and Säljö (1984) interviewed students about their approaches to learning and identified a deep and a surface approach. Geisler-Brenstein *et al.* (1996) discerned five types of cognitive learning strategies: deep learning, elaborative processing, agentic learning, methodical learning, and literal memorization. Biggs (1987) made a distinction between three types of learning strategies: deep, surface, and achieving, each corresponding to a particular study motivation: intrinsic, extrinsic, and achievement motivation, respectively. Tait and Entwistle (1996) developed a study strategies inventory that contains scales in the domain of cognitive processes (e.g., deep approach, surface approach, strategic approach, and apathetic approach) and study motivation and affection (e.g., active interest, fear of failure, intention to excel, and lack of direction). The inventory of Weinstein *et al.* (1988) contains scales not only in the domain of cognitive processing (e.g., "information processing") and motivation (e.g., "motivation"), but also on some aspects of metacognitive regulation (e.g., "self-testing"). See Lonka *et al.* (2004) for a more extended discussion of this "student approaches to learning" tradition.

The various conceptualizations of learning strategies in the domain of cognitive processing showed considerable overlap, as is the case with the various conceptualizations of student motivation dimensions. In contrast, until that time little was known about the relations among regulation activities and the way students used them (e.g., Brown, 1987; Volet, 1991). The ways in which metacognitive regulation processes and metacognitive knowledge are associated with the use of processing strategies and with student motivation also remained obscure. The cognitive, regulative, metacognitive, and motivational components of student learning were almost never examined together in a single study.

When we started our studies on student learning in higher education in the mid-eighties of the previous century, we were familiar with the work of Brown (1987) and Flavell (1987) on metacognition of school children and had just finished a study on metacognition of secondary school children using think-aloud protocols. At the same time, the work of Marton and Säljö (1984) on conceptions of learning had become widely known. Gibbs *et al.* (1984) had extended the notion of motivation and used the term "educational orientations" to refer to the whole domain of higher education students' personal goals, intentions, motives, expectations, attitudes, worries, and doubts in doing courses or studies.

One of the objectives of the series of studies reviewed in this article is to increase the integration of existing conceptualizations of student learning components and to link metacognitive aspects of student learning to students' cognitive processing strategies and study motivation. In doing so, we try to contribute to the development of a second generation of conceptualizations of student learning, focussing on cognitive, regulative, metacognitive, and motivational components and their interrelationships (see Entwistle and McCune, 2004; Richardson, 2000 for reviews of contemporary widely used student learning inventories).

This paper starts with a description of our conceptualization of student learning encompassing the above-mentioned learning components. In the theoretical part, this conceptualization is linked to theoretical notions on teaching and instruction and on the interplay between learning and teaching. The development of an instrument to measure these aspects of student learning, the ILS, is described, and empirical research using either the instrument or the theory is reviewed.

AN INTEGRATIVE THEORY AND CONCEPTUALIZATION OF STUDENT LEARNING

Pintrich (1994) compared several taxonomies of learning components and concluded that the common elements were students' knowledge base, procedural skills, self-regulation of learning, and motivation and affect. The distinction between cognitive, metacognitive, and affective/motivational components of learning can also be found in the work of several other researchers (e.g., Short and Weisberg-Benchell, 1989).

Cognitive processing activities are those thinking activities that students use to process subject matter. They directly lead to learning outcomes in terms of knowledge, understanding, skill, etc. Typical examples of these activities are looking for relations among parts of the subject matter, selecting main points, thinking of examples, and looking for applications (e.g., Geisler-Brenstein *et al.*, 1996).

Affective activities involve emotions that arise during learning and lead to affective states that may positively, neutrally, or negatively influence the progress of a learning process. Examples are activities like motivating oneself, attributing learning outcomes to causal factors, attaching subjective appraisals to learning tasks, and mastering blocking emotions (e.g., Boekaerts, 1995).

Regulation activities steer the cognitive and affective activities and, therefore, indirectly lead to learning outcomes. Examples of such activities are orienting on a learning task, monitoring whether the learning process

proceeds as planned, diagnosing the cause of the difficulties one encounters, and changing learning activities during learning (e.g., Brown, 1987).

In a series of empirical studies, both qualitative and quantitative, Vermunt (1996, 1998) investigated how students employed these activities in their normal studying behavior and how such use was related to internal and external sources. Three main cognitive processing strategies could be discerned: (a) a deep processing strategy, which combines the learning activities "relating," "structuring," and "critical processing"; (b) a stepwise processing strategy, consisting of the learning activities "analyzing" and "memorizing"; and (c) a concrete processing strategy with "concretizing" and "applying" as major learning activities.

With regard to regulation strategies, it was found that the main distinguishing dimension was internal versus external control of learning processes. Three main strategies were also consistently observed here: (a) a self-regulated strategy, in which students perform most regulation activities themselves; (b) an externally regulated strategy, in which students let their learning process be regulated by teachers, books, etc. and (c) lack of regulation, manifested when students are not only unable to regulate their learning processes themselves, but also experience insufficient support from the external regulation provided by teachers and the general learning environment.

