Learning Conceptions and their Impact on Higher Education Students' Study Strategies and Academic Achievement

Abstract

The present study investigates higher education students' learning conceptions and their impact on students' study strategies and academic achievement. Learning conceptions are defined as coherent sets of cognitions about memorizing an understanding.

A two-step cluster analysis identified *three* subgroups of students with diverging learning conceptions. Students with a *constructive* learning conception strongly equate learning with *seeking understanding* while students with a reproductive learning conception equate learning strongly with *memorizing*. To students with a mixed conception of learning, understanding and memorizing are *mutually enhancing processes*. Once one has understood the learning material to a certain extent, one should memorize it well because the latter is a precondition for gaining an even deeper understanding of the learning material.

Results further indicate that the learning conceptions identified in this study encourage the adoption of different study strategies which in turn lead to diverging study results.

Learning conceptions and their impact on higher educations students' study strategies and academic achievement

For decades educational research indicated that Western higher education students equate learning either with memorizing or seeking understanding. Recently, the validity of the dichotomy between *learning as memorizing* and *learning as seeking understanding* has been questioned by the results of both phenomenographic and quantitative research which demonstrated that Western students think more subtly about learning, memorizing and understanding than previously thought (Entwistle, 2003; Marton, Wen, & Wong, 2005; Meyer, 2000a). As a result, eminent educational researchers (e.g., Entwistle, 2003; Marton et al., 2005) have called upon their colleagues to take into account the distinctions some Western students make between different forms of memorization and understanding, when studying learning conceptions. This study answers that call and in doing so hopes to make a theoretical and empirical contribution to the study of learning conceptions.

1. Theoretical base

Research demonstrates that students think about learning in qualitatively different ways. For instance, following the analysis of students' responses to several open ended questions about learning (e.g., 'What do you actually mean by learning'), Säljö (1979) concluded that students think about learning in five distinctive different ways: (a) the increase of knowledge; (b) memorizing and reproducing; (c) the acquisition of facts; procedures which can be used in practice; (d) the abstraction of meaning; and (e) an interpretative process which is aimed at the understanding of reality. These five categories represent two fundamental conceptions of learning (Purdie & Hattie, 2002). The first three conceptions represent a reproductive view of learning that comprises the acquisition, storing, reproduction, and use of knowledge; the last two represent a constructive view of learning that implies the construction of meaning and personal change.

Following Säljo's study, three decades of research in Western educational contexts has brought the consistent and persistent message that Western higher education students conceive of learning in two fundamentally different ways. Some students view learning as the reproduction of knowledge (a

reproductive learning conception); other students equate learning with trying to understand the learning material (a constructive learning conception; Purdie & Hattie, 2002).

Students' conceptions of learning are a 'hot topic' in educational research since learning conceptions are expected to influence students' study strategies and subsequent learning outcomes (Marton, Dall'Alba, & Beaty, 1993; Vermunt, 1998; Entwistle, 2004). For instance, Van Rossum and Schenk (1984) examined the relationship between the five learning conceptions identified by Saljö (1979) and the use of a deep or a surface strategy. They found that students who view learning as an active and transformative *meaning seeking process* are more likely to adopt a deep learning strategy while students who perceive learning as a passive and mechanical *process of memorizing* information are more likely to adopt a surface oriented learning strategy. Vermunt (1998, 2005) demonstrated that perceiving learning as the construction of knowledge is associated with a self-regulated and deep oriented study strategy while perceiving learning as the intake of presented knowledge induces a more externally regulated and reproduction oriented study strategy (see below).

The relationship between conceptions of learning on the one hand and learning outcomes (e.g., level of understanding and academic achievement) on the other hand, has been repeatedly demonstrated (Entwistle, McCune, & Hounsell, 2002; Lonka & Lindblom-Ylänne, 1996; Marton & Saljö, 1997; Vermunt, 2005). A constructive conception of learning is associated with deeper levels of understanding while a reproductive learning conception induces a surface learning strategy which in turn results in barely understood and inert knowledge. Both Entwistle (2003) and Vermunt (2005) state that a reproductive conception of learning is associated with poorer exam results.

Precisely because research results indicated that students who equate learning with memorizing achieve little understanding of what is being taught, most Western educators and educational scientists tended to perceive memorizing and understanding as quasi mutually exclusive processes. The latter, especially, as educational practitioners and researchers made little or no distinction between potentially different forms of memorization and generally identified memorizing with rote memorizing (Sachs & Chang, 2003).

The perception of memorizing and understanding as mutually exclusive processes has been questioned by a phenomenon which is generally referred to as the paradox of the Chinese learner (Kember & Gow, 1991; Marton, Dall'Alba, & Tse., 1996; Watkins & Biggs, 1996). The paradox of the Chinese learner[1] introduces two stereotypes about the (South-East) Asian. learner The first stereotype, 'the Asian learner as a rote learner', is based on the perceptions of Western teachers and students that Asian students are more prone to make extensive use of rote memorization and are rather passive and less interactive in class than most other students (Biggs, 1990; Samuelowicz, 1987; Stigler & Perry, 1990). The second stereotype introduces the 'brainy Asian', and is principally based on the study success of ethnic Asian higher education students in Australia and the U.S.A., and the fact that Asian students perform very well in international comparative studies, especially in fields like mathematics and science. The stereotypes of 'the brainy Asian' and 'the Asian as a rote learner' are incompatible as taken together they seem to suggest that rote learning leads to academic success.

