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Devising A Structural Equation Model of Relationships between Preservice Teachers' Time and Study Environment Management, Effort Regulation, Self-efficacy, Control of Learning Beliefs, and Metacognitive Self-Regulation

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ABSTRACT: The objective of this study is to analyze the relationship between preservice teachers' time and study environment management, effort regulation, self-efficacy beliefs, control of learning beliefs and metacognitive self-regulation. This study also investigates the direct and indirect effects of metacognitive self-regulation on time and study environment management. Data from 506 preservice teachers was obtained using the Motivated Strategies for Learning Questionnaire (MSLQ). The results of the study showed that a positive and significant correlation existed between the variables of control of learning beliefs and metacognitive self-regulation; self-efficacy beliefs and metacognitive self-regulation; metacognitive self-regulation and time and study environment management; time and study environment management and effort regulation; metacognitive self-regulation and effort regulation. In addition to the direct effect of metacognitive self-regulation on time and study environment management, there was also an indirect effect through effort regulation.

KEY WORDS: direct and indirect effect, path analysis, preservice teachers, self-regulated learning skills

INTRODUCTION

In the process of learning-teaching, individual differences need to be taken into consideration. This is because learners' preferences for learning-teaching approaches and their reactions towards teaching implications vary, according to these individual differences. These individual characteristics can be classified under four categories: cognitive, affective, social and physiological. Within this, many factors, which may be considered to be based on individual differences, such as motivation, attitude and self-efficacy, impact on the learning process (Kuzgun & Deryakulu, 2004). Also, an examination of the literature indicates that there are many studies where the impact of affective variables have been analyzed, such as beliefs, attitudes, motivation,

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anxiety, self-efficacy beliefs, goal orientation, control of learning beliefs and epistemological beliefs (Chan, 2011; Çetin-Dindar, Kırbulut, & Boz, 2014; Deci, Vallerand, Pelletier, & Ryan, 1991; Karaarslan & Sungur, 2011; Mamlok-Naaman, 2011; Rukavina et al., 2012; Sungur & Tekkaya, 2006; Şen, Yılmaz, & Yurdugül, 2014; Turkmen, 2013). Nevertheless, more attention is paid to the impact of cognitive, than affective, variables. According to Bloom, the contributing factor for learner success is due to cognitive variables (50%), affective variables (25%), and quality of instruction (25%) (Mitchell & Simpson, 1982).

The main objective of today's information society is to train individuals who have the capacity to determine their own learning goals and having self-regulated learning skills to increase their own learning and performance. Self-regulated learning is an active and constructive process, where individuals set their own learning goals, regulating their cognition, motivation and behavior (Pintrich, 2000a). The self-regulated learning model, as suggested by Pintrich, is important as it reflects the social cognitive point of view and includes motivational processes. If the learners are not motivated to use cognitive and metacognitive skills, these skills have no importance (Pintrich & De Groot, 1990).

Analysis of the studies shows that there are many research studies about the nature, origin and development of self-regulated learning (Boekaerts, 1993; Pintrich, 2000a; Schunk, 2001; Zimmerman, 2000b). These indicates that learners' motivation is related to learning strategies (Elliot, McGregor, & Gable, 1999; Pintrich, 1999; Pintrich & De Groot, 1990, Schiefele, 1991; Şen, Yılmaz, & Yurdugül, 2014). There is an assumption that the more highly motivated students use more learning strategies (Pintrich & De Groot, 1990). According to this assumption, motivational components of self-regulation predict learners' learning strategies; moreover, more highly motivated students are expected to be more strategic.

Pintrich, Smith, Garcia, and McKeachie (1991) suggest that self-regulated learners manage and regulate their time and studying environment. Learners who manage their time and study environment (resource management strategies) are able to make schedules, manage their planning and studying time and make efficient use of their time, in order to reach their goals. Apart from regulating studying time, these learners also define realistic goals by using their studying time efficiently. Managing the studying environment implies regulations that learners use for classroom studies. Ideally, the studying environment should be well ordered and quiet; there should be no distracting visual and auditory factors. In addition, the studies conducted by Credé and Phillips (2011) and Fallon (2006) indicate that time and study environment is related to effort regulation.

Self-regulation includes effort regulation (resource management strategies) and it is not surprising that self-regulated learners have a tendency to maintain their attention and effort when facing uninteresting tasks or distractions. Effort management shows the individuals' determination to obtain their objectives despite difficulties related to self-management and the environment. Effort management not only reflects the determination to achieve objectives, but also affects the use of learning strategies. For this reason, effort management is vital for academic success. The control of learning beliefs (expectancy component) is learners' self-perception about obtaining positive results at the end of their endeavors. In this case, learners consider their success and failures without attributing them to external factors. As long as they believe that they can create a difference by their efforts within the learning process, they are expected to study more strategically and efficiently. Sungur (2007) indicates that individuals with higher motivational beliefs employ a higher use of strategy and effort management. Studies in the literature show that the control of learning beliefs is related to self-efficacy beliefs (Araz & Sungur, 2007; Sungur, 2007) and metacognitive learning strategies (Johnson, 2013; Sungur, 2007). Sungur and Tekkaya (2006) show that variables of control of learning and self-efficacy beliefs have significantly meaningful correlations with metacognitive self-regulation, time and study environment management, as well as effort regulation. The study conveyed by Johnson (2013) presents positive correlations between the variables of effort regulation and time and study environment management; self-efficacy beliefs and metacognitive self-regulation.

