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The Third Round of the Czech Validation of the Motivated Strategies for Learning Questionnaire (MSLQ)

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Abstract

The authors present findings on the third round of the Czech validation of the Motivated Strategies for learning questionnaire (MSLQ), originally developed by Pintrich et al. (1991). The validation only covered an area designed to access motivation in self-regulated learning. Data was collected from a sample of university students in regular classroom settings. Principal component analysis (PCA) was conducted with eigenvalues exceeding 1. An inspection of the scree plot, discontinuity in variance, Monte Carlo parallel analysis and Cronbach's alphas were performed to assess the psychometric properties. The results were further supported by the confirmatory factor analysis with no post hoc model modifications needed. The analysis confirmed the first and second round validation structure bringing a 3-factor model and indicated that the revised MSLQ is an acceptable measure of motivation in self-regulated learning.

Keywords: motivation, self-regulated learning, construct validity, internal consistency

1. Introduction

One of the key features of school education is to guide students' learning so that the results represent the best possible way of acquired knowledge, skills and abilities in accordance with the basic educational objectives and individual differences among students. The regulation of students' learning, however, can provide a variety of large spaces for their individual learning activities. Encouraging students to take greater responsibility for their learning is one of the main goals of self-regulated learning and constitutes a growing trend across the different levels of education.

Self-regulation is represented by a student who directs his/her learning without being directed from the outside. Rather than taking a passive role, self-regulated learners are active participants in their own learning process, who seek new information and take steps to master new skills. According to Zimmerman (2001) self-regulating skills aren't considered acquired learning skills or inborn mental skills; rather they are the self-directive processes by which learners transform their mental abilities into academic skills necessary for successful learning.

As stated, self-regulated learning includes managing students' mental capacities. Such learning requires the effective use of "skills" and "will". Skills relate to the choice of the required learning strategies and are meaningful attempts to bridge the gap between the capabilities and requirements which are laid on students through learning tasks. However, their ultimate effectiveness depends on personal beliefs, personal expectations and internal values (Garcia, in Pintrich et al., 1995). Volition ("will") refers to persevering in the use and improvement of these strategies (Perry & Rahim, 2011). The learning process (it's cognitive dimension) can hardly be maintained and develop without students' volition and commitment (non-cognitive dimensions of the self-regulated learning) (McCombs & Marzano, 1990).

Broadly speaking, self-regulated learning refers to learning that is guided not only by cognition but also metacognition and forms of internalized motivation. Common to effective self-regulated learners is that they actively set goals, plan their study time, choose appropriate strategies based on the learning context, organize materials and information, shift approaches flexibly, monitor learning and make appropriate adjustments for the future learning activities (Butler & Winne, 1995; Zimmerman, 1989).

Models of self-regulated learning are typically grounded in a social cognitive perspective (Zimmerman &

Kitsantas, 2005). These models describe the self-regulated learning as a continuum consisting of three to four stage developmental sequences in which learners move from being regulated by others (Winne & Hadwin, 2008). It is believed that the individual phases may occur during a learning situation more than once, or in several episodes of learning, and does not necessarily unfold according to the established order (Zimmerman, 2002).

Zimmerman (In Zimmerman & Schunk, 2011) and Pintrich (2000) focus their attention on the motivational aspects, while Winne and Hadwin (1998) direct their attention to the cognitive and metacognitive aspects of students' self-regulated learning. The initial motivational phase focusing on formulating personal goals is an area of Monique Boekaerts research (1995). Regardless of those differences, all models emphasize the self-directed nature of learning and certify that self-regulating students are internally engaged in their own learning with the activation of cognitive, metacognitive and motivational strategies.