The paradox of the Chinese learner was partially solved by the results of phenomenographic research in mainland China into the cognitions about memorizing and understanding of high achieving Chinese students (Marton, D'Allba, & Beaty, 1993; Marton, D'Allba, & Tse, 1996; Watkins & Biggs, 1996). These studies showed that, in comparison to Western students, high achieving Asian students make a less extreme distinction between understanding and memorizing. In contrast, they do make a clear distinction between rote memorization which they reject, and memorizing with understanding which they advocate. Memorizing with understanding has two subcomponents: 'memorizing what is understood' and 'understanding through memorization' (Marton, Dall'Alba, & Tse, 1996). The former refers to the research finding that it is easier to memorize what is already understood (see, e.g., Biggs, 1990; Biggs, & Watkins, 2001; Kember, & Gow, 1991). The concept 'understanding through memorization' seems to indicate that the act of memorizing alone somehow leads to understanding. Or, as Hess and Azuma (1991) found when studying Japanese students, that memorizing is a useful precondition for understanding. Apparently these students perceive memorization and understanding as mutually enhancing processes. To these learners memorizing and looking for understanding happen virtually at the same time and both processes contribute to each other (understanding makes memorizing easier and memorizing helps understanding). The study success of high achieving Asian

students can therefore be explained by the fact that many are able to combine the processes of memorizing and understanding very effectively (Kember, 1996; Marton et al., 1996; Marton, Saljö, 1997; Tang, 1994; Wen & Marton, 1993). Consequently, they can both reproduce what was taught and demonstrate their understanding of the learning material. What initially looked like mere rote learning is in fact a blending of both memorization and understanding.

Follow-up research made it clear that Asian students can hardly be called rote learners. For instance, Asian students consistently reflect higher deep and strategic inventory scores as compared to their Western counterparts, despite the fact that they put a lot of effort in trying to memorize the learning material (Biggs, 1990 and 2001; Kember & Gow, 1990, 1991; Kember, 2000). In numerous, both qualitative and quantitative studies, Asian students report that they are trying hard to understand what they are learning (Dahlin & Watkins, 2000; Watkins & Biggs, 1996). In a study involving 25 higher education students from Hong Kong, Sachs and Chan (2003) reported that these students felt that understanding the learning material is much more important than being able to reproduce it. In summary, these results demonstrate that Asian students value understanding as much as Western students.

The research described above identifies four key elements of high achieving Asian students' learning conception: (1) learning is seen as trying to understand what is taught; (2) a clear distinction is made between memorizing with understanding and rote memorization; (3) memorization can help understanding; and (4) memorizing and understanding are mutually enhancing processes.

Most Western researchers felt that above described cognitions about memorizing and understanding are rather characteristic of South-East Asian learners and are probably rooted in the Confucian heritage, a philosophy and a practice of education that is clearly distinct from Western educational systems (Au & Entwistle, 1999). Consequently, most research on cognitions about memorizing and understanding has focused on South-East Asian students (Boulton, Wilss, & Lewis 2003; Dahlin & Regmi, 1997; Dahlin & Watkins, 2000; Marton, Weng, & Wong, 2005; Mugler & Landbeck, 2000; Sachs & Chan, 2003).

An exception is Meyer's study (2000a) involving *Australian* students about contrasting forms of 'memorizing'. On the base of an exploratory factor analysis on data gathered with the Reflections of Learning Inventory, Meyer identified three conceptually and empirically different forms of memorizing: 'memorizing before understanding', 'memorizing after understanding' and 'memorizing as rehearsal'. The first two factors, rather surprisingly, reflect cognitions about memorizing which were also identified when studying learning conceptions of high achieving Asian students: respectively, 'memorizing helps understanding' and 'understanding makes memorizing easier'. The third factor simply measures to which extent students make use of rehearsal when studying. Meyer (2000a) concluded that researchers should start making a clear distinction between different types of memorization since this might also be helpful to gain a fuller theoretical and empirical understanding of the nature and structure of Western students' learning conceptions. However, very little research – with the exception of Entwistle (2003) – has been done about Western students' cognitions about memorizing and understanding even tough such cognitions together form the core of learning conceptions (Boulton et al., 2003).

The aim of the present study is therefore to make a theoretical and empirical contribution to the research about the learning conceptions of Western higher education students, by focusing on their cognitions about memorizing and understanding. The research questions central to this paper focus on:

(1) The identification of Western first year university students' learning conceptions which in this study are represented by cognitions about memorizing and understanding.
(2) The investigation of the potentially different impact of specific learning conceptions on the adoption of study strategies (learning and regulation strategies) and students' subsequent academic achievement.

To investigate the second the second research question, we chose Vermunt's model of self-regulated learning (cf. figure 1) as a theoretical framework since this model explicitly models theoretical relationships between learning conceptions, study strategies and learning outcomes (see also Vermunt, 1998).

