CONVERGENT VALIDATION OF COGNITIVE AND METACOGNITVE SELF REGULATION MSLQ SCALES

Ana-Maria CAZAN[1]

Abstract:

One of the most known instruments for the evaluation of self regulated learning strategies is the Motivated Strategies for Learning Questionnaire. The aspect of self regulation investigated in this research is cognitive self regulation. The purpose of this research is to estimate the convergent validity of the cognitive and metacognitive MSLQ scales, after their translation in Romanian. Our main hypothesis is that there is high level of overlapping between self regulation measured by MSLQ (The Motivated Strategies of Learning Questionnaire) and self regulation measured by ILS (Inventory of Learning Styles). The analysis of the two revealed moderately positive inter-correlation. Convergent validity showed that cognitive and metacognitive self regulation scales from MSLQ are able to measure students' learning strategies in a reliable and valid fashion.

Key words: *learning styles, learning strategies, metacognition, self regulation.*

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1 Ana Maria Cazan is a teaching assistant at the University Transilvania of Brasov, Faculty of Psychology and Education Sciences and a PhD Student at the University of Bucharest, Doctoral School of Psychology and Education Sciences.

1. Introduction

There is a considerable number of studies on the factors that affect students' success and majority of them focus on students' motivation and use of learning strategies. According to these studies, students who have high motivation and use efficient learning strategies are more likely to perform better and to be more successful. Self-regulated learning is defined as being metacognitively, motivationally, and behaviorally active in one's own learning processes and in achieving one's own goals (Eccles & Wigfield, 2002).

One of the most known instruments for the evaluation of self regulated learning strategies is the Motivated Strategies for Learning Questionnaire, developed by Pintrich and his colleagues (Pintrich et al, 1991).

The MSLQ was developed using a social-cognitive view of motivation and learning strategies, with the student represented as an active processor of information whose beliefs and cognitions mediated important instructional input and task characteristics. The social-cognitive theoretical framework assumes that motivation and learning strategies are not traits of the learner, but rather that motivation is dynamic and contextually bound and that learning strategies can be learned and brought under the control of the student (Duncan & McKeachie, 2005). Students' learning strategies varies for different courses depending on the nature of the academic tasks.

The aspect of self regulation investigated in this research is cognitive self regulation. Cognitive regulation includes cognitive and

metacognitive activities that individuals engage in to adapt and change their cognition. One of the central aspects of the regulation of cognition is the actual selection and use of various cognitive strategies for memory, learning, reasoning, problem solving, and thinking. Numerous studies have shown that the selection of appropriate cognitive strategies can have a positive influence on learning and performance. The cognitive strategies have different levels of complexity, ranging from the simple memory strategies to sophisticated strategies that individuals use for problem solving and reasoning (Wolters, Pintrich, Karabenick, 2005).

The purpose of this research is to estimate the convergent validity of the cognitive and metacognitive MSLQ scales, after their translation in Romanian. The other instrument used for the convergent validation is ILS (Inventory of Learning Style) developed by Vermunt and his colleagues (Vermunt et al, 2004). As a hole, both MSLQ and ILS combine students' beliefs and regulation and processing strategies.

The ILS measures four aspects of students' learning: Processing strategies, regulation strategies, mental models of knowledge (which can be labeled as conceptions of knowledge), and learning orientations (personal goals, intentions, motives, expectations, concerns, and doubts with respect to learning). These aspects can be categorized into three levels. The first level is the cognitive-symbolic or conceptual level consisting of students' ideas and beliefs. Mental models of knowledge and learning orientations fall into this category. Furthermore, a controlling level can be distinguished that refers to regulation processes, whereas a third level, the operational behavioral level, concerns the processing strategies. The controlling level tunes the conceptual level to

the operational level (Vermetten et al. 1999). Similar to the ILS, MSLQ proposes a three-level model in which regulation strategies mediate the relationships between conceptions and processing strategies (Loyens, Rikers, & Schmidt, 2008). Another similarity between the two instruments is that of the target population. Both questionnaires measure learning strategies at the university level. Loyens, Rikers, & Schmidt (2008) also found that for both learning models there is a complete mediation of self-regulation, implying that the influence of the conceptual level on the operational level is completely controlled by self-regulation.

2. Method

Objective and research question

The main objectives of the research are the following:

- to investigate the psychometrical properties of cognitive and metacognitive self regulation scales of MSLQ proposed by Pintrich and his colleagues.
- to analyze the relationships and the degree of overlapping between Pintrich model and Vermunt model of cognitive and metacognitive self regulation.

Our main hypothesis is that there is a high level of overlapping between self regulation measured by MSLQ and self regulation measured by ILS.

Participants:

The participants were 232 first year students at the Transylvania University of Brasov. The measures were administered to a first year educational psychology class. Participants were informed that they would receive feedback on their performance as a whole class and individual feedback as a learning style profile.