Teachers are assumed to be proximal forces of academic and psychosocial development for young people (Effeney, Carroll, & Bahr, 2013). Self-regulated learning can be encouraged by choosing from various kinds of teaching methods and strategies. Their choice can be based on general principles, such as (Simons, 1996):

- emphasize the learning activities rather than the learning outcomes;
- help students find relationships between their learning goals and appropriate teaching strategies;
- underline not only the cognitive, but also the emotional components of learning (experience, controlling stress, reducing test anxiety);
- encourage students to develop self-awareness about their knowledge, skills and practical applications;
- create certain situations in which students learn to monitor, control and adjust their learning;
- successively shift the responsibility for learning and its results to students;
- support the social and emotional dimensions of collaborative learning;
- motivate students to determine challenging, yet appropriate learning goals.

In practice, general principles need to be adapted to age, individual abilities and the experience of the students. Importantly, the development of self-regulated learning is a significant factor not only in the context of school education in acquiring new knowledge and skills across diverse disciplines but also in real life extending beyond the school environment. The incidence of the self-regulation process was also found among top athletes and skilled professionals of various fields of human activity. Currently, research inquiries point out the positive impact of the development of self-regulated learning skills and the formation of the positive attitudes towards learning and academic performance (Duffy & Azevedo, 2015; Greene et al., 2010; Zimmerman & Kitsantas, 2014).

A number of researchers have examined the expectancies, values and affect and their influences on student motivation throughout the past few decades (Anderman & Wolters, 2006). Students evaluate an academic task in terms of all three components. For example, a given task may be viewed by learners as important, useful, but not interesting, and not worth the time and effort. Another task may be seen as worth the time or cost, but not very important or interesting. Hence, in deciding whether to start or continue their studies, students must not only know the important skill of knowing how to learn and monitor this process, but also to find out why to learn. Distinguishing between the different attainments of value emerges with older students, while younger students do not think about the valuing of academic tasks (Wigfield & Eccles, 2000). These components were examined in the presented research using the validated MSLQ questionnaire.

2. Research Methodology

The main objective of the empirical research is to explore the latent factors underlying students' motivation in the process of self-regulated learning, i.e. to verify if the selected scales of the MSLQ have a satisfactory construct validity or are internally inconsistent. The other goal includes finding the dependency rate (connection) between the motivational aspects of self-regulated learning and the results of students' academic performance. Within the methodological approach in the third round of the Czech validation of the MSLQ, originally developed by Pintrich et al. (1991) the following research questions were set forth:

- What is the underlying factor structure of the measurement (scales)?
- Is the structure of the measurement (scales) in this study consistent with the previous findings? Past research suggests a three-factor structure.

Given the nature of the research questions the quantitative approach using exploratory (EFA) and confirmatory (CFA) factor analyses, Catell's scree plot and the Monte Carlo parallel analysis was used. The internal

consistency of the partial factors and questionnaire were examined by counting the Cronbach's alpha (α). The principal component (PCA) with an eigenvalue greater than 1 and the orthogonal varimax rotation that maximizes the sum of the variances of the squared loadings were analyzed. For selecting the individual scales, the following criteria were set up:

- to suppress small coefficients (absolute value below .30);
- to retain only factors with eigenvalues greater than 1, i.e. Kaiser's criterion (Kaiser, 1960);
- to realize visual exploration of a graphical representation of the eigenvalues;
- to carry out the results of the parallel analysis;
- to exclude all items with extreme means values (i.e., < 1.75 and > 6.25).

All participating students were assured that the questionnaire is anonymous and confidential. The target population consisted of university students of helping professions studying at a medium-size, public university located in the Eastern Czech Republic. Analyses were performed in SPSS v. 22 and AMOS v 21. Missing data was handled using the listwise deletion response pattern.

3. Analysis and Results

The presented findings show the third round of the adaptation process of the revised MSLQ questionnaire (Pintrich et al., 1991) in the Czech educational environment. The revised MSLQ was developed from an original motivational orientations section (MS) of the MSLQ containing 31 items and increased up to a total of 70 items. A test version of the questionnaire was subsequently presented in pilot testing to the first respondents (Jakešová & Hrbáčková, 2014).

