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Czech validation of the self-regulation and self-efficacy questionnaires for learning

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Abstract

The authors present the findings of the second round Czech validation of the Self-Regulation Questionnaire (SRQ-CZ), originally developed by Brown et al. (1999) and the Self-efficacy Questionnaire for learning (SEQ), developed by Jakešová (2014). The sample consists of participants enrolled in the formal and informal education system in the Czech Republic (n = 1.244). EFA and CFA yielded a four-factor model for SRQ-CZ with 21 items, Alpha of .85 and a one-factor model for SEQ, 8 items, Alpha of .89. The analysis suggests that the general models representing self-regulation and self-efficacy for learning are a reasonable representation of the data.

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Keywords: self-regulation; adaptation of SRQ; adaptation of SEQ; exploratory factor analysis (EFA); confirmatory factor analysis (CFA); Cronbach´s alpha

1. Introduction

Self-regulation is the ability to develop, implement, and flexibly maintain planned behavior in order to achieve one's goals (Miller & Brown, 1991). According to the foundational work of the researchers Kanfer, Miller and Brown, there are seven steps which must happen for behavioral self-regulation to occur: receive relevant information, evaluate the information and compare it to norms, trigger change, search for options, formulate a plan, implement the plan and assess the plan's effectiveness (which recycles to steps 1 and 2).

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Although this model was developed specifically to study addictive behavior, the self-regulatory processes it describes are meant to serve as general principles for behavioral self-control. The concept of self-regulation also overlaps with metacognition. Others even use the term interchangeably with metacognition. Increasingly, research is finding associations between young people's success in controlling their behavior and emotions, social competence, school success and, for example, healthy eating habits.

Self-regulation falls within the area of psychology, pedagogy, social cognitive theory and adjacent disciplines, and has been a part of research activity across all continents for the last fifty years. The diversity of theories and models is wide (cf. Boekaerts, Pintrich & Zeidner, 2005). The theory and research of self-regulation is, for example, developed in the field of alcohol abuse (Carey, Carey, Carnrike & Meisler, 1990; Chassin & De Lucia, 1996; Wills, Sandy & Yaeger, 2002), drug use (Baumeister & Heatherton, 2009), procrastination (Eerde, 2000; Senécal & Vallerand, 1995; Motiea, Heidaria & Sadeghic, 2012), students´ high drop-out and truancy rates (Veenstra, Lindenberg, Tinga & Ormel, 2010), and control of attention (Carver & Scheier, 2011). From the social cognitive point of view preferred by the authors, self-regulation is seen as the interaction of a triad of personal, behavioural, and environmental processes (Bandura, 1986). In this sense we think that self-regulation includes not only behavioural skills in managing environmental contingencies but also a sense of personal agency to enact these skills in the relevant contexts. Inner thoughts, feelings and actions that are planned, monitored and cyclically adapted according to the acquired feedback and goals are also included in the self-regulation process of behavior (Gavora, Jakešová & Kalenda, 2015).

So far, there has been no consensus on the exact number or the character of self-regulated phases. Carver and Scheier (1982) and Kanfer (1970) proposed a three-phase theory of self-regulation that includes self-monitoring, self-evaluation, and self-reinforcement. Miller and Brown (1991) built on Kanfer´s model and expanded the number of processes involved in self-regulation to seven, while Carey, Neal and Collins (2004) provided a single-dimension solution. Common to all models, however, is the fact that deficits at any one stage may result in self-regulation difficulties.

In the current state-of-the-art, researchers are exploring not only the level of self-regulation in diverse population but also the various variables that influence the achieved level of self-regulation and the relation to other concepts. According to Bandura (1986) self-regulation strongly depends on self-efficacy beliefs. Perceived self-efficacy influences the level of goal challenge people set for themselves, the amount of effort they mobilize, and their persistence in the face of difficulties. Perceived self-efficacy is theorized to influence performance accomplishments both directly and indirectly through its influences on self-set goals (Zimmerman et al., 1992, 665). In addition to the relation to learning, self-regulated learners exhibit a high sense of efficacy in their capabilities, which influences the knowledge and skill goals they set for themselves and their commitment to fulfilling these challenges. This conception not only encompasses the cognitive skills emphasized by metacognitive theorists, but also extends beyond to include the self-regulation of motivation, the learning environment, and social supports for self-directedness (Zimmerman et al., 1992, 664).