The use of these processing and regulation strategies was consistently associated with students' conceptions of learning and learning orientations. A conception of learning is a coherent system of knowledge and beliefs about learning and related phenomena (e.g., knowledge and beliefs about oneself as a learner, learning objectives, learning activities and strategies, learning tasks, learning and studying in general, and about the task division between students, teachers, and fellow students in learning processes). Learning orientations refer to the whole domain of students' personal goals, intentions, motives, expectations, attitudes, concerns, and doubts with regard to their studies (Gibbs *et al.*, 1984). Vermunt (1996, 1998) uses the term "learning style" as a superordinate concept in which the cognitive and affective processing of subject matter, the metacognitive regulation of learning, conceptions of learning, and learning orientations are united. In several studies, he found four such learning styles or patterns: undirected, reproduction-directed, meaning-directed, and application-directed learning. From the viewpoint of high-quality learning, the last two learning patterns are more desirable than the first two.

Categories that are very similar to those found in the literature on student learning activities emerge in the literature on teaching activities. For example, Rosenshine and Stevens (1986) give the following instances

of good teaching activities: explaining relationships within the subject matter, giving examples, planning the learning process, monitoring students' progress, and motivating students. Hence, one can speak of *teaching/learning functions*. Shuell (1996; see also Simons, 1997) uses the term *learning functions* to refer to the functions that need to be fulfilled for high-quality learning to take place, and that can be conducted either by the learner or by the teacher. These learning functions can be divided into processing, affective, and regulation functions, a distinction that parallels the distinction between cognitive, affective, and metacognitive (regulative) learning activities.

Teaching functions refer to those functions that promote high-quality student learning. The processing functions of teaching concern presenting and clarifying the subject matter. The affective functions refer to creating and maintaining a positive motivational and emotional climate for learners. The regulation functions are aimed at steering students' learning processes.

From the viewpoint of their influence on the cognitive activities students use to learn, different teaching strategies can be distinguished. They can be placed on a dimension ranging from strongly teacher-regulated to shared regulation to loosely teacher-regulated (compare Biggs, 1996). In the case of loose teacher regulation, the need for student-regulation of learning is high. These teaching strategies, or more general instructional strategies, constitute different levels of external regulation and, therefore, also of the degree of control students are expected to exert over their own learning. The interplay between self-regulation and external regulation of learning may give rise to either congruence or friction between learning and teaching strategies (see Vermunt and Verloop, 1999). Congruence occurs when students' learning strategies and teachers' teaching strategies are compatible; friction occurs when this is not the case.

Two kinds of friction are discerned: constructive and destructive. Constructive friction can stimulate students to employ learning and thinking strategies that they have not used before, and hence give rise to an increase in the use of those strategies (e.g., Trigwell *et al.*, 1999). Destructive friction occurs, for example, when a teacher takes over from students learning activities that they are already used to employing of their own accord. This friction may result in a decrease in students' use of learning and thinking activities (e.g., Clark, 1990; Lunenberg and Volman, 1999). Friction of a destructive nature may also occur when the distance between the level of self-regulated learning that the teacher expects from the students, and the self-regulatory skills these students possess, is too great (for an elaborate discussion of the interplay between self-regulation and external regulation of learning, see Vermunt and Verloop, 1999).

A DIAGNOSTIC INSTRUMENT: THE INVENTORY OF LEARNING STYLES (ILS)

The development of the *Inventory of Learning Styles* (ILS) is based on the theoretical notions described above. Moreover, it is based on phenomenographic analyses of interviews with university students about their way of learning, their ideas about learning, studying and teaching, and their motives, concerns, and personal goals in their studies (Vermunt, 1996). On the basis of the descriptive categories that resulted from this phenomenographic study, statements were selected from the interviews that were considered to be characteristic of the various categories. When necessary, the formulations were slightly adapted. These statements were included as items in the inventory. In various studies, the final version of the instrument was constructed, using factor, reliability, item, and test–retest analyses. For a description of this construction process and the psychometric qualities of the instrument, see Vermunt (1998).

The instrument was constructed in the context of a research project on students' regulation of learning processes in higher education. The first results of the research project were reported in a book written in Dutch (Vermunt, 1992). Later, the results were discussed at international conferences, the analyses were refined, new analyses were conducted, the theoretical background was elaborated, and the results were reinterpreted from a growing understanding of the data (e.g., Vermunt, 1995, 1996, 1998; Vermunt and Verloop, 1999). From 1992 onward, the ILS was used by researchers in the Netherlands, Belgium, Finland, England, Cyprus, USA, Brazil, Argentine, Indonesia, and Sri Lanka. This article reviews some studies that used the ILS as a research instrument.

The final version of the ILS consists of 120 statements that cover four learning components: cognitive processing strategies, metacognitive regulation strategies, conceptions of learning, and learning orientations. For the strategy items, students are asked to indicate on a 5-point scale the degree to which they use the described learning activities in their studies. For the items on learning conceptions and learning orientations, students are asked to indicate on a 5-point scale the degree to which the described views and motives correspond to their own views and motives. The ILS assesses five processing strategies, five regulation strategies, five conceptions of learning, and five learning orientations. These ILS scales and their content are described in Table I.

