

# The development of learning patterns throughout higher education

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## **Abstract.**

Research on learning pattern development in higher education contexts is scarce. In this longitudinal study the development of learning patterns of professional bachelor students is analyzed. Participants in the study were 254 students enrolled in eight different study disciplines. Vermunts' Inventory of Learning Styles was used to assess individual differences in learning conceptions and learning strategies. By examining intra-individual changes in learning patterns we expected to find developmental trends within learning patterns. Results show that meaning oriented learning increases over time and undirected learning decreases. Some learning patterns are however more subject to change than others. The development of learning patterns was found to be relative and dependent on the learning pattern which students have already mastered in the first-year of professional bachelor education.

**Keywords:** learning conception, learning pattern, learning style, longitudinal study, self-regulation, student learning

## **1. Introduction**

Research shows that a large number of personality and environment-related factors can have an impact on students' learning conceptions, their learning strategies and learning approaches (e.g. Entwistle et al., 2003). The debate as to whether learning approaches are 'trait or state' is an important part of this. Some researchers take the view that learning approaches are, in reality, fixed personality-related characteristics which are difficult to change in the context of education (e.g. Messick, 1996). Other researchers have underlined the relative changeability of learning approaches (e.g. Entwistle and Ramsden, 1983; Meyer and Muller, 1990; Wierstra and Beerends, 1996; Vermetten et al., 1999). Vermunt (1992) argues that learning approaches or learning patterns exhibit quite a high degree of stability. However, this still does not mean that all learning components have to be considered as stable characteristics. In his study he further states that the stability of some components of learning patterns varies. It would appear, therefore, that learning strategies, as learning pattern characteristics, are less stable than learning conceptions and learning orientations. According to Vermunt (1992) this points to the fact that strategies may show a greater correlation with environment-related factors than learning conceptions and learning orientations. Thus learning patterns are not to be considered as immutable personal characteristics. In studies in which the relationship between learning patterns and personality characteristics were investigated no strong correlations could be discerned. This also shows that learning patterns should not be seen as completely stable characteristics of an individual (e.g. Busato et al., 1998). The rather scarce longitudinal research into learning patterns in higher education has

indicated that some learning components can be subject to change. On this basis certain authors have stated that the meaning-oriented learning pattern increases during higher education degree courses (Busato et al., 1998; Donche & Van Petegem, in press, Vermetten et al., 1999; Vermunt and Minnaert, 2003).

Longitudinal studies on learning patterns (e.g. Vermunt, 1992; Vermetten et al., 1999; Vermunt and Minnaert, 2003) often studied the changeability of learning pattern characteristics over a short time period (< 12 months). In this respect we think it worthwhile to allow a greater time interval in the study of development of learning patterns. Are the more stable components of learning patterns, such as learning conceptions, as established previously, still not subject to change when the time interval is greater?

So far, changes in learning patterns have also been reported at the level of learning components. In this regard, our second research question is whether the development of learning patterns may not also be related to the learning pattern which students exhibit on entering higher education.

## **2. Methodology**

### *2.1. Design and respondents*

The study took place in eight three-year professional bachelor education programmes in higher education. We examined how first-year students in Flanders (Dutch speaking part of Belgium) learn and develop their learning throughout three consecutive years of study. We are aware that during their professional bachelor education programmes students undertake a variety of learning activities, such as amongst others ‘academic’ learning activities like ‘studying theoretical texts in a critical way’ or more experiential learning activities such as ‘relating theory to experiences during practice placements’. As carrying out more ‘academic’ learning tasks is still an important part in the curriculum of professional bachelor education programmes we concentrated in this study on the development of ‘academic’ learning.

1.039 first-year students from eight different professional bachelor education programmes participated in the first run of this study (response = 74%). From this group we were able to collect data from 283 students twice, namely in the first and third year of their study programme. From 254 students we have collected survey-data at three points during their study career in higher education, namely during their first, second and third year of their study. The three datasets were used in the analyses.