The present study focuses on the adaptation of a self-regulation instrument and validation of an academic self-efficacy tool. We argue that quality research should be based on a valid and reliable tool. The core results of the adaptation and validation processes of the two tools are presented here, as well as an indication of the directions of future research.

2. Research methodology

Since no reliable or valid instruments existed for measuring self-regulation of behavior in the Czech educational environment and as developing a new questionnaire is very time-consuming, the authors´ aim was to adopt an existing research instrument. When validating a questionnaire it is important that a sample is used that is as close as possible to the representative one of the population in which the instrument will be administrated. This criterion was met by using a large sample, as described below. The construct validity and reliability of the questionnaire were investigated. For this purpose, exploratory (EFA) and confirmatory (CFA) factor analyses were used. The internal consistency of the questionnaire and individual items was checked using Cronbach's alpha (α).

The instrument chosen for adaptation and adapted for the research population was **The Self-Regulation Questionnaire (SRQ)** developed by Brown, Miller and Lawendowski (1999). The SRQ is widely used in the

academic and non-academic environments as it measures general rather than domain-specific self-regulation of human behavior rather than self-regulated learning. The other instrument used was **The Self-efficacy Questionnaire (SEQ)** (Jakešová, 2014) to gather data about the student´s ability to study efficiently.

2.1. Measurements

The Self-Regulation Questionnaire (SRQ-CZ). The original SRQ (Brown, Miller & Lawendowski, 1999) used in the research is a 63-item self-report instrument designed to assess the ability for self-regulation in individuals in the seven phases mentioned before. These phases reflect the steps necessary for effective behavioural self-regulation (Miller & Brown, 1991).

The questionnaire uses a 5-point Likert scale ranging from "strongly disagree" to "strongly agree", the centre point being "uncertain". Higher scores mean better capacity for self-regulation. The convergent validity of the questionnaire using data from clients with high alcohol consumption and the divergent validity with clients with low alcohol consumption was confirmed. However, a factor analysis to prove the seven phases of self-regulation on which its items were theoretically based was not performed by the authors.

Further steps to assess the psychometric attributes of the SRQ were carried out primarily in the US environment (Carey, Neal & Collins, 2004; Neal & Carey, 2005). Nevertheless, they failed to provide empirical support for the existence of the 7 phases of self-regulation (Miller & Brown, 1991).

In this adaptation, the original English version of the questionnaire was first translated into the Czech language, then the translation was then checked by a fluent English-Czech speaker (Gavora, Jakešová & Kalenda, 2015). The adaptation of the questionnaire was based on a suitable (not literal) meaning of the items, thus rendering close correspondence with Czech cultural traditions. The arithmetic mean to express the total raw score of the questionnaire and the scores of the dimensions was used.

The Self-efficacy Questionnaire (SEQ). The authors created an original self-report instrument SEQ to gather data on the respondents´ beliefs in the ability to study efficiently (Jakešová, 2014). The Self-efficacy Questionnaire (SEQ) consists of 10 items. The overall level of self-efficacy for learning is expressed by calculating the arithmetic average. Higher scores mean more confidence in the students´ learning.

2.2. Sample

The population consists of all participants enrolled in the formal and informal education system in the region of Zlín in the Czech Republic (N = 10.585). These were students in any field and forms of study at Tomas Bata University in Zlín actively studying in the academic year 2013/2014 as well as students at the University of the Third Age in the region of Zlín.

The research sample consisted of 1,244 respondents. Of that number, 27% (333) were males and 73% (903) were females with a mean age of 31 years (range 19-83 years, SD = 16.537). 84% (1,049) students attended formal education and 16% (193) were students of the informal education system, i.e., enrolled at the University of the Third Age. Before enrolling in the university, the students had completed different levels of education, with secondary-school education prevailing, and were most often motivated to study at the university to obtain a diploma or by an employer (see table 1).