In several studies with a total of 795 regular university students and 654 open university students, the internal consistencies of these scales (Cronbach's alpha) varied between .63 and .85 for processing strategies, from .48 to .79 for regulation strategies, between .70 and .89 for conceptions

Table I. Scales of the *Inventory of Learning Styles* (ILS) and Their Content

Parts and scales of the ILS	Description of content
Processing strategies	
Deep processing	
Relating & structuring	Relating elements of the subject matter to each other and to prior knowledge; structuring these elements into a whole.
Critical processing	Forming one's own view on the subjects that are dealt with, drawing one's own conclusions, and being critical of the conclusions drawn by textbook authors and teachers.
Stepwise processing	
Memorizing & rehearsing	Learning facts, definitions, lists of characteristics and the like by heart by rehearsing them.
Analyzing	Going through the subject matter in a stepwise fashion and studying the separate elements thoroughly, in detail and one by one.
Concrete processing	Concretising and applying subject matter by connecting it to one's own experiences and by using in practice what one learns in a course.
Regulation strategies	
Self-regulation	
Learning process & outcomes	Regulating one's own learning processes through regulation activities like planning learning activities, monitoring progress, diagnosing problems, testing one's outcomes, adjusting, and reflecting.
Learning contents	Consulting literature and sources outside the syllabus.
External regulation	
Learning process	Letting one's own learning processes be regulated by external sources, such as introductions, learning objectives, directions, questions or assignments of teachers or textbook authors.
Learning outcomes	Testing one's learning outcomes by external means, such as the tests, assignments, and questions provided.
Lack of regulation	Monitoring difficulties with the regulation of one's own learning processes.
Conceptions of learning	
Construction of knowledge	Learning viewed as constructing one's own knowledge and insights. Most learning activities are seen as tasks of students.
Intake of knowledge	Learning viewed as taking in knowledge provided by education through memorising and reproducing; other learning activities are tasks of teachers.
Use of knowledge	Learning viewed as acquiring knowledge that can be used by means of concretising and applying. These activities are seen as tasks of both students and teachers.

Table I. Continued

Parts and scales of the ILS	Description of content
Stimulating education	Learning activities are viewed as tasks of students, but teachers and textbook authors should continuously stimulate students to use these activities.
Cooperative learning	Attaching a lot of value to learning in cooperation with fellow students and sharing the tasks of learning with them.
Learning orientations	
Personally interested	Studying out of interest in the course subjects and to develop oneself as a person.
Certificate oriented	Striving for high study achievements; studying to pass examinations and to obtain certificates, credit points, and a degree.
Self-test oriented	Studying to test one's own capabilities and to prove to oneself and others that one is able to cope with the demands of higher education.
Vocation oriented	Studying to acquire professional skill and to obtain a(nother) job.
Ambivalent	A doubtful, uncertain attitude toward the studies, one's own capabilities, the chosen subject area, the type of education, etc.

of learning, and from .57 to .84 for learning orientations for regular university students. For open university students, the alphas varied from .67 to .83 for processing strategies, between .67 and .81 for regulation strategies, from .76 to .93 for conceptions of learning, and between .74 and .86 for learning orientations. In 33 of the 40 cases, the scales had alphas of .70 or higher (see Vermunt, 1998).

In Table II, the factor loadings of ILS scales in a four-factor Oblique solution are presented for these two samples of first-year students (adapted from Vermunt, 1998, p. 162). The patterns of loadings from the two samples are very similar and are fairly typical for university students in the first years of their studies. The first factor shows high loadings of the "relating and structuring," and "critical processing" strategies, "self-regulation of learning processes and learning contents," "construction of knowledge" as a conception of learning, and "personal interest" as learning orientation. "Concrete processing" also loads on this factor. This factor was interpreted as a meaning-directed learning pattern or "style." The second factor represents a reproduction-directed learning pattern, with high loadings of the ILS scales "memorizing and rehearsing," "analyzing," "external regulation of learning processes and of learning outcomes," "intake of knowledge" as conception of learning, and "certificate" and "self-test-directed" learning orientations. The third factor was interpreted as an undirected learning pattern, with high loadings of "lack of regulation," and an "ambivalent learning orientation," and "cooperation" and "stimulating education" together as conceptions of learning. Finally, the fourth factor represents an application-directed learning pattern, with high loadings of "concrete processing," "use of knowledge" as conception of learning, and a "vocational learning orientation."

THE INTERNAL STRUCTURE OF LEARNING STRATEGIES, CONCEPTIONS, AND ORIENTATIONS IN DIFFERENT EDUCATIONAL CONTEXTS

Recent research with first-year students in higher education has repeatedly confirmed the internal structure of learning styles as shown in the patterns of factor loadings of the ILS scales. For example, Busato *et al.* (1998) found a very similar pattern of factor loadings with first-year Psychology students of the University of Amsterdam, as did Schouwenburg (1996) with students from Groningen University. The internal consistencies of the ILS-scales found by Busato *et al.* were comparable to those found by Vermunt (1998). Studies in which the ILS was translated and administered to higher education students in other countries mostly confirmed the

Table II. Factor Loadings (pattern matrices) of ILS Scales in a 4-Factor Oblique Solution for Open University ($N = 654$) and Regular University ($N = 795$) Students (Principal Component Analysis; Loadings > −.25 and <.25 Omitted)[a]