The first validation brought the 3-factor model containing 27 items (Jakešová & Hrbáčková, 2014). The following second validation confirmed the 3-factor model of the revised MSLQ containing 17 items (Jakešová, 2014). The presented wave of the validation analysis aims to further verify the underlying factors of the revised MSLQ. Among other, the results may be important for the future international comparative studies supported by a valid and reliable research instrument.

3.1 Participants

The sample consisted of 544 university students enrolled in a traditional face-to-face course delivery format. Of those who voluntarily participated in the research, 93% (n = 505) were women while 76% (n = 416) of students were daily students and 24% (n = 128) of students were part-time students in the helping professions. The students had an average age of 24 years (range 19-49 years, SD = 6.3 years). The average academic success of the respondents reached 1.9 (range from 1 to 3.5). The participants were informed as to the voluntary and anonymous nature of the study.

3.2 Measurement

The MSLQ (Pintrich et al., 1991) has been applied since 1986 in various fields of educational psychology (Hammann & Steves, 1998), biology, social and medical sciences (Barker & Olsen, 1995; Lin, McKeachie, & Kim, 2001) and distance learning (Lynch & Dembo, 2004). The self-report MSLQ instrument consists of 81 items, designed to measure college students' motivational orientations (items 1-31) and their use of different learning strategies (items 32-81) with the ultimate goal of helping students improve their learning (Duncan & McKeachie, 2005).

The MLSQ structure is based on the social-cognitive theory and motivational orientations section proposes three general constructs: value, expectancy and affect. The instrument consists of 15 sub-scales (Artino, 2005), six within the motivation section (i.e. intrinsic and extrinsic goal orientation, task value, control of learning beliefs, self-efficacy for learning & performance and test anxiety) and nine within the learning strategies section (i.e., rehearsal, elaboration, organization, critical thinking, metacognitive self-regulation, time/study environmental management, effort regulation, peer learning, help seeking).

The respondents record their answers on a seven-point Likert scale detecting not only the content, but also its approximate strength. The variable takes values from 1 to 7 and the time allocated for completing the questionnaire is defined in the range of 15-20 minutes. The reliability and validity of the MSLQ were tested in several stages. The reliability coefficient ranged from .52 to .93.

The psychometric properties of the adapted versions of the MSLQ with a search for the explanation of the correlation structure are often presented in current studies using MSLQ. The frequent occurrence of the MSLQ was found in Asia. The confirmatory factor analysis of the data gathered from a sample of 477 secondary school

students aged 12 to 19 years using the literal translation accepted original factor structure of the MSLQ (Pintrich et al., 1991) on the Chinese population of Hong Kong. However, the other results suggest that the Chinese version of the MSLQ (MSLQ-CV) is better described as an instrument with a single self-regulated learning factor (Rao & Sachs, 1999). Moreover, further studies examining the psychometric properties of the MSLQ-CV arising from the same cultural environment of Hong Kong conversely pointed out a different structure of the latent factors than in the original version of the MSLQ (Lee, Yin, & Zhang, 2010).

Likewise research carried out on the European continent introduces different results of the factor structure. In the case of the Turkish adaptation (Karadeniz et al., 2008), which included 762 students between 12 and 18 years, the original structure was confirmed. Although the results confirm the same structure (the number and nature of the original MSLQ factors), depending on the results of the confirmatory factor analysis several items were excluded from both motivational orientations and the use of different learning strategies sections due to very low factor loadings. Similar results were seen in Mexico, where an adapted MSLQ named Cuestionario de Motivación y Estrategias de Aprendizaje (CMEA) corresponded with the original MSLQ version (Ramírez-Dorantes et al., 2013).

As can be seen, conclusions regarding the validity and reliability of locally adapted versions of the MSLQ scales vary widely. One of the proposed options for the future MSLQ investigation is the verification of whether the MSLQ predicts the students' academic performance. A positive relationship was previously confirmed (Hsu, 1997; Langley, 2007), as well as rejected (Barker & Olsen, 1997; Bartels, Magun-Jackson, & Kempt, 2009). However, the study of the validity and reliability of the MSLQ may help shape developmental trajectories for self-regulated learning in future students.