Table 1. Composition of the sample of respondents by education and the motivation to study

	Level of education completed						Motivation to study	
	High school	High school with GCE	Higher vocational school	Bachelor's course	Master's course	Ph.D. course	Employer	University diploma
Frequency	28	976	54	119	48	3	842	379
Valid percent (%)	2.3	79.5	4.4	9.7	3.9	.2	69	31

3. Results

The research focuses on confirming the construct validity of two instruments: the Czech version of the **Self-Regulation Questionnaire (SRQ-CZ)** and the Czech version of the **Self-efficacy Questionnaire (SEQ)** for academic learning.

3.1. Self-Regulation Questionnaire (SRQ-CZ)

We started the process of analysis with EFA. The first step involved verifying if the data set is suitable for EFA. Therefore, the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) was checked. The KMO index was .883. In addition, Bartlett's Test of Sphericity was calculated, yielding $x^2 = 5685.356$; df = 231; $p < .000$. Both measures showed that using EFA was appropriate with the present data set.

To determine the number of factors inferred from patterns of association among sets of observed variables, the Scree plot was used. It suggested a four- or five-factor solution. The Principal Component (PCA) with Varimax rotation for a number of factor solutions was calculated, yielding an interpretable structure with items clustered into four underlying factors, as expected by the theory. The four factor solution covered 22 items and explained 45% of the variance. Cronbach's Alphas of factors ranged from .69 to .71, with total Alpha for 22 items of .85.

The first factor, **Goal Orientation** (see Table 2) consisted of 5 items with factor loadings from .783 (*I hold tight with my plans when they work*) to .496 (*I know what kind of person I want to be*), demonstrating a high relevance for the factor. The second factor, representing **Self-direction,** consisted of 7 items with factor loadings from .676 (*I can´t seem to learn from my mistakes*) to .430 (*I have problems planning my activities*). The third factor, representing **Decision Making,** covered 6 items with factor loadings from .735 (*My precedence is that I can find more ways to solve the problem*) to .437 (*When I find out that things are not working as they should, I try to change things*). The last factor, **Impulse Control,** consisted of 4 items with factor loadings from .670 (*I have ideas, but can´t decide how to implement them*) to .559 (*I easily give up when faced by an obstacle*).

Table 2. Factor loadings of the SRQ-CZ items

No.	Item	F_1	F_2	F_3	F_4
2.	I hold tight with my plans when they work.	.783			
1.	Usually I act in a certain manner to achieve my goals.	.710			
4.	I have personal rules by which I try to live.	.639			
11.	I have firm principles.	.521			
7.	I know what kind of person I want to be.	.496			
13.	I can´t seem to learn from my mistakes.		.676		
9.	I often ignore what I am doing until somebody else tells me something.		.630		
5.	I learn from my mistakes.		.586		
20.	Sometimes I discover the consequences of my actions too late.		.565		
16.	Usually I think first before I do something.		.547		
6.	I doubt that I can change, even if I wanted to.		.457		
26.	I have problems planning my activities.		.430		
15.	My precedence is that I can find more ways to solve the problem.			.735	
19.	Usually there are multiple ways how I can achieve my goals.			.620	
8.	When I want to change something, I usually seek several solutions.			.582	
27.	I can see that things should be changed much sooner than other people.			.558	
3.	A new problem or challenge raises an immediate search to find solutions.			.539	
22.	When I find out that things are not working as they should, I try to change them.			.437	

23.	I have ideas, but can´t decide how to implement them.				.670	
10.	If I have to decide I often hesitate.				.648	
12.	Even if I decide to do something, I have difficulties realizing it.				.647	
21.	I easily give up when faced by an obstacle.				.559	
		Goal orientation	Self-direction	Decision Making	Impulse Control	Total
	Number of items	5	7	6	4	22
	Explained variance in %	25	9	6	5	45
	Cronbach´s Alpha	.710	.707	.714	.692	.848
	Average score	3.99	2.51	3.52	2.82	3.99
	S.D.	.64	.66	.58	.79	.64