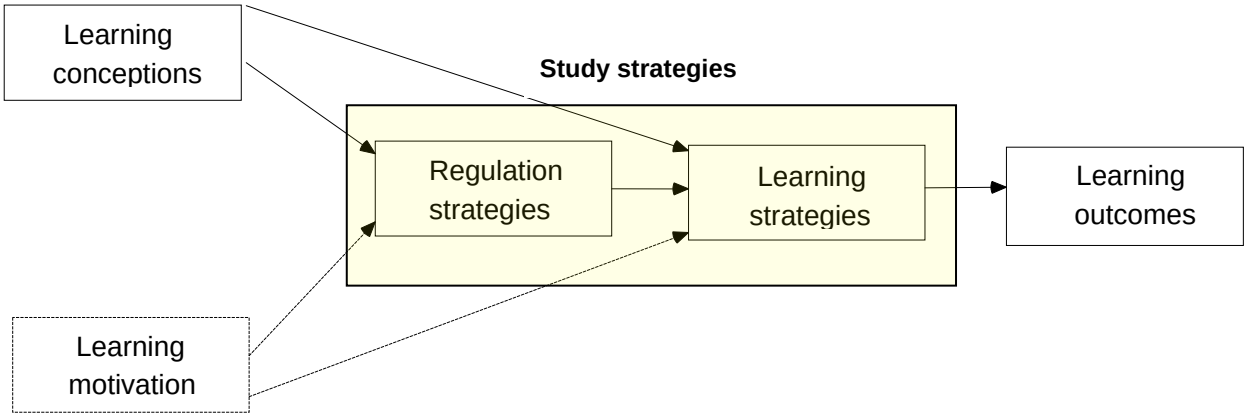

Figure 1. - Vermunt's (1998) model of self-regulated learning

Vermunt's model 'defines' a 'study strategy' (see also Entwistle & McCune, 2004) as encompassing a *regulation strategy* (a metacognitive strategy) and a *learning strategy* (synonyms: cognitive strategy, processing strategy, learning approach). A *learning strategy* describes the *learning activities* (or cognitive processes) students apply to process the learning material. Examples are: looking for relationships between elements of the learning material, selecting the main points of a chapter, thinking of examples, checking if one agrees with a theory, repeating the main points of a summary, memorizing a definition without understanding, etcetera. A *deep learning strategy* is characterized by learning activities such as relating ideas and seeking evidence and reflects an intention to understand what is being taught. *A surface learning strategy* is characterized by learning activities such as rote memorization and other routine processing activities (e.g., repetition) and reflects a focus on recall and reproduction (Biggs, 1987; Entwistle, 1998; Marton & Saljö, 1984; Vermunt, 1998).

Regulation strategies (metacognitive regulation) describe how students *steer their learning activities*. Examples of regulation activities are checking whether the learning process proceeds as planned and diagnosing causes for not achieving a learning goal. Vermunt & Vermetten (2004, p.362) distinguish between three main regulation strategies: '(a) a self-regulated strategy, in which students perform most regulation activities themselves; (b) an externally regulated strategy, in which students let their learning activities be regulated by teachers, books etc.; and (c) a lack of regulation, manifested when students are not only unable to regulate their learning activities themselves, but also experience insufficient support from the external regulation provided by teachers and the general learning

environment'. In this context it is to be noted that educational practitioners encourage their students to adopt a deep oriented and self-regulated study strategy as the latter has become synonymous for *independent*, *high quality*, and *meaningful* learning which in turn results in deeper levels of understanding (Entwistle & Entwistle, 1991; Vermunt & Vermetten, 2004).

2. Method

2.1. Participants and procedures

A questionnaire was presented to the entire population of freshmen (N = 473) studying psychology, educational sciences or social work and welfare studies (261, 152 and 60 respectively) at Ghent University. The group consisted of 49 male and 424 female students who are predominantly of Belgian origin. The questionnaire was administered two and half months after the start of the academic year. Informed consent was obtained of all participating students.

2.2. The research instrument

Students' cognitions about memorizing and understanding were measured on the basis of six scales which were inspired by everyday student comments, the Reflections on Learning Inventory (Meyer, 2000b), and the results of both phenomenographic and quantitative research on the learning conceptions of high achieving Asian students. These six scales, developed in the context of previous studies[2] (see for instance Ferla, Valcke, & Schuyten, 2008) encompass 18 questions (see Appendix A) to be answered on a five-point Likert-scale (scores ranging from (1) 'I strongly disagree' to (5) 'I strongly agree'). In the present study, the reliability and validity of the SCALI was reanalyzed on the base of a confirmatory factor analysis (CFA, Amos 6 with maximum likelihood estimation) and by calculating Cronbach alpha values. Results demonstrate a good fit: X^2_{120} = 181.97, p = 0.000, X^2/df = 1.516, GFI = 0.952, RMSEA = 0.038. The expected theoretical relationships between the latent variables and their indicators are confirmed by factor loadings consistently higher than 0.50, while no cross loadings were observed. No modifications had to be applied to optimize the measurement model. Cronbach's alpha values varied from 0.69 to 0.82. Table 1 presents the six scales, their focus and a typical test item. Table A1 in appendix A summarizes the Cronbach alpha values for the different scales and the factor loadings (based on a CFA) of each latent variable on its indicators.

Table 1 - Conceptions of understanding and memorization scales with indicative items

Scale	Representative item
Learning is seeking understanding	It is important to me to understand the learning material very well.
Learning is memorizing	It' is important to me to be able to reproduce the learning material successfully.
Understanding requires active processing	To understand what is taught you have to transform the learning material into a logical and coherent set of ideas.
Memorizing can help understanding	Memorizing the subject matter sometimes helps me to understand it.
Memorizing presupposes understanding	To be able to memorize the subject matter successfully you really have to understand the subject matter.
Memorization always requires a lot of repetition	Memorizing what is taught requires a lot of repetition even though one understands the learning material.

The first two scales check to which extent a student identifies learning with seeking understanding and/or memorizing. The scales 'understanding requires active processing' and 'memorizing can help understanding' were developed to determine to which degree students feel that 'developing understanding' is the result of either meaning seeking activities and/or memorizing. The scales 'memorizing presupposes understanding' and 'memorizing requires a lot of repetition' measure the extent to which a student feels that remembering the learning material is the result of 'achieved understanding' and/or repetition.

Students' learning strategies and regulation strategies were determined with 55 ILS- questions (Inventory of Learning Styles; van Rijswijk & Vermunt, 1987). The optimal psychometric properties of the ILS have been repeatedly demonstrated in the literature (Coffield, Mosely, Hall, & Ecclestone, 2004). ILS- items are scored on a five-point Likert scale with scores ranging from (1) 'I never or hardly ever do this' to (5) 'I (almost) always do this'. These items make up eight subscales, five of which measure students' learning strategy; three subscales measure the nature of students' regulation strategy. Table 2 presents an overview of the different subscales and their meaning. The subscales 'relating and structuring' , 'critical processing' and 'concrete processing[3]' refer to a deep learning strategy; a surface learning strategy is indicated by high scores on the subscales 'memorizing', 'analyzing' and 'rote memorization'. This last scale is not part of the original ILS but was added to the questionnaire in order to distinguish between memorizing (e.g., repetition) and rote memorization. The

'rote memorization' was developed[4] as several authors (see for instance Entwistle, 2003; Marton, D'Allba & Tse, 1996; Meyer, 2000a) explicitly call upon educational researchers to make a distinction between different forms of memorizing when studying learning conceptions, especially since different forms of memorizing might be induced by different cognitions about learning, memorizing and understanding.