	F1		F2		F3		F4	
ILS scale	OU	RU	OU	RU	OU	RU	OU	RU
Processing strategies								
Deep processing								
Relating & structuring	.71	.72						
Critical processing	.75	.70						
Stepwise processing								
Memorizing & rehearsing			.65	.73				
Analyzing	.27		.69	.76				
Concrete processing	.58	.65					.43	.39
Regulation strategies								
Self-regulation								
Learning process & outcomes	.78	.74						
Learning contents	.69	.72						
External regulation								
Learning process			.82	.73				
Learning outcomes			.67	.54				
Lack of regulation					.75	.74		
Conceptions of learning								
Construction of knowledge	.72	.75						
Intake of knowledge		−.36	.67	.54	.35	.33		
Use of knowledge							.67	.74
Stimulating education					.59	.73		
Cooperative learning					.67	.61		
Learning orientations								
Personally interested	(.24)	.54					−.70	−.25
Certificate-oriented		−.41	.40	.40			.59	.33
Self-test-oriented			.34		.32	.29		
Vocation-oriented							.84	.80
Ambivalent					.73	.65		
Eigen value	3.6	4.3	3.0	3.0	2.4	1.9	2.0	1.3
% Explained variance	17.9	21.3	14.9	15.2	11.9	9.6	9.8	6.4
Cumulative %	17.9	21.3	32.8	36.5	44.7	46.1	54.6	52.5

[a]Adapted from Vermunt, 1998, p. 162.

internal structure of the learning patterns. Lonka and Lindblom-Ylänne (1996) combined the ILS-parts on regulation strategies and learning conceptions with other scales in the area of approaches to studying and epistemological beliefs. They administered their instrument to students of Psychology and Medicine of the University of Helsinki in Finland. Three of the four dimensions that resulted from their factor analyses strongly resembled the dimensions from the regular and open university studies: reproduction-directed, meaning-directed, and application-directed learning. The fact that they did not find the undirected learning pattern as a separate dimension may be explained by the more selective admission system of Finnish universities.

To the extent that the population and educational context deviate more from the population and context of students in the beginning years of higher education, greater deviations are usually found in the nature of the learning patterns compared to those of students in higher education. For example, Severiens (1997) found, among adult students in secondary education, a factor that she interprets as a learning style directed at "proving yourself." Probably this learning pattern is typical of students in this "second chance" type of education, who more often than average have experienced failure in their educational career. Slaats *et al.* (1999) studied the learning styles of students in secondary vocational education. They found only two different learning patterns: reproduction-directed and meaning-directed learning. It is possible that in a strongly application-directed environment such as vocational education, students hardly vary on the dimension of application-directed learning. This conclusion is supported by research of Oosterheert and Vermunt (2001) on individual differences in the learning of students in teacher education. They also did not find a separate application-directed dimension: all students were strongly application directed in their learning. Individual differences did show up on the other dimensions: reproduction directed, meaning directed, and undirected learning.

Cultural differences in pedagogical and educational practices may give rise to differences in learning pattern structures. Ajisuksmo and Vermunt (1999) studied the learning styles and self-regulation of learning of Indonesian university students. They had the ILS translated into the Indonesian language and used that version for their studies. A comparison of the factor structures of Dutch and Indonesian students showed, among other things, that Dutch students experience aspects of learning patterns as separate aspects that for Indonesian students can go well together. This resembles the results of a study of Marton *et al.* (1997) on learning conceptions of Chinese students. Marton *et al.* (1997) found that these students do not experience memorizing and understanding as opposite poles, as is

often found among Western students, but as phenomena that are closely interwoven.

DEVELOPMENTS IN LEARNING PATTERNS DURING THE SCHOOL CAREER

Young pupils do not discern as many learning strategies, conceptions, and orientations as students in higher education usually do, as Klatter (1995) showed. She administered the ILS to a sample of 984 students in the first year of secondary education (about 12 years of age). The ILS items were adapted to the language and school context of these pupils. Factor analyses on the data resulted in the following picture. Four of the five processing strategies showed their highest loading on the same, first factor. The same held for three out of five regulation strategies (factor 2), four conceptions of learning (factor 3), and four learning orientations (factor 3). This indicates a clear lack of differentiation within the learning components. Boekaerts *et al.* (1997) found very comparable results concerning this lack of differentiation when they administered the ILS to large groups of pupils in the first, second and third year of secondary education (age 12–14 years). This could point to an interesting developmental phenomenon. It may well be that one's development as a learner proceeds along this line of increasing differentiation within learning components.

Another possible developmental line concerns the increasing associations among the learning strategies students use and their learning conceptions and orientations (Vermunt and Verloop, 2000). For adult students, there is often a high internal coherence among these learning components, whereas for students in the first years of secondary education this coherence is almost lacking (Boekaerts *et al.*, 1997; Klatter, 1995). This second developmental phenomenon could mean that learning behavior is increasingly coming under the control of the views and motives of the learner. Roosendaal and Vermunt (1996), who applied the ILS to students in the upper phase of secondary education (age about 16 years), found a clear factor structure resembling the structure found in tertiary education. They stated that the interrelations between the ILS domains were stronger than in Klatter's study, but not as strong as in tertiary education.