In addition to EFA, the model fit was tested by confirmatory factor analysis (CFA) with the maximum likelihood method. In contrast to EFA, CFA required the identification of which items should fall onto which latent variables. Model fit was evaluated through several fit indices. The minimal requirements for good model fit were non-significant x^2 – fit statistic (we might never see non-significant results with a large sample size as presented here), a chi-square to degrees of freedom ratio (x^2/df) of less than 5, ideally less than 3 and their GOF indexes Root Mean-Square Residual (RMR) of .50 or less, a Root Mean Square Error of Approximation (RMSEA) ≤ .05 indicates close approximate fit, a Tucker-Lewis Index (TLI, Bentler-Bonett Non-normed Fit Index (NFI or BBNFI), or ρ^2), and the Bentler-Bonett Normed Fit Index (NFI). Most of these fit indices have values that range between approximately 0 and 1.0. Some of these indices are "normed" so that their values cannot be below 0 or above 1 (e.g., NFI, CFI). Others are considered "non-normed" because, on occasion, they may be larger than 1 or slightly below 0 (e.g., TLI, IFI). In the past, these indexes were generally used with a conventional cut-off in which values larger than .90 are considered good fitting models, but the consensus now seems to be that this value should be increased to .95. Comparative Fit Index (CFI) greater than .90, a Goodness-of-fit Index (GFI) and Adjusted Goodness-of-fit Index (AGFI) 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 date well.

Firstly, goodness of fit (GOF) statistics were calculated, x^2 (df = 203, p = .000) = 1006,066, x^2/df = 4.956, RMR = .054, RMSEA = .059, TLI = .834, CFI = .854, GFI = .921, AGFI = .902, PCLOSE = .000. These pointed out that the model was not fit at the expected level. Concerning the results, factor loading of items varies from .36 (item 27) to .68 (items 21).

Item 27 from the factor Decision Making was deleted due to its very low factor loading (.36) and then GOF indexes were checked. According to the results of the second analyses, x^2 (df = 183, p = .000) = 948.42, x^2/df = 5,183 and their GOF indexes values RMR = .056, RMSEA = .061, TLI = .836, TLI = .836, CFI = .857, GFI = .922, AGFI = .902, PCLOSE = .000 pointed out that the model doesn´t fit in a satisfactory level. Once the modification indices had been produced, it was stated that there was a notable relation between the error covariances of item 2 and item 1; item 11 and item 4; item 20 and item 13 and 16 and between the error covariances of item 12 and item 23. Covariances were acceptable since the items were expected to exist in the same factor.

The third CFA results were as follows: x^2 (df = 178, p = .000) = 65.148, x^2/df = 3.873 and GOF indexes are as RMR = .052, RMSEA = .050, TLI = .887, CFI = .904, GFI = .944, AGFI = .927, PCLOSE = .452. Those changes collectively improved the model fit and the tested model is coherent at a satisfactory level. A diagram regarding these results is given in Fig. 1.

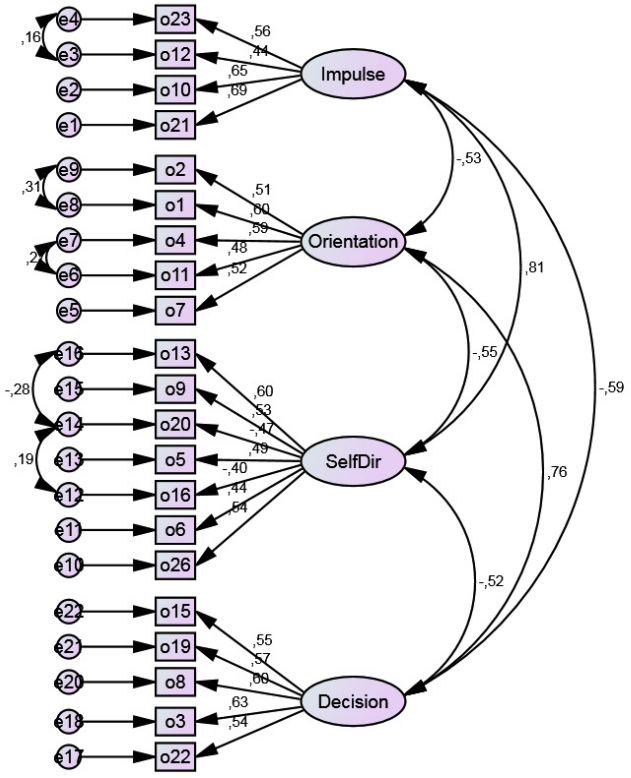

Fig. 1. CFA results of the self-regulation questionnaire.