Table 2 - ILS-scales: Learning and regulation strategies

Scale name and description	**Meaning**
Relating an structuring[1]	Inferring relationships within the subject matter as well as relationships with other knowledge and structuring parts of knowledge into a logical whole.
Critical processing[1]	Being critical to the opinion of the author, comparing one's ideas to that of teachers, etcetera.
Concrete processing[1]	Seeking examples, trying to personalize and relate to one's own experience, and trying to use acquired knowledge outside a study context.
Memorizing[2]	Memorizing by repetition of important facts, definitions, etc.
Analyzing[2]	Step by step processing of the subject matter and paying much attention to detail.
Rote memorizing[2]: *added to the ILS*	Memorizing without insight. Representative item: 'If I don't understand the subject matter I just learn it by hart'.
Self-regulation	Controlling the study process yourself, by orientation, planning, monitoring, evaluating, etcetera
External regulation	Depending on an external source for regulation of the study process, e.g., taking learning goals or directions and questions of teachers to heart.
Lack of regulation	Having difficulties regulating one's study process: lack of clear goals, not knowing which study method to use etcetera.

1 indicative of a deep learning strategy *2 indicative of a surface learning strategy*

2.3 Data-analysis

To identify learning conceptions – as discussed earlier in this article - a two step cluster analysis[5] was carried out. This technique was chosen in preference of other analysis techniques such as factor analysis, as the latter describes relationships between variables in the population as a whole, but is

not helpful to identify sets of related variables (e.g., cognitions about memorizing and understanding) within specific subgroups of students.

Secondly, a multivariate analysis of variance was performed to investigate the impact of specific learning conceptions on students' study strategies (e.g. learning and regulation strategies). In the MANOVA the identified clusters represented the levels of the independent variable; the ILS-scales functioned as dependent variables.

Finally, the impact of conceptions of learning on students' academic achievement was investigated with the help of a One-way ANOVA.

3. Results

3.1. Students' conceptions of learning

The two-step cluster analysis identified three groups of students (n_1= 158, n_2= 162, n_3= 150) with different learning conceptions which we respectively describe as a constructive, a reproductive and a mixed conception of learning. Table 3 presents the group means of these three student groups on the 6 scales which measure students' cognitions about memorizing and understanding.

The stability of the cluster solution and the reliability of the cluster pattern were assessed using a split half procedure. The total sample was divided at random into two equal sized groups. The data for each half of the sample were then submitted to a seperate two-step cluster analysis. Results (see appendix B) demonstrate the robustness of the cluster solution and the pattern cluster means for the total sample since:

- The cluster analyses on both sub samples, like the cluster analysis on the total sample, identified three clusters.
- The cluster analyses on the sub samples assigned 92.8% of the cases to the same cluster (e.g. students with a constructive, a reproductive or a mixed learning conception) they were assigned to by the cluster analysis on the total sample (Cohens kappa = 0.898, p = > 0.001; see also table C1 in the Appendix B).

- Visual inspection of tables B2 and B3 in Appendix B learns that the cluster means on the six cognitions about memorizing and understanding scales are very similar to each other and to those of the total sample. Consequently also the pattern of cluster means differences is almost identical for each of the three cluster solutions (e.g. the cluster analysis on the total sample and the two sub samples).

Table 3 indicates that students with a constructive conception of learning:

- Equate learning strongly with understanding and very weakly with memorizing (cf. their cluster-mean score on the 'learning is understanding' and the 'learning is memorizing' scales)
- Do not believe that memorizing can facilitate understanding.
- Believe that once the learning material is well understood it doesn't take a lot of effort (repetition) to commit it to memory.
- Feel more strongly than other students that one can not successfully commit the learning material to memory without having understood it first.

Students with a reproductive conception of learning:

- Are the only group of students who equate learning almost as much with memorizing as with understanding.
- Believe that memorizing the learning material can facilitate understanding it.
- Report, in contrast to other students, that memorizing is almost as important as active processing for achieving understanding of what is taught.
- Are less convinced than other students that one has to understand the learning material before one can successfully memorize it.

Students with a mixed conception of learning:

- Equate learning as much with understanding as students with a constructive learning conception, but in contrast to the latter, they also feel that memorizing is an important part of learning.
- Believe that memorizing can facilitate understanding.
- Are convinced that understanding is more important for remembering the learning material than repetition.

Table 3 - Cluster means of students with a constructive, a reproductive, and a mixed conception of learning

Scale	C	R	M	C-R	C-M	R-M
1. Learning is seeking understanding	4.10	3.81	4.05	0.29*	0.05	-0.24*
2. Learning is memorizing	2.71	3.58	3.42	-0.87*	-0.71*	0.16
3. Understanding requires active processing	4.06	3.69	4.25	0.37*	-0.19	-0.56*
4. Memorizing can help understanding	1.71	3.40	3.21	-1.69*	-1.50*	-0.19
5. Memorizing presupposes understanding	4.47	3.95	4.75	0.52*	-0.28*	-0.80*
6. Memorization always requires a lot of repetition	1.98	2.58	3.02	-0.60*	-1.04*	-0.44*

C = students with a constructive learning conception **R** = students with a reproductive learning conception **M** = students with a mixed learning conception

C-R = difference score between students with a constructive learning conception and students with a reproductive learning conception

C-M = difference score between students with a constructive learning conception and students with a mixed learning conception

R-M = difference score between students with a reproductive learning conception and students with a mixed learning conception

- Strongly believe that one has to understand the learning material well, if one wants to remember it successfully.