Measures:

1. *MSLQ – The Motivated Strategies for Learning Questionnaire (Pintrich et al, 1991)*

The MSLQ consists of 81, self-report items divided into two categories: a motivation section and a learning strategies section. The Learning Strategy Section contains three types of scales: cognitive, metacognitive and behavioral strategies. For this research, we used only the cognitive section. This section includes the following scales: rehearsal (4 items), organization (4 items), elaboration (6 items), critical thinking (5 items), metacognitive self regulation (12 items).

Cognitive and metacognitive strategies include students' use of basic and complex strategies for the processing of information from texts and lectures. The most basic cognitive strategy subscale provides a measure of the use of rehearsal by students (repeating the words over and over to oneself to help in the recall of information). The use of more complex strategies is measured by two subscales concerning the use of elaboration strategies (paraphrasing, summarizing) and organization strategies (outlining, creating tables). A subscale on critical thinking is included that assesses students' use of strategies to apply previous

knowledge to new situations or make critical evaluations of ideas. The second general category is metacognitive control strategies, measured by one large subscale related to the use of strategies that help students control and regulate their own cognition. This subscale includes planning (setting goals), monitoring (of one's comprehension), and regulating (e.g., adjusting reading speed depending on the task).

2. *ILS – Inventory of Learning Styles (Vermunt & Vermetten, 2004)*

The ILS includes four domains of learning, two of which were considered relevant for the present research: cognitive processing and metacognitive regulation (both defined as learning strategies). The selected part of the instrument consisted of 50 items, all of which described learning activities.

The selected scales are the following: concrete processing, stepwise processing, deep processing, and self regulation of learning and lack of regulation. Relating and structuring refers to inferring relations within the subject matter as well as relations with other knowledge, and structuring parts of knowledge into a whole. Critical processing refers to being critical to the opinion of the author, comparing one's vision to that of teachers. Memorizing measures rote learning and learning by heart of facts, definitions. Analyzing is a step-by-step processing of subject matter and paying much attention to details. Concrete processing represents seeking examples, trying to personalize and relate to one's own experience, and to use knowledge outside the study context. Self-regulation measures the control of the learning process by orientation, planning, monitoring, and evaluation. In opposition, externally regulation

is depending on an external source for the regulation of the learning process, e.g., taking learning goals or directions and questions of teachers to heart. Lack of regulation refers to noticing one's difficulties with regulation of the learning process (Vermetten, Lodewijks & Vermunt, 1999). The scales were translated in Romanian and the alfa Cronbach coefficients for the translated version are between .65 and .80.

ILS was used in order to assess the convergent validity of MSLQ.

3. Results

The reliability of the MSLQ scales was checked by determining internal consistency Alfa Cronbach. Alpha coefficients of MSLQ are smaller than those obtained by Pintrich for the original version of the same instrument for rehearsal, critical thinking and metacognitive self regulation. We obtained higher Alfa Cronbach coefficients for two scales, elaboration and organization. The differences between the questionnaires can be explained through the insufficiently accurate quality of the Romanian translation or through the population's trans-cultural characteristics. Although, the translation of the questionnaire followed the standard procedure for the adaptation of foreign instruments: forward translation of the original instrument and back translation. Both versions (original and back translated) were compared (Duncan, 2002).

Table 1. Internal consistency of MSLQ scales for American and Romanian sample

Scales:	Nr of items	Romanian Version	Pintrich's Version
Rehearsal	4	.56	**.69**
Elaboration	6	**.78**	.76
Organization	4	**.68**	.64
Critical thinking	5	.72	**.80**
Metacognitive self regulation	12	.71	**.79**

All the scales have alpha coefficients between 0.70 and 0.60 which shows a high level of internal consistency of the analysed scales. Although two scales have values of internal consistency under 0.70 (rehearsal and organization), which recommends a careful translation revision of the questionnaire.

The factorial analysis performed for this section of the questionnaire, revealed that even after the varimax rotation the 5 factor corresponding to the 5 self regulation strategies explained nearly 47% of the total variation. The first factor, metacognitive self regulation, covers after rotation 16,8% from the total variation. The second factor, critical thinking covers 9,3% from the total variation. Organization covers 8,9%, elaboration 6,9% and rehearsal 5,3% of the total variance. Although metacognitive self regulation and critical thinking seemed to be well represented in the total variance, the items have a high communality for

the two factors. All 5 factors seemed to be major factors, but a great amount of variance remains unexplained. Also, the obtained factorial structure does not overlap efficiently the content of the questionnaire. Thus the construct validity of cognitive and metacognitive scales is insufficiently estimated.

The use of ILS (Inventory of Learning Style) made possible to highlight the convergent validity of MSLQ scales. The correlation coefficients obtained between the score of the two mentioned questionnaires are high and statistically significant, which demonstrates that MSLQ is a valid measurement tool for self regulated learning strategies. The metacognitive strategies are strongly associated with the deep processing strategies and with self regulation of learning strategies. We can also observe that cognitive and metacognitive strategies are negatively associated with the lack of regulation.