### *2.2. Measurements*

*Learning conceptions.* Students’ learning conceptions were assessed with 4 scales from the self-report questionnaire ‘Inventory of Learning Styles’ (ILS; Vermunt, 1998). Four scales representing

four different conceptions, that is, intake of knowledge (e.g., "To me, learning means trying to remember the subject matter I am given "; 9 items;  $\alpha = .74$ ), construction of knowledge (e.g., " If I have difficulty understanding a particular topic, I consult other books of my own accord "; 9 items;  $\alpha = .72$ ), use of knowledge (e.g., "The things I learn have to be useful for solving practical problems "; 6 items;  $\alpha = .75$ ) and stimulating education (e.g., "The course team should encourage me to compare the various theories that are dealt with in a course"; 8 items;  $\alpha = .86$ ). Learning conceptions items are scored, ranging from (1) 'I completely disagree' to (5) 'I completely agree'

*Learning strategies.* Students' regulation and processing strategies were assessed with six scales from the self-report questionnaire 'Inventory of Learning Styles' (ILS; Vermunt, 1998). Three scales representing three different regulation strategies, that is, self-regulation (e.g., "To test my learning progress. I try to answer questions about the subject matter which I make up myself"; 11 items;  $\alpha = .78$ ), external regulation (e.g., "I study according to the instructions given in the course materials"; 11 items;  $\alpha = .68$ ) and lack of regulation (e.g., "I notice that it is difficult for me to determine whether I have mastered the subject matter sufficiently"; 6 items;  $\alpha = .72$ ). Three main scales and five subscales representing different qualities in processing strategies, that is, deep processing and more in particular 'relating and structuring' (e.g., "I try to combine the subjects that are dealt with separately in a course into one whole"; 7 items;  $\alpha = .81$ ) and 'critical processing' (e.g., "I try to understand the interpretations of experts in a critical way"; 4 items;  $\alpha = .67$ ), secondly surface processing and more in particular 'memorising' (e.g., "I memorise lists of characteristics of a certain phenomenon"; 5 items;  $\alpha = .73$ ) and 'analysing' (e.g., "I analyse the different parts of a theory step by step"; 6 items,  $\alpha = .67$ ), and thirdly concrete processing (e.g., "I pay particular attention to those parts of the course that have practical utility"; 5 items;  $\alpha = .68$ ). All items are scored, ranging from 1 (I never or hardly ever do this) to 5 (I (almost) always do this). Cronbach alpha reliability coefficients for the ILS-scales measuring learning conceptions and learning strategies were between 0.66 and 0.86 and are comparable with other ILS-studies (see Vermunt & Vermetten, 2004).

### **3. Results**

#### *3.1. Preliminary analysis*

In a first step we examined whether there were groups of learners with homogenous learning patterns among first-year students. The dataset collected from the entire population of first-year students of the eight involved study disciplines was used (N= 1.039). A cluster analysis (Ward, 1963) was carried out on the basis of 10 main ILS scales relating to the following learning pattern components: learning conceptions, regulation strategies and processing strategies. On the basis of the distance coefficients and the way in which clusters could be interpreted a clustering into three groups of students was chosen. A three cluster solution also explains the most variance in ILS scores. One-way analyses of variance were

carried out to analyse differences between clusters with respect to the 10 ILS scales. Post hoc complex comparisons were applied using the Bonferroni method. Three learning patterns could be distinguished: students with a meaning-oriented (16,2%), reproductive/undirected (46,3%) and flexible learning pattern (37,5%). These learning patterns are comparable with former cluster results on ILS scales in higher education. The ‘flexible’ learning pattern corresponds to the ‘flexible/versatile’ cluster identified by Wierstra and Beerends (1996). The ‘meaning-oriented’ and ‘reproductive/undirected’ learning pattern corresponds to the ‘surface/undirected’ and ‘deep’ cluster identified by Vermetten et al. (2002). However, a cluster formed by ‘inactive’ learners which Vermetten et al. (2002) identified was not found in this study. The clusters are comparable with earlier cluster results on ILS scales in first-year teacher education in Flanders (Donche & Van Petegem, in press).