Along with the students' progress in education, the factor structure underlying their learning strategies, learning conceptions, and learning orientations may become more focused and may reveal stronger interrelations. This explanation of the outcomes of the studies described in the previous paragraph is a development hypothesis. Another possibility is a context hypothesis, suggesting that it is not structural development that explains

the depicted results, but the educational context. Severiens (1997) put forward this explanation. Her research with the ILS in adult secondary education did not show stronger relations between the ILS domains, despite the fact that these students were aged 26 on average. Furthermore, her results showed a different factor pattern, with no application-directed style, but instead a 'prove-yourself'-directed style. Because this pattern seemed to be a direct consequence of the specific educational context, she proposed the learning environment as an explanatory factor. Vermetten *et al.* (1999a) found, in their studies with first and second-year university students, that the factor structure after the first semester was less clear than after the third semester. When students have progressed further in their studies, the underlying factors can be interpreted better. There are stronger and more coherent relations between the learning strategies, on the one hand, and learning conceptions and learning orientations on the other. These results fit the development hypothesis.

The differences between the factor structures within Vermetten *et al.*'s study (Vermetten *et al.*, 1999a) resemble the differences between the factor structure Klatter (1995) found in the first year of secondary education, and the one Roosendaal and Vermunt (1996) found in the upper phase of secondary education. Between these phases of secondary education, a more consolidated and clear factor structure developed. When comparing the factor structure in the upper phase of secondary education with the first one in Vermetten *et al.*'s study, the factor structure seems to disintegrate. This contradicts the development hypothesis, which suggests that progression in education implies that different learning components become more interrelated. Maybe here the context is an important explanatory factor.

Both unclear factor patterns belonged to the starting period in a new stage of education, in other words, a new educational context. The diffuse factor patterns could therefore be an indication of a period of change and acclimation, comparable to a period of 'friction': a period in which students find that their ideas of knowledge and how to go about learning are no longer adequate (Vermunt and Verloop, 1999). The adaptation to a new learning environment may cause temporal diffuse patterns of relations between learning strategies, learning conceptions, and learning orientations.

It seems that the development hypothesis generally holds true for students progressing within one type of education, but that the context hypothesis is necessary to explain the different factor structures between different types of education. In entering a new type of education, a period of friction is spontaneously induced. This probably triggers a change in students, which is reflected in a disorganized factor pattern and rather unstable learning conceptions.

CONSISTENCY AND VARIABILITY IN STUDENTS' USE OF LEARNING STRATEGIES

How stable are learning patterns? Busato *et al.* (1998) computed correlations between first- and second-year university students' ILS scores on learning style level at two different points of time with an interval of about 14 months. They found correlations of .65 for undirected learning, .60 for reproduction-directed learning, .56 for meaning-directed learning, and .42 for application-directed learning. Vermetten *et al.* (1999a) administered the ILS to first and second-year university students on two different occasions with an interval of about 6 months. For learning strategies, *r* varied between .51 and .72. Learning orientations showed coefficients between .58 and .71. For learning conceptions, *r* varied from .54 to .64. Minnaert and Van der Hulst (2000) administered the ILS to first-year university students with an interval of about 6 months and found correlations on scale level of between .40 and .70 for learning strategies, from .41 to .69 for learning orientations and of between .42 and .66 for conceptions of learning. Vermunt (1998) also found that the stability of these learning patterns is rather high, but not so high that they should be conceptualized as unchangeable phenomena. In his study the ILS was administered twice to a sample of adult open university students with an interval of about 3 months. For learning strategies, *r* varied between .55 and .79, for conceptions of learning *r* varied from .70 to .79, and for learning orientations the variation of *r* was between .72 and .80.

The issue of whether or not students' use of learning strategies shows consistency or variability was studied more specifically by Vermetten *et al.* (1999b). They asked Law students from two subsequent cohorts for their learning strategies during four different courses. Analyses of variance showed that students varied their use of learning strategies for the different courses. This result points to a context-specific component in the use of learning strategies. However, correlations showed that students were also consistent in their strategy use over different courses. This points to an individual-bound component in the use of learning strategies. So it seems that the question of variability versus consistency does not yield an either–or answer. However, Vermetten *et al.* (1999b) also found indications that learning strategies differ from each other in their degree of variability. For example, students' use of a memorizing-processing strategy turned out to be relatively insensitive to differences in the course context, whereas the use of a concrete-processing strategy and lack-of-regulation showed a rather high sensitivity for the course context.

DISSONANCE IN STUDENTS' REGULATION OF LEARNING PROCESSES

For some groups of students the expected interrelations between learning conceptions, learning motives, and learning processes do not emerge, a phenomenon that Meyer (2000) referred to as "dissonance" in student learning patterns. He describes the concept of "dissonance" as unexpected, theoretically incompatible combinations of particular motives, intentions, strategies, regulatory mechanisms, contextual perceptions, learning conceptions, and so on. Similarly, Beishuizen *et al.* (1994) asked Psychology students to perform a task using a study text that was presented on a computer, after these students had completed the ILS. For the data analysis, four groups of students were formed representing different combinations of processing and regulation strategies. The results showed that students who combined self-regulation with deep processing, and students who combined external regulation with stepwise ("surface") processing achieved good results on this task. However, students who combined external regulation with deep processing, and especially students who combined self-regulation with stepwise processing, performed much worse. Vermunt and Verloop (2000) found, among a group of low achieving university students, several indications of dissonance in their learning patterns: they showed a lack of differentiation within learning strategies, conceptions, and orientations, and a lack of integration between these learning components.