Table 2. Correlation coefficients between overall scores for MSLQ and ILS scales

MSLQ / **ILS**	Cognitive self regulation	Metacognitive self regulation
Deep processing	**.44****	**.51****
Stepwise processing	**.31****	**.40****
Concrete processing	**.35***	**.43****
Self regulation of learning process	**.51****	**.55****

Self regulation of learning content	.45**	.46**
Self regulation of learning	.55**	.60**
External self regulation	.53**	.44**
Lack of regulation	-.19*	-.24*

* p< .05, ** p< .01 N=232

As we can observe in the table 2 the correlations between scales are significant, albeit moderate, demonstrating convergent validity. The strongest correlation is obtained between the metacognitive strategies and the self regulation of learning.

The high convergent validity of MSLQ is sustained by the strong and statistically significant correlations between MSLQ and ILS, regarding the cognitive and metacognitive learning strategies, analyzed separately (Table 3).

Table 3. Correlation coefficients between scores for cognitive and metacognitive MSLQ and ILS self regulation scales

ILS / MSLQ	Relating structuring	Critical processing	Memorizing rehearsing	Analyzing	Concrete processing	SR of process	SR of content
Rehearsal	.134*	-.021	.439**	.273**	.078	.207**	.170**
Elaboration	.513**	.443**	.166*	.394**	.502**	.520**	.436**
Organization	.374**	.249**	.162*	.312**	.297**	.417**	.333**

Critical thinking	.478**	.485**	.124	.327**	.444**	.466**	.365**
Metacognitive self regulation	.466**	.345**	.142*	.400**	.315**	.504**	.447**

* p< .05, ** p< .01, N=232

Rehearsal associates positively significantly with memorizing and rehearsing (r = .44), also elaboration and organization associate with relating, structuring (r = .51), and analyzing (r = .39). We can also observe that the correlations between rehearsal and self regulation are weak (r = .20) compared with those obtained between metacognitive strategies and self regulation (r = 50 for self regulation of process and r = .45, for self regulation of content). As expected, critical thinking (measured with MSLQ) is associated with critical processing (r = 49) and with both self regulation of content (r = .37) and self regulation of process (r = .47). Metacognitive self regulation is strongly associated with self regulation of content (r = .45) and of process (r = .50), and weakly associated with concrete processing (r = .32) and memorizing and rehearsing (r = .14). An important result is represented by the higher correlations obtained mainly between MSLQ scales and self regulation of process than those between MSLQ and self regulation of content, which illustrate the idea that MSLQ measures mostly the strategies involved in the process of learning such as planning, controlling, adjusting the results.

We can conclude that all correlations were in the expected direction, further adding to the validity of the MSLQ scales.

Table 4. Correlation between cognitive and metacognitive self regulation strategies and academic performances at the end of the first semester

	Rehearsal	Elaboration	Organization	Critical thinking	Metacognitive self regulation
Academic performances	,156	**,184***	**,187***	,056	**,192***

* p< .05, N=232

As for the association between cognitive and metacognitive self regulation strategies and academic performances at the end of the first semester, we found that the correlations are weak. The highest correlation is obtained for metacognitive self regulation. Another research showed that self regulation strategies are strongly associated with academic adjustment than with academic performances (Cazan, 2011 in press).

4. Discussions and conclusions

Several studies revealed that MSLQ in a valid and reliable instrument (Barker & Olsen, 2002; Pintrich et al., 1991) and is thus, according to Pintrich et al. (1994), a reliable and useful tool that can be adapted to a number of different purposes for researchers, instructors and students.

The analysis of the two instruments for the evaluation of self regulation strategies revealed moderately positive inter-correlation. Convergent and predictive validity showed that cognitive and metacognitive self regulation scales from MSLQ are able to measure students' learning strategies in a reliable and valid fashion.

We consider the MSLQ to be an efficient, practical, and ecologically valid measure of students' learning strategies. The exploratory factor analysis confirmed previous research which showed that the three general aspects of metacognition—planning, monitoring, and regulating—do not load into separate factors in a factor analyses but load into one factor (Duncan & McKeachie, 2005).

The explanation for the weak correlation between self regulation strategies and academic performances can be that some of the learning strategies exhibit curvilinear relationships with academic performances that are not captured by correlation coefficients. Rehearsal, Rehearsal is one if the strategy that is not related to academic performance in a linear manner. Rehearsal reflects rote memorization and repetition of - behaviors that are unlikely to be practiced by either high achieving students, who likely have no need for it, or low achieving students, who

may be too unmotivated to engage in these behaviors or do not realize that they need to engage in these behaviors (Crede & Philps, 2011 in press). Also, academic performance is not a good criterion because the manner in which grades are determined often does not require students to use effective learning strategies.

Despite some limitations regarding the validity of MSLQ scales, MSLQ represents a viable means for assessing student use of learning strategies in the classroom. The low coefficients for some of the aspects regarding validity can be explained by the constructivist, social-cognitive model on which the MSLQ is based assumes that students' responses to the questions might vary as a function of different courses, so that the same individual might report different levels of motivation or strategy use depending on the course (Duncan & McKeachie, 2005).

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