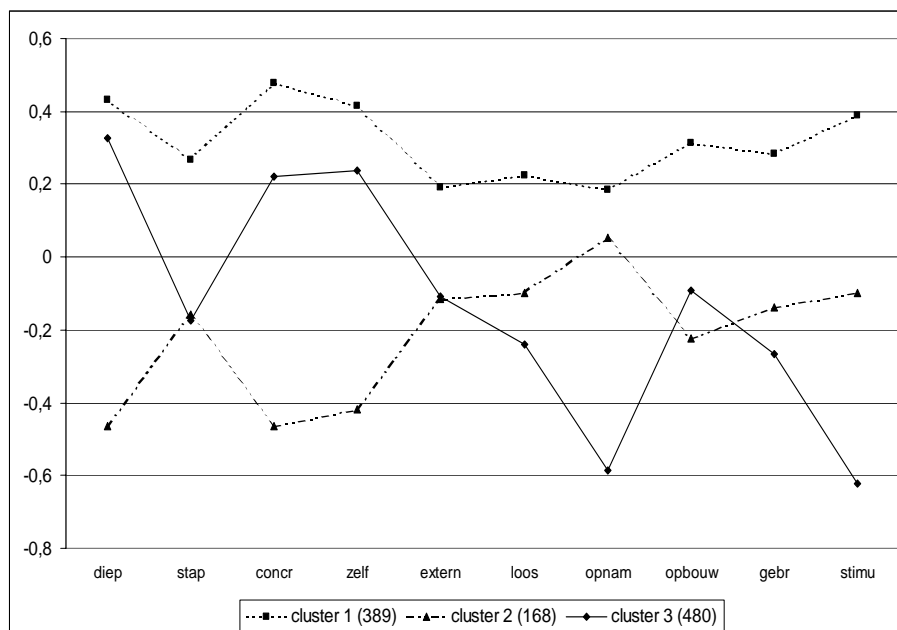


Figure 1. Clusteranalysis on 10 ILS scales

### 3.2. Repeated measures analyses

To test the hypothesis that student learning becomes more meaning-oriented over time and which further implies that learning conceptions and learning strategies are subject to change, we conducted one-way within-subjects ANOVA's with the factor time and the dependent variables being the ILS scale scores. Significant time effects (Wilk's  $\lambda$ ) were found on 9 out of 12 ILS scales (Table 1). The results show that learning conceptions and learning strategies are subject to change and generally confirm the hypothesis that students score higher on learning conceptions and learning strategies which are characteristic of more meaning-oriented learning across time. In addition, we found a decrease on scales measuring learning

conceptions and learning strategies which are characteristic for reproduction oriented and unregulated learning. It should be noted that there was little change in ILS scale means between the first and second year of study, most significant changes occur after two years of study.

**Table 1.** Results of repeated measurement analyses, time effect (Wilk's  $\lambda$ ), pre- and post-test mean scale scores and standard deviations between brackets, t-test results