3.3 Validity

We started the process of analysis with EFA. The first step involved verifying if the data set is suitable for EFA, the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) was checked. The KMO index was .87 ("great" according to Field, 2009, p. 659), and all KMO values for the individual items listed in the anti-image matrix yielded satisfactory values (> .7) which is well above the acceptance limit of .5 (Field, 2009, p. 659). In addition, the Bartlett's test of sphericity $x^2 = 3233.14$; df = 136; $p < .000$, indicated that correlations between items were sufficiently large for EFA. Both calculations showed that using EFA was appropriate with the presented data set.

A Principal component analysis (PCA) was conducted on the 17 items (see Appendix) and revealed the presence of the three components with eigenvalues exceeding 1, explaining 24.2%, 22.5% and 9.3% of the variance respectively. Suitable values of discontinuity in variance and inspection of the scree plot revealed a clear break after the third component.

Given the large sample size, the convergence of the scree plot, taking into account the results of the previous model-structure analysis (Jakešová & Hrbáčková, 2014; Jakešová, 2014) and consideration of Kaiser's criterion, the three components were retained in the final analysis. The structure was further supported by the results of the Monte Carlo parallel analysis (see Table 1), showing the three components with eigenvalues exceeding the corresponding criterion values for a randomly generated data matrix of the same size (17 variables and 544 respondents). In summary, all of the analysis pointed to a three-factor structure. However, the final selection of the remaining factors was primarily based on the interpretation of the nature of the factors which is a crucial point of the factor analysis.

Table 1. Actual eigenvalue from PCA and criterion value from parallel analysis comparison

Component number	Actual eigenvalue from PCA	Criterion value from parallel analysis	Decision
1	4.120	1.3197	**accept**
2	3.830	1.2526	**accept**
3	1.574	1.2022	**accept**
4	.762	1.1610	reject

To aid in the interpretation of these three components, orthogonal rotation varimax was performed. The rotated solution revealed the simple three-factors structure with all variables strongly loaded only on the one factor out of three with adequate interpretability. The three component solution explained a total of 56% of the variance (see Table 2).

Table 2. Total variance explained

Component*	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative%	Total	% of Variance	Cumulative%	Total	% of Variance	Cumulative%
1	4.120	24.235	24.235	4.120	24.235	24.235	3.688	21.694	21.694
2	3.830	22.529	46.764	3.830	22.529	46.764	3.371	19.828	41.522
3	1.574	9.262	56.025	1.574	9.262	56.025	2.465	14.503	56.025
4	.762	4.482	60.507						
5	.721	4.238	64.746						

Note. Extraction Method: Principal Component Analysis. *Due to the length shortened.

The interpretation of the factors was consistent with previous Czech validation on the MSLQ, i.e. the three motivational scales measure the three general components of university students' motivation in the Czech educational environment. These factors are as follows: factor one: *Self-efficacy for learning and performance* (i.e. "I expect to do well in my studies") accounted strongly for the total variance[3] of 24.24% with factor loadings ranging from .79 to .63 (4 items). Factor two: *Task value* (i.e. "I believe that what I learn in study, I can use in practice") accounted for 22.53% of the variance with factor loadings of .80 to .65 and covered by 6 items and factor three: *Test anxiety* (i.e. "During the test I am very nervous") accounted for 9.26% with factor loadings range from .76 to .69 variance (7 items).