Since some authors (e.g. Eklund-Myrskog, 1998) have suggested that learning conceptions are both gender and curriculum related two extra analyses were performed to check the relationships between above mentioned variables. However, in this study we did not find that learning conceptions are gender or curriculum related ($\chi_2^2 = 5.226, p = 0.073$; $\chi_4^2 = 3.935, p = 0.415$)

3.2. The impact of learning conceptions study strategies

Table 4, presents group mean scores (cf. the MANOVA described in the method section) of students with a constructive, a reproductive and a mixed conception of learning on the scales which measure students' learning and regulation strategies. Learning conceptions do not lead to differences in the extent to which students process the learning material critically (F(2,455) = 0,678, p > 0.05) and the extent to which they self-regulate their study process (F(2,455) = 1,928, p > 0.05). Learning conceptions do explain 3 to 15 percent of the variance in the scores on the other scales measuring a student's study strategy.

Students with a *constructive conception of learning* have adopted a more deep oriented learning strategy than students with a reproductive view on learning. The latter is demonstrated by their higher scores on the 'relating and structuring' and 'concrete processing' scales and their lower scores on the 'memorizing' and 'rote memorizing' scales.

The learning strategy of students with a *reproductive learning conception* is more surface oriented than the learning strategy of other students. This is indicated by comparing their total score on the scales representing a surface learning strategy with the scores of other groups (cf. table 4). These students are also the only ones who make extensive use of rote memorizing.

Students with *mixed learning conception* seem to have adopted both a deep and a surface learning strategy. Their scores on the scales representing a deep learning strategy are as high as those of

Table 4 - Learning and regulation strategies[1]: group means of students with a constructive, a reproductive, and a mixed learning conception

Scale	**C**	**R**	**M**	**C-R**	**C-M**	**R-M**
1. Relating and structuring	3.52	3.22	3.54	0.30*	-0.02	-0.32*
2. Critical processing	2.79	2.69	2.75	0.10	-0.04	-0.06
3. Concrete processing	3.06	2.78	3.12	0.28*	-0.06	-0.34*
4. Memorizing	2.75	3.14	3.13	-0.39*	-0.38*	0.01
5. Analyzing	2.90	2.93	3.10	-0.03	-0.20*	-0.17*
6. Rote memorizing	2.16	3.21	2.59	-1.05*	-0.43*	0.62*
7. Self-regulation	2.57	2.45	2.58	0.12	-0.01	-0.13
8. External regulation	3.11	3.02	3.31	0.09	- 0.20*	-0.29*
9. Lack of regulation	2.42	2.77	2.56	-0.35*	-0.14	0.21*

Total scores	**C**	**R**	**M**	**C-R**	**C-M**	**R-M**
Deep learning strategy (sum score of scales 1, 2 and 3)	9.37	8.69	9.41	0.68*	-0.04	-0.72*
Surface learning strategy (sum score of scales 4, 5 and 6)	7.81	9.28	8.82	-1.37*	-1.11*	0.46*
Total use of regulation strategies (sum score of scales 7 and 8)	5.68	5.47	5.89	0.21*	-0.21*	-0.42*

C = students with a constructive learning conception **R** = students with a reproductive learning conception **M** = students with a mixed learning conception

C-R = difference score between students with a constructive learning conception and students with a reproductive learning conception

C-M = difference score between students with a constructive learning conception and students with a mixed learning conception

R-M = difference score between students with a reproductive learning conception and students with a mixed learning conception

[1] The groups means on the ILS-scale were computed with a MANOVA in which the identified clusters represented the levels of the independent variable while the ILS-scales functioned as dependent variables

students with a constructive learning conception while their scores on the scales measuring a surface oriented learning strategy are, with one exception, as high as those of students with a reproductive learning conception. The latter have a higher score on the scale 'rote memorization'.

All students report they have difficulty self-regulating their study strategy. Consequently, they primarily depend on teachers to direct their study process. However, the study strategy of students who equate learning with understanding (e.g., students with a constructive or a mixed learning conception) is more self-regulated than the study strategy of students who equate learning with memorizing. The study strategy of students with a mixed learning conception is more externally regulated than the study strategy of other students. The latter also makes clear that students with a mixed learning conception make a greater total use of internal and external regulation strategies in comparison to their peers. Students with a reproductive learning conception feel more than other students that their study process lacks regulation.

3.3. The effect of learning conceptions on academic achievement

Learning conceptions explain 5,3% of the variance in academic achievement (obtained overall percentage). Students with a constructive conception of learning obtain on average 51,88%, students with a reproductive learning conception average 51,50%, while the mean score of students with a mixed conception of learning amounts to 58,32%. The differences between students with a mixed learning conception and others is significant on the 5 percent level (t_{438} = 4,801, p = 0.000) while the difference between students with a constructive and students with a reproductive learning conception is statistically not significant (t_{438} = 0,226, p = 0.821)

4. Discussion

This study identified three conceptions of learning that reflect a specific mixture of conceptions of memorizing and understanding: a constructive, a reproductive and a mixed learning conception.

Students with a *constructive* learning conception[6] strongly equate learning with understanding. Consequently, they put a lot of effort in trying to understand what is being taught. Once they have understood the learning material they memorize it in order to commit it to memory. The latter

demonstrates that they perceive memorizing and understanding as two distinctly different processes which happen at different moments in time: one can only memorize the learning material successfully after one has fully understood it. To students with a constructive learning conception memorizing only plays a small part in the learning process: memorizing doesn't facilitate understanding; rote memorization is considered to be an ineffective way of committing learning material to memory and memorizing what is understood doesn't take a lot of effort. The previous demonstrates that these students, in contrast to their Asian colleagues, do *not* perceive memorizing and understanding as mutually enhancing processes, although they do make a strong distinction between memorizing with and without understanding.