ILS-scales	1st year	2nd year	3rd year	Wilk's $\lambda$	1st vs. 2nd year	2nd vs. 3rd year	1st vs. 3rd year
<b>Processing strategies</b>							
<i>Deep processing</i>							
Relating and structuring	3.22 (.76)	3.27 (.76)	3.37 (.79)	.95**	-	**	**
Critical processing	2.60 (.78)	2.69 (.79)	2.79 (.83)	.94***	-	*	***
<i>Stepwise processing</i>							
Memorising	3.28 (.85)	3.21 (.82)	3.14 (.89)	.97*	-	-	**
Analysing	3.02 (.69)	3.05 (.69)	3.01 (.72)	-	-	-	-
<i>Concrete processing</i>	3.14 (.72)	3.20 (.71)	3.35 (.68)	.90***	-	***	***
<b>Regulation strategies</b>							
<i>Self-regulation</i>	2.57 (.63)	2.59 (.65)	2.72 (.68)	.92***	-	***	***
<i>External regulation</i>	3.29 (.59)	3.21 (.56)	3.12 (.61)	.92***	*	**	***
<i>Lack of regulation</i>	2.50 (.73)	2.36 (.68)	2.24 (.73)	.89***	**	**	***
<b>Learning conceptions</b>							
<i>Intake of knowledge</i>	3.69 (.62)	3.55 (.56)	3.40 (.62)	.80***	***	***	***
<i>Construction of knowledge</i>	3.43 (.53)	3.40 (.54)	3.51 (.55)	.95**	-	**	*
<i>Use of knowledge</i>	4.08 (.57)	4.03 (.51)	4.06 (.55)	-	-	-	-
<i>Stimulating education</i>	3.28 (.78)	3.10 (.71)	3.09 (.77)	.95**	**	-	**

N=254, Significance level:  $p < .001=***$ ;  $p < .01=**$ ;  $p < .05=*$ ; - = non significant

To answer the second research question, if the development of learning patterns is related to the learning pattern which students exhibit when entering higher education, we conducted paired sample t-tests for each of the three learning pattern clusters. The students remaining at the end of the third year are a representative subset of those entering higher education (14.4% meaning-oriented, 46% reproductive/undirected and 38% flexible learning pattern compared to respectively 16.2%, 46.3% and 37.5%).

Table A (see appendix) shows the results of the various paired t-tests. Effect values (Cohen's  $d$ ) fluctuate between .17 and .82. According to the  $d$ -index interpretation guidelines  $d = 0.2$  is indicative of a small effect, while  $d = 0.5$  and  $d = 0.8$  represent a medium and large

effect, respectively (Cohen, 1988). Results of t-tests within learning pattern clusters show that some learning patterns are more subject to change than others.

First-year students who exhibited a reproductive/undirected learning pattern appear, in general, change in the third year. The medium effect sizes found on several ILS-scales indicate that their learning exhibits fewer undirected learning pattern characteristics such as a decrease in lack of regulation ( $M = 2.25, SD = .75, t(131) = 2.41, p < .05$ ) and conceptualising learning as primarily the intake of knowledge ( $M = 3.45, SD = .57, t(131) = 5.77, p < .001$ ). An increase is noted on the more meaning-oriented learning pattern characteristics, such as the use of deep and concrete processing strategies ( $M = 3.04, SD = .65, t(131) = -5.57, p < .001$ ), and self-regulation strategies ( $M = 2.44, SD = .61, t(131) = -5.64, p < .001$ ).

First-year students who exhibited the characteristics of a flexible learning pattern appear to learn in a more meaning-oriented manner in the third year. The flexible character of their learning appears to be developed in the direction of more meaning-oriented learning. This can be deduced from small to medium effect sizes found on ILS-scales measuring reproductive and undirected learning pattern characteristics. We notified an important decrease of average scores on conceptualising learning as primarily the intake of knowledge ( $M = 3.50, SD = .58, t(74) = 7.59, p < .001$ ) and stimulating education ( $M = 3.38, SD = .78, t(74) = 4.53, p < .001$ ). In addition also a significant decrease of average scores was found on scales measuring external regulation ( $M = 3.28, SD = .56, t(74) = 3.90, p < .001$ ) and lack of regulation ( $M = 2.33, SD = .76, t(74) = 5.92, p < .001$ ).