Dissonance may also have affective consequences. Lindblom-Ylänne and Lonka (2000) found, among advanced medical students in a traditional curriculum, a discrepancy between their (meaning-directed) conception of learning and the (reproduction-directed) learning strategies they used. This inner contradiction between beliefs and behavior led to a high level of dissatisfaction and tension among the students concerned. Interviews with students who had dissonant learning style profiles showed that many of them went through a process of change in their study practices. All these students had changed their way of studying during their medical studies. It seemed that the learning environment had forced these students to study in a way that did not match their conceptions of learning. Transitional phases in learning patterns may be induced by a poor fit between learning and teaching strategies. Lindblom-Ylänne and Lonka (2000) concluded that the students with dissonant patterns had experienced frictions that had forced them to change their learning patterns into reproductive forms that did not match their own, constructive, learning conceptions.

RELATIONS BETWEEN LEARNING PATTERNS AND PERSONAL AND CONTEXTUAL FACTORS

Personality

In what way are learning patterns related to personality factors? Busato *et al.* (1999) administered both the ILS and a Big Five Personality test to first-year Psychology students. In general, the correlations between learning style and personality factors were modest. Most remarkable were the positive associations between meaning-directed learning and "intellectual openness" and between reproduction-directed learning and "conscientiousness" and "agreeableness." Undirected learning correlated positively with "neuroticism" and negatively with "conscientiousness" and "intellectual openness." Finally, application-directed learning correlated positively with "agreeableness," "intellectual openness," "extraversion," and "conscientiousness." Vermetten *et al.* (2001) found that surface-level strategies were related to entity theory beliefs and ego orientation, as well as to "conscientiousness," "agreeableness," and "effort orientation." Deep-level strategies were only directly related to "task orientation" and "intellectual openness."

Epistemologies

A reproduction-directed learning pattern goes together with a dualistic conception of knowledge, in which knowledge and information are conceived of as "true" or "false" (Lonka and Lindblom-Ylänne, 1996). Rozendaal *et al.* (2001) found that students with a more relativistic view of knowledge had higher scores on all ILS-scales representing meaning directed learning, that is deep processing, self-regulation, construction of knowledge as conception of learning, and a personally interested learning orientation. Students with a more absolutistic view of knowledge were more likely to report aspects of a reproduction-directed learning pattern (stepwise processing, external regulation, intake of knowledge, and certificate orientedness) and an undirected learning pattern (lack of regulation, ambivalent orientation, and cooperation).

Gender

Do men and women learn differently? Severiens and Ten Dam (1997) studied the relation between learning styles, gender, and gender-identity

of students in adult secondary education. Concerning gender, they found that men, on average, scored higher than women on undirected learning, whereas women scored higher than men on reproduction-directed learning.

Context

How are personal and contextual factors associated with students' learning patterns? Personal variables such as age, gender, prior educational level, and study experience, and context variables such as subject area and type of learning environment (regular campus-based or distance education) were related to ILS scale scores in a study by Vermunt (1992). Meaning-directed learning was found most often among students from the social and cultural subject areas. This learning pattern was also found more among older students, and among students from a distance education program than among students from a campus-based university. Reproduction-directed learning turned out to occur most among students with a relatively low prior educational level, and among students of Economics, Law, and Natural Sciences. In distance education this learning pattern was found relatively often among women, older students, and advanced students. Open university students from the management sciences and regular university Law students showed most characteristics of application-directed learning. Futhermore, this learning pattern occurred more often among students from the regular university than among students from the open university. Finally, undirected learning was found remarkably more often among students in regular education than among those in distance education. Students who were older or had a lower level of prior education showed more lack of regulation in their study behavior. At the open university, beginning students showed more aspects of this learning pattern than relatively advanced students, whereas at the regular university, this learning pattern occurred most often among students from the large Faculty of Economics.

Wierstra *et al.* (2003) developed the Inventory of Perceived Study Environments (IPSE) and administered both the ILS and IPSE to a large sample of international exchange students. They found that meaning-directed learning was related to a learning environment perceived as emphasizing connections and relations between study topics and as student-oriented in nature. Reproductive learning was related to a learning environment perceived as stressing the memorization of facts and as giving students few incentives for active participation in a course.

RELATIONS BETWEEN LEARNING PATTERNS AND LEARNING OUTCOMES

Beishuizen and Stoutjesdijk (1999) studied the relation between learning style and achievement in a computer-supported learning environment. They found that students with a deep learning pattern had better achievements than students with a surface pattern, even for questions on factual knowledge. Busato *et al.* (1998) found that undirected learning was consistently negatively related to study success. Meaning-directed learning showed a positive association with study success and the other two patterns (reproduction-directed and application-directed learning) showed no relation.

Meaning-directed learning correlates positively and reproduction directed learning correlates negatively with students' portfolio grades in an innovative course (Lonka *et al.*, 1997). Lindblom-Ylänne and Lonka (1999) found that for medical students, meaning-directed learning was consistently and positively related to both preclinical and clinical study achievements. Reproduction-directed learning was also consistently associated with achievements, but in a negative way instead.