Students with a *reproductive* conception of learning feel that memorizing facilitates understanding and that understanding the learning material makes memorizing it easier. This implies that, similar to high achieving Asian students, these students view memorizing and understanding as mutually enhancing processes. But there are also dissimilarities. These students are the only group of students who equate learning almost as strongly with memorizing as with understanding. Consequently they put a lot effort in trying to memorize what is taught, both through repetition and rote learning (cf. see their scores on the scales indicating a surface oriented learning strategy). In their view understanding plays a subordinate role in learning. Understanding the learning material (to some degree) is convenient as it makes memorizing it somewhat easier but their ultimate goal remains being able to reproduce the learning material. These students' motto seems to be: if once can reproduce the learning material, one also must have understood it. Tang (1993) called this learning strategy an elaborative surface strategy or memorizing with some understanding. The above demonstrates that students with a reproductive learning conception make less distinction between seeking understanding, memorizing with understanding and rote memorization than other students.

Students with a mixed learning conception state that (1) once one has understood the learning material to a certain degree, one should memorize it well as the latter is a precondition for gaining even more insight into the learning material, and (2) the better one understands the learning material, the easier it becomes to memorize it successfully. The latter makes clear that students with a mixed learning conception, like students with a reproductive learning perception, feel that (1) memorizing is

an important component of learning, and (2) that seeking understanding and memorizing are two mutually enhancing processes. However, in contrast to students with a reproductive learning conception, these students do not feel that seeking understanding is subordinate to memorizing. On the contrary, students with a mixed learning conception equate learning as much with understanding as students with a constructive learning conception which explains why they put so much effort into trying to understand what is being taught. However, in contrast to students with a constructive learning conception, they also feel that being able to reproduce the learning material is an important learning goal

The learning conception of students with a mixed learning conception comes the closest to the one identified with high achieving Asian students, though this could not be tested in the present study. Cross cultural studies should be able to shed more light on this issue.

The above findings only partially confirm the results of earlier research in Western educational contexts which consistently identified two conceptions of learning; one in which learning is equated with seeking meaning and one in which learning is equated with acquiring knowledge through memorizing (Marton, Dall'Alba, & Beaty, 1993; Säljö, 1979). This study identified a third group of students who strongly equate learning with seeking understanding but who are also convinced that understanding and memorizing are two processes which strengthen each other. The question then arises why or under what circumstances a mixed conception of learning develops.

Some researchers (e.g., Purdie, & Hattie, 2002) have suggested that students' conceptions of learning represent a developmental trend. In their view a reproductive learning conception represents a lower developmental stage than a constructive learning conception as the latter leads to better learning outcomes (e.g., students' level of understanding). Since the literature about high achieving Chinese learners and the present study suggest that students with a 'mixed learning conception', obtain better study results, a mixed learning conception may represent a third a developmental stage which is probably only be reached by students with a great deal of study expertise. This hypothesis is corroborated by the results of two studies (Marton, Watkins, & Tang, 1997; Marton et al., 2005) involving Chinese high school and university students. Marton et al. (2005) report that at least some

students evolve from (1) not making a differentiation between memorizing and understanding when in high school, (2) on to a conception in which memorizing and understanding are two distinctive processes which happen at distinctly different moments in time, and (3) ultimately to a learning conception in which memorizing and seeking understanding are perceived as two mutually enhancing processes. This last stage was only reached by elite university students with a substantial amount of study experience. The fact that the three learning conceptions identified in our study closely resemble those accompanying the three developmental stages described by Marton, suggests that Western and Asian learning conceptions evolve in a similar way. Indeed, in a study involving *Australian* students, Bond (2000) observed the same trend towards the development of a learning conception in which understanding and memorizing are perceived mutually enhancing processes which are aimed at both understanding and being able to reproduce the learning material. Considering Bond's findings, Marton et al. (2005) concluded that this progression towards integrating understanding and memorizing is more universal than previously thought, although Asian students may develop such a learning conception – or be aware of it – to a greater extent than Western students.

Other researchers (Entwistle, 1998; Säljö, 1987) put less emphasis on the developmental nature of learning conceptions but stress that learning conceptions are dependent on cultural characteristics and the characteristics of the learning environment. Säljö (1987, p. 106) observed that "… learning does not exist as a general phenomenon. To learn is to act within man-made institutions and to adapt to the particular definitions of learning that are valid in the educational environment in which one finds oneself". As will be described later, some researchers (e.g., Tang, 1991) suggest that a mixed conception of learning is primarily induced by a learning environment that rewards the reproduction of knowledge. In any case, additional research is needed to determine to which degree learning conceptions are the result of developmental processes and/or characteristics of the cultural and learning environment.

In line with the research results of Vermunt (2005) and Van Rossum and Schenk (1984), this study demonstrates that students with a constructive learning conception are more likely to adopt a deep learning strategy while students with a reproductive conception of learning are more likely to adopt a surface oriented learning strategy. Students with a mixed learning conception primarily want to

understand what is being taught, but at the same time they also want to be able to reproduce the learning material. Consequently they combine a deep learning strategy with elements of a surface learning strategy (memorizing, analyzing, but not rote learning). The previous suggests that at least some Western students make use of a learning strategy similar to the one frequently used by high achieving Asian students and which Tang (1991) labelled 'deep memorizing' while Marton et al. (1996) prefer to use the term 'memorization with understanding'. Kember (1996) demonstrated this learning strategy is rooted in the intention to both understand and memorize the learning material. Both Tang (1994) and Kember (1996) argue that 'deep memorizing' may well be a strategic response of students who primarily intent to understand the learning material but who, in order to obtain high grades, are compelled by (perceived) assessment demands to memorize the subject matter well. The latter opens the possibility that a mixed learning conception, similar to a mixed learning strategy (e.g., deep memorization), especially thrives in a learning environment in which students are required to both understand and reproduce the learning material in order to achieve academic success. The latter is certainly the case for Belgian first year university students.