On the other hand, reliability for the new model fit (consisting of 21 items) reached α = .85, demonstrating good internal consistency. Taken together, CFA suggests that the general model representing a student´s ability to self-regulate their behavior enrolled in the formal and informal education system from the region of Zlín in the Czech Republic with four factors is a reasonable representation of the data.

3.2. Self-efficacy Questionnaire (SEQ)

The KMO index for SEQ was .93 and Bartlett's Test of Sphericity yielded $x^2 = 5710.79$; df = 45; $p < .000$. The use of EFA was appropriate with the presented data set. The Scree plot suggested a one-factor solution. The Principal Component (PCA) with Varimax rotation showed an interpretable structure with items clustered into one underlying factor, as was expected. The one-factor solution covered 10 items with 54% of variance explained and Cronbach's alpha for the 10-item was .904.

The Self-efficacy factor (see Table 3) consisted of 10 items with factor loadings from .797 (*When concentrating enough, I can handle very difficult subject matter*) to .657 (*I believe that if I sufficiently concentrate I can handle larger amounts of learning material*), demonstrating a high relevance for the one factor. The model fit was tested by CFA with the maximum likelihood method.

Table 3. Factor loadings of the SEQ items

No.	Item*	F_1
10.	When concentrating enough, I can handle very difficult subject matter.	.797
4.	I think I can make sufficient effort needed to study at university.	.795

2.	Although the subject matter is difficult, I can make an effort to handle it.	.749
6.	I can accomplish all academic requirements that are required during the course.	.731
3.	I think I can obtain credits and manage exams without too much trouble.	.731
9.	I am confident that I will do well in my course.	.723
7.	I believe that if I exert sufficient effort I will obtain excellent study results.	.720
5.	Even though I am in a hurry, I can make the effort to complete my assignments.	.719
8.	I am convinced that I am able to easily learn core subject matter in any subjects.	.718
1.	I believe that if I sufficiently concentrate I can handle larger amounts of learning material.	.657
	Number of items	10
	Explained variance in %	54
	Cronbach's Alpha	.90
	Average score	3.8
	S.D.	.7

Firstly, goodness of fit (GOF) statistics were calculated, x^2 (df = 35, p = .000) = 400.049, x^2/df = 11.430, RMR = .039, RMSEA = .093, CFI = .934, GFI = .934, AGFI = .896, PCLOSE = .000. This pointed out that the model did not fit with the expected level. Concerning the results, factor loading of each item was quite high, varying between .57 (item 1) and .76 (items 10 and 4). However, a notable relation between error covariances of item 10 and item 9; item 9 and item 5; item 6 and item 7; item 1 and item 4; item 1 and item 10 was found. Covariances were acceptable since the items were expected to exist in the same factor. Also, **item 1** was deleted due to its lowest factor loading.

The results of the second analyses were as follows: x^2 (df = 23, p = .000) = 107.885, x^2/df = 4.691 and their GOF indexes values RMR = .020, RMSEA = .055, CFI = .983, GFI = .981, AGFI = .962, PCLOSE = .191 pointed out that the model fits in a satisfactory level. Nevertheless, when its standardized residual covariances matrices were checked, **item 10** (with value 1,374) was deleted. CFA was calculated again with an 8-item structure.

The third CFA results were as follows: x^2 (df = 17, p = .000) = 65.148, x^2/df = 3.832 and GOF indexes are as RMR = .018, RMSEA = .048, CFI = .988, GFI = .987, AGFI = .971, PCLOSE = .558. Those changes collectively improved the model fit and the tested model is coherent at a satisfactory level (see Fig. 2).