In addition, the model fit was tested by the confirmatory factor analysis (CFA) with the maximum likelihood method to establish evidence towards the construct validity of the measure. In contrast to EFA, CFA requires the identification of latent components and items that are covered by them. The model fit is evaluated through several fit indices. The minimal requirements for a good model fit were non-significant x^2 – fit statistic, a chi-square to the degrees of freedom ratio (x^2/df) of value less than 5 represents an acceptable fit and their GOF indexes: A root mean-square residual (RMR) of 0 and increasingly higher values indicate a worse fit, a Steiger-Lind root mean square Error of approximation (RMSEA) with a value of 0 indicates the best fit, a Comparative fit index (CFI) with values greater than roughly .90 or close to it may indicate a reasonably good fit of the model, a Goodness-of-fit index (GFI) and Adjusted goodness-of-fit index (AGFI) with values of .85 or greater and a *p* of Close fit (PCLOSE) greater than .05 are heuristic values that indicate that the model fits the input data at a satisfactory level (Brown, 2006).

Firstly, the goodness of fit (GOF) statistics were calculated, $x^2 = 328.11$ (df = 116, $p < .001$), $x^2/df = 2.83$ with goodness of fit indices RMR = .14, RMSEA = .06, CFI = .93, GFI = .94, AGFI = .92, PCLOSE = .04. These values indicate that the tested model (17 items) is at a satisfactory level (Anderson & Gerbing, 1984; Hoyle & Duvall, 2004). Secondly, modification indices (covariances) and estimates (standard residual covariances) were checked showing no major obstacles in the model fit, i.e. no post hoc model modifications were needed. The diagram regarding these results is given in Figure 1.

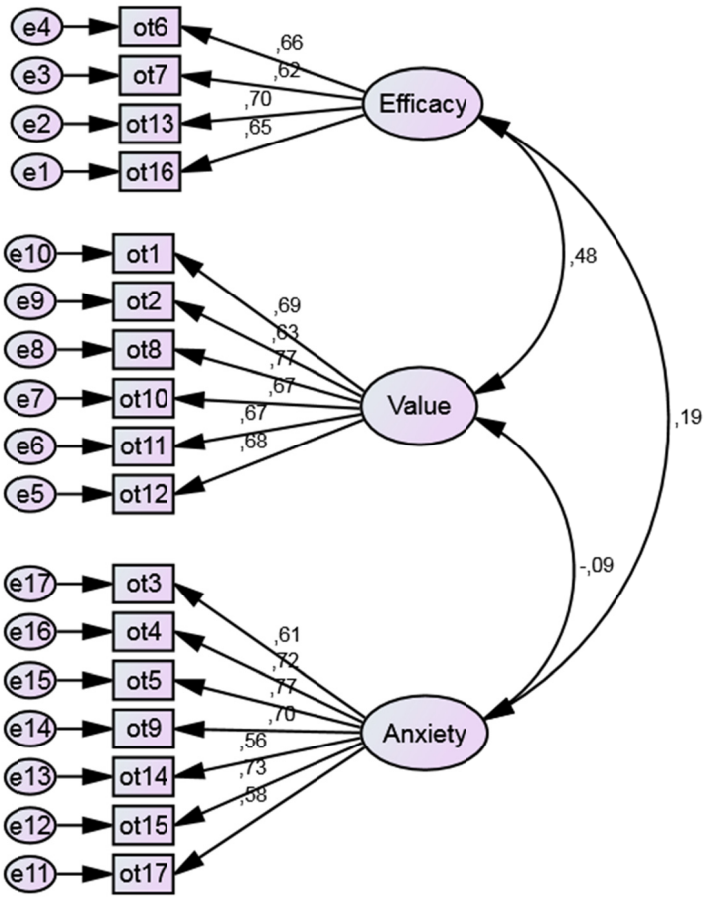

Figure 1. A three-factor model with standardized path coefficients for motivation subscale

Taken together, CFA suggests that the general model representing student's motivation in the process of self-regulated learning with three factors is a reasonable representation of the data and hence can be freely used for further research.

3.4 Reliability

The self-efficacy for learning and performance, task value and test anxiety subscales of the revised MSLQ for the Czech educational environment all had high reliabilities, all Cronbach's α = .79 (for 17 items). The internal consistency of students' judgments of their academic self-efficacy yielded α = .75 (4 items). The task value beliefs that students have regarding their expectancies about how useful, interesting and practical the course is to them also proved to be internally consistent α = .84 (6 items) and the last general motivational construct representative affect, in the form of test anxiety, reached the internal consistency of α = .85 (7 items).