All students, whatever their learning conception, indicate that their study process is primarily externally regulated and that they experience difficulties in regulating their own study process. The latter is probably due to the fact that first year university students have to adjust to a new learning environment in which they are expected to process much more learning material and to study more independently than they are used to. Consequently, it is not surprising that in contrast to Vermunt (1998), this study didn't find a positive relationship between a conception of learning as 'understanding' (e.g., students with a constructive or mixed learning conception) and the ability to regulate one's own study process. However, in line with Vermunt (1998) we did find that students with a reproductive learning conception feel more than other students that their study process lacks direction. Furthermore, our results also support the finding of Purdie, Hattie, & Douglas (1996) that a conception of learning as 'understanding' is associated with a greater total use of both internal and external regulation strategies (cf. table 4).

Students with a mixed conception of learning obtain better study results than other students. Their study success might well be explained by the fact that these students try hard to both understand and memorize what is taught. Consequently, these students can both demonstrate their (deeper)

understanding of the learning material and/or reproduce the learning material depending on what is required (Marton, Dall'Alba, & Tse, 1996). A second possible explanation lies in the fact that the study strategy of students with a mixed learning conception is both strongly externally regulated and deep oriented. This study strategy is very reminiscent of what Entwistle (2000) identified as 'deep strategic learning'. A deep strategic study strategy is adopted by students who aim to understand the learning material but at the same time want to obtain the highest possible grades by, amongst others, being very alert to assessment demands. Such a study strategy is generally related to high levels of academic achievement.

This study identified a 'mixed' learning conception amongst Western higher education students which resembles high achieving Asian students' learning conception. Such a 'mixed' learning conception induces a strong use of both internal and external regulation strategies and the adoption a learning strategy which reflects the intention to both understand and memorize the learning material. In turn, this study strategy leads to better academic results.

5. Limitations and suggestions for future research

Recently, educational researchers like Meyer (2000a), Entwistle & Entwistle (2003) and Marton et al. (2005) have urged other researchers to abandon the simple dichotomy between memorizing and seeking understanding when studying learning conceptions. Instead educational researchers should focus on the complex interplay between different forms of seeking understanding and memorization. This study hopes to have made a small contribution towards achieving that goal. However, the present study also reflects a number of limitations. The limitations are related to the used research instruments, the research design and the restricted nature of the tested models.

The first important limitation of this study concerns the representativity of the study for the entire population of higher education students. The sample used in this study was limited to Ghent university freshmen studying psychology, educational sciences or social welfare studies. Consequently, the research results can not be generalized to students of other study domains. Moreover the sample was strongly female-skewed which could mean that our findings are less representative for male students.

Future research should replicate the research reported in this dissertation with samples which are more representative for the entire population of higher education students.

The second limitation pertains to validity problems associated with quantitative research in general and survey research in particular. Several researchers (e.g. Entwistle & Entwistle, 1991) have stated that learning conceptions, are hard to measure validly with survey scales alone. The validity of survey research can be seriously affected by problems like a lack of self-awareness and social desirability. Hence, qualitative research, especially phenomenographic research linking learning conceptions to personal epistemologies (Nieminen, Lindblom-Ylännei, & Lonka, 2004), could shed more light on the true meaning of (a combination of) scale scores aimed at measuring cognitions about memorizing and understanding. In this context, we also note that the SCALI, which we used to measure student cognitions about learning, is a relatively new research instrument. Therefore, we hope future research additionally focuses on the psychometric qualities of the SCALI.

A third limitation is related to the research design. Measuring students' learning conceptions only once and relatively early on during freshman year provides little insight into the origin, the variability and the manipulability of students' learning conceptions. It is quite possible that learning conceptions strongly evolve during freshman and subsequent years. Especially since freshmen have to adapt to a new learning environment in which they are expected to process much more learning material and to study more independently than they are used to in secondary education. Moreover, limiting our samples to Ghent university students yields little or no insight into the extent to which student cognitions about learning are induced by the characteristics of the learning environment. Future research should investigate students' learning conceptions at different moments in a student's 'academic career' and in a variety of learning environments. The results would provide more insight into the origin, the stability and the manipulability of learning conceptions.

The fourth limitation is related to the issue of causality. The research reported in the present study is correlational and not experimental. This implies that we can never be sure about the validity of the described causal relationships (e.g., the causal direction of relationships). However, in line with

several other authors (Entwistle & McCune, 2004; Vermunt 1998) we assumed that learning conceptions influence study strategies and not vice versa

We should also remark that learning conceptions only explain a limited amount of variance in freshmen's study strategies and study results. Other variables such as cognitive ability (Busato, Prins, Elshout, & Hamaker, 1998), earlier educational experiences (Biggs, 1999), personality traits (De Raad & Schouwenburg, 1996), the characteristics of the learning environment (Boekaerts, 1997; Butler, & Winne, 1995), and especially motivational factors (Deci, 2000) will certainly also help explain differences in study strategies and study results of university freshmen. Future research should test more complete models

Finally, we note that the differences between students with regard to their cognitions about learning, memorizing and understanding, should be put into perspective. For instance, we stated that some students equate learning strongly with memorizing. In reality, all students equate learning primarily with seeking understanding. In the end, the differences between students with regard to their learning conceptions are relatively small. However, the present study also demonstrates that these relatively small differences do induce differing study strategies and therefore quite likely also qualitatively differing learning outcomes (e.g., levels of understanding; see also Prosser & Trigwell, 1991)

Endnotes

1) The paradox of the Chinese learner not only applies to Chinese students but to South-East Asian students in general. In this paper we refer to these students, as is often done in articles which discuss the phenomenon of the Chinese learner, as Asian students.