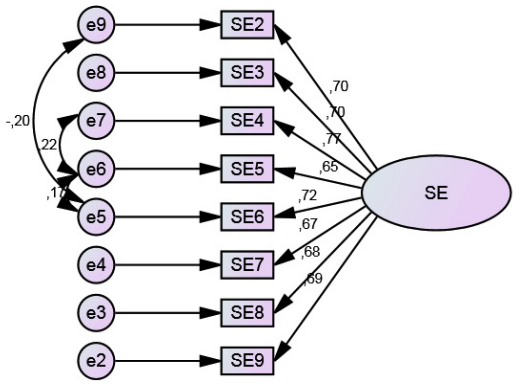

Fig. 2. CFA results of the self-efficacy questionnaire.

The reliability for the new model fit (consisting of **8 items**) reached α = .885, demonstrating good internal consistency. Taken together, the Alphas and CFA suggest that the general model representing self-efficacy in students enrolled in the formal and informal education system from the region of Zlín in the Czech Republic with one factor is a reasonable representation of the data.

4. Summary and discussion

The presented research contributed to the ongoing discussion on the adaptation process of the **Self-Regulation Questionnaire (SRQ)** (Brown et al., 1999) in the Czech education environment. Although the adaptation shows satisfactory psychometric characteristics, it failed to prove the seven phases of the ability for self-regulation as mentioned by its authors (Brown et al., 1999). Four factors were assumed to be the best factorial solution, i.e., (1) Impulse Control, (2) Goal Orientation, (3) Self-Direction and (4) Decision Making.

Impulse control represents the management of short-term desires. Students with low impulse control are prone to act on immediate desires and are unable to regulate their behavior at a given time. Determining the specific goals of own behavior is also necessary during the regulation of behavior. It was found that self-regulation also refers to students' self-generated thoughts, feelings and actions which are systematically oriented toward attainment of their goals. In other words, **goal orientation** is an individual's general schema or theory for approaching the task, doing the task, and evaluating their performance of the task (Pintrich, 2000, 473). This pattern is considered to be the foundation for successful academic performance (Ames, 1992; Pintrich & De Groot, 1990; Pintrich & Schrauben, 1992).

Based on this research, the opportunities for **self-direction** is a valid factor representing self-regulated behavior. In terms of the research focus area of learning, self-directed (SDL) and self-regulated learning (SRL) skills are seen by some authors as synonyms (Deepwell & Malik, 2008; Malik & Shabbir, 2008), by others as two separate constructs (Jossberger et al., 2010). Self-directed learning is a process in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes (Knowles, 1975). Self-direction may include self-regulation but not the opposite (Jossberger et al., 2010). In other words, a self-directed student is supposed to be self-regulated, but a self-regulated student may not self-direct.

The self-regulation of behavior includes the thought process of selecting a logical choice from the available options. Every **decision-making** process produces a final choice that may or may not prompt action. In two additional studies (Vohs at al., 2005), people were better at self-regulation after they had performed a task they had chosen, as compared to performing a task chosen by others.

As a result of CFA, the **SRQ-CZ** consists of 21 items with Alpha of .85, thus demonstrating good internal consistency.

The other aim of the research was validation of the **Self-efficacy Questionnaire (SEQ)** developed by Jakešová (2014). The instrument measures self-efficacy for learning, seen as a belief in the ability to study efficiently. PCA with Varimax rotation showed an interpretable structure with items clustered into one underlying factor. The one factor solution was covered by 10 items with 54% of variance explained and Cronbach's alpha for the 10-item was .904. The model fit was tested by CFA with the maximum likelihood method. The findings suggest that the general model representing self-efficacy in students enrolled in the formal and informal education system from the region of Zlín in the Czech Republic with one factor is a reasonable representation of the data.

On the basis of these data it is suggested that a further direction for research will include bivariate statistics using socio-demographic data. This will determine the differences in the degree of self-regulation of behavior by gender, age, year of study and specialization. The findings can help to uncover the essence of differentiation of the process of self-regulation including the detection of differences in formal and informal kinds of study. These and other research questions, together with correlation analysis of self-regulated behavior and self-efficacy for learning, will be part of future analyses.

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