The ways in which students' learning strategies, conceptions, and orientations are related to various success indicators in two types of learning environments and different subject areas was studied by Vermunt (1992). Learning patterns explained an important part of the variance in exam results, between 25 and 55% for the different subject areas at the regular university. However, the results also revealed that the usual exams in the first years of higher education hardly capitalize on students' use of critical, analytical, and concrete processing strategies. Meaning-directed learning generally is positively correlated to most indicators of exam results, both in distance education and regular education, as well as in various subject areas. Especially the use of a "relating and structuring processing strategy" was positively associated with all types of exam results, e.g., with the scores on factual knowledge questions, insight questions, application questions, multiple choice questions, and open questions. Some aspects of this learning pattern were, however, in some analyses, negatively related to study pace. Reproduction-directed learning in general shows mostly negative correlations with exam results. An exception is the positive association in open distance education of the learning orientation aimed at gaining certificates and study pace and exam participation. Application-directed learning is consistently and positively related to study pace, but negatively to exam participation. In regular education application-directed learning shows hardly any relations with exam results. Finally, in all analyses, undirected learning is

consistently and negatively related to all types of exam results, in both types of universities and in all subject areas.

PROCESS-ORIENTED INSTRUCTION

Process-oriented instruction is aimed at the integrated teaching of domain-specific knowledge on the one hand, and learning and thinking strategies on the other (Simons, 1997). It as an educational concept especially aimed at promoting "learning to learn," at discouraging undirected and reproduction-directed learning patterns and at promoting meaning- and application-directed learning patterns. It is called process-oriented teaching because it focuses on the learners' processes of knowledge construction and utilization. The emphasis is on a gradual transfer of control over student learning processes from the teacher and/or other instructional agents to students (Vermunt, 2003; Vermunt and Verschaffel, 2000). Schatteman *et al.* (1997) implemented process-oriented teaching in the form of interactive working groups at the Faculty of Sciences of the University of Brussels, Belgium. The major goal of these interactive working groups was to promote in-depth learning by training general and specific learning skills in a content-specific context. The working groups were organized in parallel with the regular courses in physics, mathematics, chemistry, and biology. The instructor interacted on a metacognitive level with the students, and the method induced the active participation of the students in regulating their learning processes. Schatteman *et al.* compared the ILS learning patterns and exam performances of an experimental group of students, who had participated in the working groups frequently, with those of a group of students who had not participated in these working groups at all. The results showed that participation in the interactive working groups induced positive effects on learning approach and regulation, effects that induced an increase in students' performance in examinations.

Lonka and Ahola (1995) conducted a longitudinal study on the effects of an educational innovation that had many process-oriented features (e.g., diagnosing and activating conceptions, fostering the learning process and reflective thinking, giving feedback, and challenging misconceptions), and was intended to induce the employment of deep and self-regulated learning strategies in students. Their results showed that, in the beginning, this type of teaching slowed down the study pace of students, but after a while, exam results were better than those of preinnovation students. Probably, the attention needed in the beginning to acquire new learning strategies was paid at the expense of attention for the subject matter. Once these strategies had

become more automatized, the students were rapidly rewarded with qualitatively better learning processes. Volet *et al.* (1995) studied the effects on learning strategies and exam results of process-oriented instructional principles built into regular university courses in computer science in Australia. Masui and DeCorte (1999) applied similar principles to first-year university studies in Belgium, with a focus on improving students' use of orienting and self-judging regulation activities. These studies all showed that the quality of university education can be improved considerably by changes in a process-oriented direction.

Can students' conceptions of learning be changed in a constructive direction? Vermunt (1995) studied the effects of an instructional program consisting of the ILS, a learning guide, and tutorials on Psychology students in the Netherlands. The linking of a thorough diagnosis of the students' own way of learning and their preconceptions about studying to individually tailored instructional measures, turned out to be a powerful way to activate students to reflect on their own way of learning and on alternative possibilities. Moreover, the results showed different learning effects for different types of students. Students with undirected and reproduction-directed learning patterns changed their learning conceptions in a constructive direction. For students with meaning- and application-directed learning patterns, the program resulted in a higher degree of integration and usability of their constructive learning conceptions than before its introduction. The program also resulted in transfer effects that were reflected in higher exam scores in another course.

Theophilides (1997) implemented process-oriented innovations in an introductory course on the foundations of education at the Department of Teacher Education, University of Cyprus. Through individual and group work, students had to pinpoint main ideas, compare and contrast information, draw their own conclusions, and test the validity of these conclusions. Research results showed that the course promoted deep understanding and metacognition, and that the students regarded the instructional process applied in the course positively: they liked the diversity and originality of the learning activities, endorsed participation in the instructional process, and enhanced their self-actualization feelings.

CONCLUSIONS AND DISCUSSION

The studies reviewed in this article have revealed that in the first years of higher education, four clear dimensions in student learning can be discerned: undirected, reproduction-directed, meaning-directed, and application-directed learning patterns. These are characterized by rather

strong interrelations between students' conceptions of learning, their learning orientations, and their use of regulation and processing strategies. The more the context deviates from the first years of higher education, the more the internal structure of the learning patterns differs from this four-dimensional structure. The meaning-directed, reproduction-directed and undirected patterns are found in various contexts. Application-directed learning is especially found as a strong separate dimension among adult students. In strongly application-oriented environments, like vocational education and teacher education, all students seem to become more application-directed in their learning.

There seem to be three important developmental phenomena in students' learning patterns. First, there is an increasing differentiation within learning components. Older or more experienced students show greater ability to differentiate various learning strategies, conceptions, and orientations than younger or less experienced students. Second, there is an increasing integration of learning components. Older or more experienced students show stronger interrelations between their learning strategies, conceptions, and orientations than younger or less experienced students. Third, application-directed learning as a distinct learning pattern seems relatively late in its development, because this dimension is clearly a separate dimension only in adult or advanced groups of students. In most student learning research, particularly with first-year students, this dimension is not recognized as a distinct one, but as an element of meaning-directed learning (e.g., Entwistle and McCune, 2004).