2) The six scales with which we measured students' cognitions about learning, memorizing and understanding are part of a new research instrument called the Student Cognitions About Learning Inventory (the SCALI). The SCALI was developed within the framework of the Ph-D project of one the authors of the present article and aims to measure student cognitions about learning (learning conceptions, academic self-efficacy, attributions for academic performance, etc). In accordance with the guidelines of several authors (DeVillis, 2003; Gerbing & Hamilton, 1996) the validity of the SCALI-scales was tested using a two-step strategy. In a first step, the underlying measurement model (e.g. the number of factors/constructs) is identified using an exploratory factor analysis. In a second step, confirmatory factor analysis is used to validate the measurement model. In this strategy, EFA is considered "a useful tool to aid the researcher in recovering an underlying measurement model that can then be evaluated with CFA" (Gerbing & Hamilton, p. 71).

   Over the years, on the base of the results of several exploratory and confirmatory factor analyses, the psychometric qualities of these scales were improved by adding questions to the scales, dropping items, or rephrasing items. Thus, prior to the present study, the validity and the reliability of the SCALI was repeatedly tested within the context of other studies (see for instance: Ferla, Valcke & Schuyten, 2008). In each of these studies the results of both an exploratory and confirmatory factor indicated good reliability and validity.

   In the context of the present study the reliability and validity of the scales measuring student cognitions about memorizing and understanding was reanalyzed on the base of a confirmatory factor analysis (CFA, Amos 6 with maximum likelihood estimation) and by calculating Cronbach alpha values.

3) Vermunt (1998) makes a distinction between three learning strategies: a deep, a surface and a concrete learning strategy. The latter represents a learning strategy in which the practical application of knowledge takes a central place. However in studies with first year university students this learning strategy is often not recognised as a distinct one and then becomes an element of a deep oriented learning strategy (Vermunt & Verloop, 2000).

4) In accordance with the guidelines of several authors (DeVillis, 2003; Gerbing & Hamilton, 1996) the validity of the 'rote memorization' scale was tested using a two-step strategy. In a first step, an explorative factor analysis (Maximum Likelihood with varimax rotation) was used to detect the factor structure of the items constituting the 'memorization' scale (ILS) and the 'rote memorizing' scale. Results confirmed that with one exception that the ILS-items which make up the 'memorizing' scale and the items which constitute the 'rote memorization'-scale represent two different forms of memorizing (e.g., repetition and rote memorization). One ILS-item loaded highly on both scales (.514 and .384 respectively) and was subsequently removed from the 'memorization'-scale. Next a confirmatory factor analysis was performed to validate the factor structure identified by the EFA. Results demonstrate a good fit: X^2_{12} = 22.634, *p* = 0.031, X^2 /*df* = 1.886, GFI = 0.984, RMSEA = 0.047. All factor loadings are consistently higher than 0.40, while no cross loadings were observed. Only one modification had to be applied to optimize the measurement model. The Cronbach alpha value of the rote memorization scale reflects high internal consistency (α = 0.84 respectively).To check whether 'rote memorizing' represents a component of a surface learning strategy a second exploratory factor analysis (Maximum Likelihood with varimax rotation) was performed on the six ILS-scales which indicate students' learning strategy. As expected the 'rote memorization' scale loaded strongly on the component representing a surface learning strategy (0.63).

5) A two-step cluster analysis uses the BIRCH algorithm *(Zhang et al. 1996)* and is preferred for large datasets, since hierarchical and k-means clustering do not scale efficiently when *n* is large (Everitt & Rabe-Hesketh, 1997). The two-step method is a one-pass-through-the-data approach which addresses the scaling problem by identifying pre-clusters in a first step, then treating these as single cases in a second step which uses hierarchical clustering. The researcher can let the two-

step algorithm determine the number of clusters. The determination of the number of clusters is based on the Schwarz's Bayesian information criterion (BIC). In a first step the BIC is calculated for each number of clusters within a specified range (1 to 15 by default in SPSS) and used to find the initial estimate for the number of clusters. The second step refines the initial estimate by finding the greatest change in distance between the two closest clusters in each hierarchical clustering stage.

6) The conclusions drawn with regard to particular learning conceptions are based on the results of both the cluster analysis and the MANOVA.

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Appendix A

Table A1 - Cognitions about learning, understanding and memorizing scales, with Cronbach alpha's and factor loadings resulting from a CFA.

Scale	α	*n*	*factor loadings of the constructs on their indicators (CFA)*			
Learning is seeking understanding	0.82	3	0.80	0.88	0.82	
Learning is memorizing	0.77	3	0.74	0.83	0.75	
Understanding requires active processing	0.73	4	0.55	0.57	0.64	0.74
Memorizing can help understanding	0.81	2	0.82	0.84		
Memorizing presupposes understanding	0.71	3	0.57	0.81	0.67	
Successful memorization always requires a lot of repetition	0.69	3	0.67	0.81	-0.51	

Appendix B

Table B1- Comparison of classification of cases by cluster analyses on total sample and on sub samples

		Cluster assignment by analyses on sub samples			
		1	**2**	**3**	
Cluster assignment by cluster analysis on total sample	**1**	150	2	6	158
	2	2	137	11	150
	3	4	9	149	162
		156	148	166	470

Table B2: Sub sample 1 - Group means of students with a constructive, a reproductive and a mixed conception of learning

Scale	**C**	**R**	**M**	**C-R**	**C-M**	**R-M**
1. Learning is seeking understanding	4.18	3.81	4.11	0,37*	0,07	-0,30*
2. Learning is memorizing	2.81	3.54	3.52	-0,73*	-0,71*	0,02
3. Understanding requires active processing	4.07	3.70	4.21	0,37*	-0,14	-0,51*
4. Memorizing can help understanding	1.73	3.28	3.20	-1,55*	-1,47*	0,08
5. Memorizing presupposes understanding	4.49	3.97	4.73	0,52*	-0,24*	-0,76*
6. Memorization always requires a lot of repetition	1.99	2.57	3.02	-0,58*	-1,03*	-0,45*

** p<.05 (confidence level adjustment: Bonferroni)*

C = students with a constructive learning conception (n=70) **R** = students with a reproductive learning conception (n=79) **M** = students with a mixed learning conception (n=86)