Students who had already mastered a meaning-oriented learning pattern in the first year of professional bachelor education programmes appear to develop this learning pattern further in the same direction. This can be mainly deduced from small to medium effects sizes found on ILS scales measuring meaning oriented learning characteristics. We found a further increase of average ILS-scores on self-regulation ( $M = 2.86, SD = .61, t(74) = -2.04, p < .05$ ) as well as the increase of the learning conception ‘construction of knowledge’ ( $M = 3.58, SD = .51, t(74) = -1.91, p < .05$ ).

The results of t-tests within learning pattern clusters also show that some learning characteristics are repeatedly found to be rather stable. In particular we did not notice significant changes on the level of stepwise processing strategies such as analysing and the learning conception ‘use of knowledge’.

#### **4. Conclusion**

The present research demonstrated that learning pattern characteristics during three year professional bachelor programmes are subject to change. Longitudinal results indicate that first-year students learn in a more undirected manner than third-year students. In general, third-year students appear to exhibit more characteristics of meaning oriented or deep learners

which is in line with former research in higher education (Busato et al., 1998; Dipelhofer-Stiem, 1989; Donche & Van Petegem, in press; Severiens et al., 2001; Vermetten et al., 1999; Vermunt, 1992; Vermunt and Minnaert, 2003; Watkins and Hattie, 1981;). This change, however, seems to occur quite slowly and even in the final year reproduction oriented learning continues to play a crucial role. This enhancement of meaning oriented learning strategies accompanied by a moderate use of reproduction oriented learning strategies may point to the fact that students during time have adopted more flexible learning strategies. This may as well refer to the fact that senior students have advanced in their capacity to judge which strategies are more suited to the demands of particular tasks which can also refer to the concept of 'strategic learning' (Entwistle, 1998). In particular, combining meaning oriented and reproduction oriented learning characteristics seems to be a fruitful way to cope in professional bachelor education programmes. As former research has indicated that constraints like for instance heavy workload can be linked to more surface approaches to learning (Entwistle et al., 2003), it remains unclear if this aspect played an influencing role in the relative development of learning patterns. In the longitudinal study it was further demonstrated that the developmental trends differ according to the learning patterns which students have already acquired in the first-year of their study programme. In addition it was shown that a meaning oriented learning pattern is a more stable pattern in comparison with the reproductive undirected learning pattern. This may also reflect that students who are already more meaning oriented learners in the first year have a learning pattern which enables successful passing throughout their study path in higher education. Students with a more reproductive and undirected learning pattern at the beginning of their study programme undergo important changes on the level of their learning pattern during their study path, especially during the second and third year of their study.

The results of this research further demonstrate that developmental trends in learning patterns are present but large scale research on this topic still has to be carried out to further validate and extend these findings. The results of the presented study point at the fact that further empirical investigation of a developmental hypothesis regarding to student learning patterns in higher education contexts is needed. In this study we have provided evidence that when learning patterns are measured at three crucial points of time in a three year professional bachelor programme with equal intervals of 12 months, some learning patterns are more subject to change than others. It is far too simplifying to infer from our research findings that the development of learning patterns can be now presented as consecutive, by which is suggested that the development of learning patterns takes place in a gradual, phased manner from reproductive/undirected (phase 1) to more flexible learning (phase 2) and thereafter to more meaning-oriented learning (phase 3). What we need now mostly in the investigation of possible transitional phases in learning pattern development are studies in which students'

learning patterns are investigated on more than three measure moments across time (Bijleveld et al., 1998).