3.5 Interpretation of the Factors

Factors resulting from the factor analysis must be primarily interpretable, i.e. only variables that are supported by the theory or defined by the hypothesis should be considered. As far as factor one is considered, a close check of the meanings of the items and loadings signals that the items represent the expectancy belief that students have about their own abilities due to the learning process. It also refers to personal judgments of performance capabilities in a given domain of activity and is highly influencing performance outcomes. Overall, the first factor was labelled as ***Self-efficacy for learning and performance*** (no. of items: 4, α = .75, mean = 5.03). Furthermore, a very low connection among individual items, total scale and academic performance was found (see Table 3).

Table 3. Descriptive statistics for Self-efficacy for learning and performance

No. of items	M	SD	Correlation with final grade
6	5.11	1.29	- .23
7	5.09	1.44	- .12
13	4.97	1.12	- .27
16	4.93	1.26	- .22
Total scale	5.03	.97	- .27

The second factor refers to the student's evaluation of how useful, important and interesting the task is (i.e. "What do I think about this task?"). This motivational factor indicates students' assessment of the task generating greater interest and involvement in learning. Thus, the label found in the original structure of the MSLQ questionnaire ***Task value*** precisely captures the content validity of this factor (no. of items: 6, α = .84, mean = 4.69). Moreover, there is not much of an association among individual items and total scale and academic performance (see Table 4).

Table 4. Descriptive statistics for Task value

No. of items	M	SD	Correlation with final grade
1	5.22	1.40	- .12
2	5.03	1.33	- .16
8	4.68	1.33	- .12
10	4.90	1.64	- .09
11	3.56	1.35	- .02
12	4.78	1.38	- .15
Total scale	4.69	1.05	- .14

The items that loaded into the third factor cover the anxiety related to school performance. The factor refers to students' negative thoughts that can disrupt schooling attention and performance and occur frequently during the challenging period of study, which is primarily the examination period of the school semester. The affective component was labeled as ***Test anxiety*** (no. of items: 7, α = .85, mean = 3.78). In addition, very low correlation appeared among each item and total scale and academic performance (see Table 5).

Table 5. Descriptive statistics for test anxiety

No. of items	M	SD	Correlation with final grade
3	4.45	1.62	- .05
4	3.65	1.88	- .06
5	2.82	1.80	- .01
9	4.60	2.04	- .01
14	3.69	1.84	- .07
15	3.17	1.83	- .04
17	4.11	1.81	- .12
Total scale	3.78	1.33	- .05

4. Discussion

In thinking about our own behavior and actions, the process of planning study goals and the strategies to achieve them over time is done daily and is often largely unnoticed. If we find that some strategies are not successful, then a modification or adaptation of behavior to the more current situation is needed. Yet, the entire process is monitored and/or changed based on feedback. This process can be generally described as self-regulation, in educational settings more precisely as self-regulated learning.

In the narrow sense, self-regulation is tied to a specific situation or behavior. Most often we talk about self-regulated learning involving cognitive, non-cognitive and motivational components. The presented research is focused on the self-regulated learning of university students in the Czech Republic. The focus of interest, however, is even deeper. Areas of research interest are motivational aspects of self-regulated learning, which appear to be the strongest factor in the entire process.

The exploratory approach of the latent factors, i.e. verification of the selected and revised MSLQ scales construct validity and internal consistency, were conducted. The three-factor structure represents a coherent conceptual and empirically validated framework for assessing motivational believes in self-regulated learning in university students in the Czech Republic. The final version of revised MSLQ is represented by 17 items (see Appendix).