Studies in which the ILS was administered twice to the same group of students with time intervals ranging from 3–14 months, show that the stability of learning patterns is rather high, but not so high that they should be conceptualized as unchangeable phenomena. Moreover, in a rather constant educational context, the intercorrelations between first and second administration are higher than in a context in which traditional teaching methods are changed into innovative ones (Minnaert and Van der Hulst, 2000). This means that learning patterns are susceptible to educational influences.

Research on a course-specific level showed that students do vary their use of learning strategies for different courses, but that students are also consistent in their strategy use over different courses. Accordingly, there seems to be both a context-specific and an individual-bound component in the use of learning strategies. All in all, this points to the conclusion that learning patterns are rather stable within a constant educational context, but that they can be changed. However, this will probably not be possible from one day to another, and to be successful, *all* learning components should be addressed in the interventions, not just learning strategies.

Several studies tried to relate students' learning conceptions, orientations, and strategies to other personal and contextual factors. For example, for personal epistemologies, consistent and positive relations between a more relative view of knowledge and meaning-directed learning were found, and between a more absolute view of knowledge and reproduction-directed learning. The magnitude of the correlations is such, however, that it seems wise to see epistemologies and learning patterns as distinct but related phenomena. Some studies found modest associations with the Big Five personality variables, especially between meaning-directed learning and intellectual openness and between reproduction-directed learning and conscientiousness and agreeableness. Other studies showed that learning patterns are associated in a comprehensible but sometimes surprising manner with personal variables like prior educational level, study experience, age, and gender, and with contextual variables like subject area and type of learning environment.

In reviewing evidence for dissonance in studies that used the ILS as one of the instruments, Vermunt and Verloop (2000) identified five phenomena of dissonance in student learning patterns: lack of differentiation within learning strategies, conceptions, and orientations; lack of integration between learning strategies, conceptions, and orientations; lack of the application-directed learning pattern; incompatibility of learning strategies, conceptions, and orientations; and missing elements from learning patterns. Especially when students enter a new type of education, there may be a temporary misfit, or friction, between the students' learning conceptions, orientations, and strategies, and the demands of the new learning environment.

In general, studies show that meaning directed learning is associated positively with indicators for study achievements, even with scores on factual exam questions. In the majority of studies, reproduction-directed learning showed negative correlations with outcome measures. Undirected learning mostly showed strong negative relations to exam performance, whereas application directed learning showed no relation to study success in most cases. However, the studies also showed a lot of variation in the relationships that were found, perhaps due to different assessment practices. The studies also showed that, in general, the usual exams in the first years of higher education hardly capitalize on students' use of critical, analytical, and concrete processing strategies.

Several intervention studies were reviewed in which the objective was to change students' learning patterns in a favorable direction, mainly toward meaning-directed and sometimes also application-directed learning. These studies are promising and show that it is indeed possible to influence student learning patterns in such way that, for example, their level of deep

processing and self-regulation increases. Moreover, they show that these improvements in learning patterns often go together with improvements in learning outcomes. However, until now studies in this area are scarce, and much work remains to be done. What we need mostly are field studies in which the gradual transfer from external regulation to self-regulation of learning is implemented in a regular curriculum, and in which the effects of this innovation on learning processes and outcomes are carefully studied (Vermunt, 2003).

One of the most important implications for practice is the realization that there are qualitatively different learning patterns and that some patterns are better than others in view of the knowledge they lead to, and in view of the preparation for lifelong learning competence. Assessing the learning patterns of their own student population may give a teacher, a faculty, or an institution a view of the dominant student learning patterns. Often, for example, traditional teaching programs, with a high focus on teacher control and transfer of knowledge, are associated with reproductive learning patterns of the students in these programs (Trigwell *et al.*, 1999). Increasingly, people are becoming dissatisfied with these types of teaching and learning environments, and the call for innovative teaching methods, stressing active, constructive and self-regulated learning, is increasing. The theoretical framework described above can help in designing teaching programs that are more process-oriented in nature and that stimulate students to develop more meaning- and application-directed learning patterns. Those are exactly the patterns they will need when, after graduation, they face a long period of lifelong, self-directed learning.

Future research and theory development should be directed at a further integration of the various conceptualizations in the field of student learning in higher education. In further theory development, we think it is important to incorporate the affective and social/collaborative learning components more prominently. In this way, a third generation of conceptualizations of student learning can be developed. Instrument development could follow a similar path. It would be worthwhile to study the interrelations among the various instruments that are used in the field, and to strive for a kind of integrated student learning inventory that incorporates the best of the existing ones, supplemented with affective and social/collaborative components. Further research should also focus on the interplay between self-regulation and external regulation of learning. For example, how different degrees of self-regulation and external regulation of learning operate in relation to each other, and whether this happens differently in different kinds of learning environments, are important issues for further study. Future research should also be directed at the way in which promotion of more favorable learning patterns can be concretely realized

in different types of learning environments. To achieve this, the design, implementation and evaluation of process-oriented study programs in ecologically valid settings are of utmost importance.

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