## References

- Bijleveld, C., van der Kamp, L., Mooijaart, A., (1998), *Longitudinal data analysis: designs, models and methods*, London: sage.
- Boyle, E.A., Duffy, T., Dunleavy, K., (2003), Learning styles and academic outcome: the validity and utility of Vermunt's inventory of learning styles in a British higher education setting, *British Journal of Educational Psychology*, 73, 267-290.
- Busato, V.V., Prins, F.J., Elshout, J.J., Hamaker, C., (1998), Learning styles: a cross-sectional and longitudinal study in higher education, *British Journal of Educational Psychology*, 68, 427-441.
- Dippelhofer-Stiem, B., (1989), The development of research-oriented learning in five European countries, *European Journal of Psychology of Education*, 4, 489-503.
- Donche, V., Van Petegem, P., (2005), Assessing pre-service teachers' orientations to learning to teach and preferences for learning environments, *Scientia pedagogica experimentalis*, 42 (1), p.27-52.
- Donche, V. & Van Petegem, P. (in press). The development of learning patterns of student teachers: a cross-sectional and longitudinal study. *Higher Education*.
- Entwistle, N., (1988), Motivational factors in students' approaches to learning, in R.R. Schmeck (Ed.), *Learning strategies and learning styles*, New York: Plenum Press, pp. 21-51.
- Entwistle, N., (1998), Improving teaching through research on student learning, in J.J.F. Forest (Eds.). *University teaching: international perspectives*, New York, Garland, 72-112.
- Entwistle, N. McCune, V., Hounsell, J. (2003), Investigating ways of enhancing university teaching-learning environments: measuring students' approaches to studying and perceptions of teaching, in E. De Corte, L. Verschaffel, N. Entwistle, J. van Merriënboer (Eds.), *Powerful learning environments: unravelling basic components and dimensions*, Advances in learning and instruction series, Amsterdam/Boston/London: Pergamon, pp. 89-107.
- Entwistle, N., Ramsden, P., (1983), *Understanding student learning*, London, Croom Helm.
- Meyer, J.H.F., Muller, M.W., (1990), Evaluating the quality of student learning. An unfolding analysis of the association between perceptions of learning context and approaches to studying at an individual level, *Studies in Higher Education*, 15 (2), 131-155.
- Messick, S., (1996), Cognitive styles and learning, in E. De Corte, F. Weinert (eds.), *International encyclopaedia of developmental and instructional psychology*, Oxford, Elsevier Science Ltd, pp.638 – 641.

- Severiens, S., Ten Dam, G., Van Hout Wolters, B., (2001), Stability of processing and regulation strategies, Two longitudinal studies on student learning, *Higher Education*, 42, 437-453.
- Vermetten, Y.J., Lodewijks, H.G., Vermunt, J.D., (1999), Consistency and variability of learning strategies in different university courses, *Higher Education*, 37, 1-21.
- Vermetten, Y.J., Vermunt, J.D., Lodewijks, H.G., (2002), Powerful learning environments? How do university students differ in their response to instructional measures, *Learning and Instruction*, 12, 263-284.
- Vermunt, J.D.H.M., (1992), *Leerstijlen en sturen van leerprocessen in het hoger onderwijs – naar procesgerichte instructie in zelfstandig denken*, [Learning styles and regulation of learning in higher education – toward process-oriented instruction in autonomous thinking], Amsterdam/Lisse, Swets & Zeitlinger.
- Vermunt, J.D., (1998), The regulation of constructive learning processes, *British Journal of Educational Psychology*, 68, 149-171.
- Vermunt, J.D., (2005), Relations between student learning patterns and personal and contextual factors and academic performance, *Higher education*, 46(3), 205-236.
- Vermunt, J.D., Minnaert, A., (2003), Dissonance in student learning patterns: when to revise theory? *Studies in Higher Education*, 28 (1), 49-61.
- Vermunt, J.D., Vermetten, Y.J., (2004), Patterns in student learning: relationships between learning strategies, conceptions of learning, and learning orientations, *Educational Psychology Review*, 16 (4), 359-385.
- Ward, J.H., (1963), Hierarchical grouping to optimise an objective function, *Journal of the American Statistical Association*, 58, 236-244.
- Watkins, D., Hattie, J., (1981), The learning processes of Australian university students: investigations of contextual and personological factors, *British Journal of Educational Psychology*, 51 (3), 384-393.
- Wierstra, R.F.A., Beerends, E.P.M., (1996), *Leeromgevingspercepties en leerstrategieën van eerstejaars studenten sociale wetenschappen*, [Perceptions of the learning environment and learning strategies of first-year students of social sciences], *Tijdschrift voor Onderwijsresearch*, 21(4), 306-322.