Factor one, which measures students' motivational beliefs in the form of self-efficacy for learning and performance, included 4 items. Factor two represents students' beliefs about the task value covered by 6 items while the final factor, factor three, indicates the existence of test anxiety and consisted of 7 items. Taken together, all of the analyses presented in this study suggest that the general model representing student's motivation in the process of self-regulated learning with three factors is a reasonable representation of the data and hence can be freely used for further research.

Moreover, there are not many associations among the individual items and total scales and academic performance. Hence, significant dependency rates between the motivational aspects of self-regulated learning and the results of students' academic performance weren't confirmed. Future research should consider testing the general issue of measurement invariance.

Like any other research inquiry, the current study consists of several limitations. Historically, exploratory factor analysis is well known for its methodological critics in the form of construction of an additional rotation or selection of a different angle between the factors that each researcher can use to prove their own theory about the arrangement of factors. When working with the factor analysis, it should be borne in mind that factor analysis is not a common statistical test that provides clear answers. Conversely, researcher expertise is irreplaceable as he/she is the main person who takes decisions on a number and interpretations of the factors into his/her own hands. Neither confirmatory factor analysis is entirely clear for its several authentication factor structure methods. More importantly, we didn't carry out a factor analysis of the population, but only on the selection of this data set. Therefore, the results of the factor analysis will always represent only analogous estimates of the real factor. Despite these limits, the presented analyses are very valuable instruments measuring the construct validity and also opened the non-stereotypical, adventurous and discovery work of researchers.

Understanding how independent learning is regulated, and how to educate others in this process may lead to an improvement in students' study habits, and greater professional competence in the future; specifically, the acquisition of skills that go beyond the boundaries of the professions.

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Notes

Note 1. The strong continuity of self-regulation and motivation is evident in the Self-determination theory (SDT) (Deci & Ryan, 2000, p. 71). Self-determinated motives are those that stem from the inner needs of students and stand in opposition to external regulation and amotivation or unwillingness. SDT has addressed the importance to the processes through which nonintrinsically motivated behaviors can become truly self-determined based on the processes of internalization and integration. Internalization refers to people's "taking in" a value or regulation, and integration refers to the further transformation of that regulation into their own so that, subsequently, it will emanate from their sense of self.

Note 2. After each wave of the data collection it is highly recommended to repeatedly assess the factor structure and the reliability of the instrument. Replication of the factor solution with a new sample can demonstrate the solution's generalizability. Authors (Osborne & Fitzpatrick, 2012, p. 7) encourage researchers to take this additional step of performing and reporting replication results as a routine practice, and to further move forward (with new samples) to confirmatory factor analysis and present the scale for broad usage.

Note 3. The first component in PCA always accounts for the most variance and therefore has the highest eigenvalue, and the next components account for as much of the left over variance as possible (Field, 2009, p. 660).

Appendix

Factor loading of The Motivated Strategies for learning questionnaire (MSLQ)

		Factor		
No.	Item	1	2	3
5	I'm very nervous when I take an exam.	.787		
15	I often have a feeling of anxiety during the exam period.	.787		
9	I have an uneasy, nauseous feeling when I take an exam.	.755		
4	Stage fright causes me to reach poorer performance in exams.	.750		
14	I often can't forget about how poorly I performed in exams.	.666		
3	I can't concentrate during the exam.	.658		
17	I often feel that I don't understand anything and can't handle my studies.	.633		
8	I'm very interested in the content area of the school courses.		.803	
10	I think I will be able to use what I learn at school in the real world.		.769	
12	I think the course materials are useful for me to learn.		.735	
1	I like to learn because I'm interested in my field of study.		.729	
11	Our school assignments are mostly interesting for me.		.708	
2	I like to learn to know something new.		.646	
13	Considering the difficulty of the study, I can put in enough effort to handle it.			.761
6	I'm confident I can make sufficient effort required at university.			.750
7	I'm certain I can master the study assignments even though I'm feeling under pressure.			.709
16	I can meet all academic requirements that that are required.			.694
Eigenvalue		4.120	3.830	1.574

Note. * The items were provided to respondents in the Czech language. English is used here for illustration purposes.