## APPENDIX

**Table A - Results of paired t-tests on ILS-scales within the meaning oriented (N = 42), flexible (N = 109) and reproductive/undirected (N = 132) learning pattern cluster<sup>1</sup>**

<i>ILS-scales</i>	<i>Meaning-oriented</i>				<i>Flexible</i>				<i>Reproductive/undirected</i>			
	<i>1<sup>st</sup> year</i>	<i>3<sup>rd</sup> year</i>	<i>t (42)</i>	<i>d</i>	<i>1<sup>st</sup> year</i>	<i>3<sup>rd</sup> year</i>	<i>t (109)</i>	<i>d</i>	<i>1<sup>st</sup> year</i>	<i>3<sup>rd</sup> year</i>	<i>t (132)</i>	<i>d</i>
<i>Processing strategies</i>												
Deep processing												
Relating and structuring	3.51 (.52)	3.63 (.78)	-1.06	--	3.69 (.63)	3.68 (.77)	.18	--	2.77 (.64)	3.05 (.68)	-4.44***	.44
Critical processing	2.99 (.70)	2.92 (.77)	.60	--	2.93 (.73)	3.07 (.82)	-1.99*	.19	2.20 (.67)	2.52 (.74)	-4.59***	.50
Stepwise processing												
Memorising	2.87 (.99)	2.80 (1.02)	.54	--	3.51 (.78)	3.28 (.94)	3.05**	.29	3.23 (.83)	3.16 (.80)	.90	--
Analysing	2.95 (.67)	2.86 (.72)	.80	--	3.29 (.59)	3.21 (.63)	1.48	--	2.88 (.70)	2.96 (.77)	-1.29	--
Concrete processing	3.57 (.61)	3.56 (.58)	.09	--	3.60 (.52)	3.63 (.58)	-.56	--	2.70 (.57)	3.04 (.65)	-5.57***	.60
<i>Regulation strategies</i>												
Self-regulation	2.68 (.47)	2.86 (.61)	-2.04*	.38	3.01 (.54)	3.03 (.62)	-.49	--	2.16 (.50)	2.44 (.61)	-5.64***	.56
External regulation	3.20 (.51)	3.02 (.72)	1.96(*)	.35	3.48 (.48)	3.28 (.56)	3.90***	.42	3.12 (.61)	3.02 (.60)	1.88(*)	.17
Lack of regulation	2.12 (.66)	1.96 (.59)	1.56	--	2.76 (.77)	2.33 (.76)	5.92***	.56	2.40 (.54)	2.25 (.75)	2.41*	.28
<i>Learning conceptions</i>												
Intake of knowledge	3.13 (.58)	3.08 (.64)	.52	--	3.92 (.51)	3.50 (.58)	7.59***	.82	3.74 (.55)	3.45 (.57)	5.77***	.53
Construction of knowledge	3.42 (.39)	3.58 (.51)	-1.91(*)	.41	3.75 (.43)	3.75 (.46)	.02	--	3.19 (.49)	3.34 (.54)	-3.72***	.31
Use of knowledge	3.98 (.55)	3.99 (.58)	-.07	--	4.34 (.38)	4.25 (.48)	1.76	--	3.94 (.57)	3.95 (.58)	-.29	--
Stimulating education	2.55 (.69)	2.77 (.86)	-1.49	--	3.72 (.54)	3.38 (.78)	4.53***	.63	3.21 (.76)	3.07 (.71)	1.87	--

<sup>1</sup>Significance level :  $p < .001=***$ ;  $p < .01=**$ ;  $p < .05=*$ ; -- = not significant