Self-efficacy implies not only judgments about task accomplishment but also the confidence to perform that task. Added to this, many studies in the literature emphasize that motivational beliefs have an important impact on learners' metacognitive strategy use (Al-Ansari, 2005; Coutinho, 2007; Dembo & Eaton, 2000; Kanfer & Ackerman, 1989; Pintrich & De Groot, 1990; Shu-Shen, 2002). Studies in the literature indicate that self-efficacy plays an important role in the learners' metacognition (Kanfer & Ackerman, 1989; Sungur, 2007). Learners with high self-efficacy beliefs utilize more metacognitive strategies than learners with low self-efficacy beliefs (Bouffard-Bouchard, Parent, & Larivee, 1993; Kanfer & Ackerman, 1989; Pajares, 2002; Sungur; 2007). With this in mind, it is not surprising that Greene, Miller, Crowson, Duke and Akey (2004) assert that self-efficacy and learning goals significantly predict strategy use.

Metacognitive self-regulation (cognitive and metacognitive strategies) is another key variable. Metacognition is related to the awareness, knowledge and control of cognition. General metacognitive self-regulatory activities include planning, monitoring, and regulating. Planning activities help to activate prior knowledge, which is beneficial

for understanding the subject. Monitoring activities include self-testing, questioning and self-monitoring during reading and these activities both help learners to comprehend the material and combine the existing knowledge with new knowledge. Regulating ability indicates the individual's adjustment to the cognitive activities. Researchers claim that regulating activities can enhance the learners' performance by helping them control and improve learning behaviors (Pintrich, 1999; Pintrich & De Groot, 1990; Pintrich et al., 1991). The study of Sungur (2007) indicates that highly motivated learners, despite various difficulties, make more effort to learn and use various learning strategies. At the same time, other studies in the literature, show that self-efficacy has an impact on self-regulating learning process and self-management behaviors (Dembo, 2000; Pintrich & Schunk, 2002; Schunk, 2001). Likewise, there is a high correlation between metacognitive self-regulation and self-efficacy (Fallon, 2006; Wu, 2006).

The basis of this study is a determination of the cognitive, metacognitive and motivational characteristics that self-regulated learners are expected to have, such as effort regulation, control of learning beliefs, metacognitive self-regulation, self-efficacy for learning and performance, time and study environment management. For this reason, the purpose of this study is to analyze, using a path model, the relationships between the variables of effort regulation, control of learning beliefs, metacognitive self-regulation, self-efficacy beliefs and time and study environment management. The researchers observe the direct and indirect effects of the variables and investigate whether or not there are any mediating effects.

The proposed model is summarized in Figure 1 and accordingly, the study put forward 8 hypotheses.

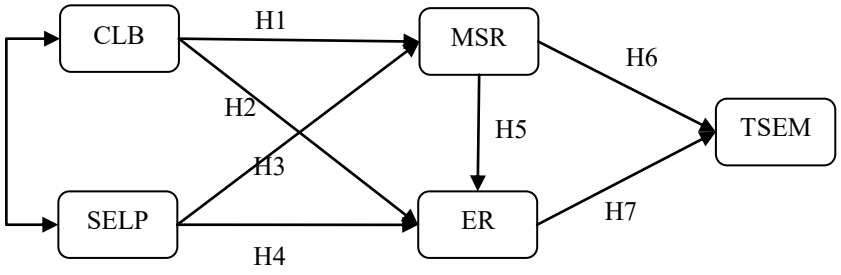

Figure 1. The proposed model.

H1: Preservice teachers' control of learning beliefs (CLB) will be a positive predictor of metacognitive self-regulation (MSR).

H2: Preservice teachers' control of learning beliefs (CLB) will be a positive predictor of effort regulation (ER).

H3: Preservice teachers' self-efficacy for learning and performance (SELP) will be a positive predictor of metacognitive self-regulation (MSR).

H4: Preservice teachers' self-efficacy for learning and performance (SELP) will be a positive predictor of effort regulation (ER).

H5: Preservice teachers' metacognitive self-regulation (MSR) will be a positive predictor of effort regulation (ER).

H6: Preservice teachers' metacognitive self-regulation (MSR) will be a positive predictor of time and study environment management (TSEM).

H7: Preservice teachers' effort regulation (ER) will be a positive predictor of time and study environment management (TSEM).

H8: The relationship between time and study environment management (TSEM) and metacognitive self-regulation (MSR) will be mediated by effort regulation (ER).

METHODOLOGY

Participants

This study comprised a total of 506 preservice teachers (345 females and 161 males), who were studying in the chemistry, biology, physics and science education departments. Participation by the preservice teachers was voluntary. The mean age of the preservice teachers was 20.27 (*SD*=.85).

Instrument

*Motivated Strategies for Learning Questionnaire (MSLQ)**:*** This is a self-reported questionnaire, developed by Pintrich et al. (1991). The MSLQ is composed of two key parts; motivation and learning strategies. There are 31 items and six subscales in the motivation part and 50 items and nine subscales in the learning strategies part. Preservice teachers rate themselves on a 7-point Likert scale. The MSLQ was translated and adapted into Turkish by Büyüköztürk, Akgün, Özkahveci, and Demirel (2004). The subscales of questionnaire are modular and can be used either in their entirety or with selected subscales according to the purpose of the study. In this study, the effort regulation (ER), control of learning beliefs (CLB), metacognitive self-regulation (MSR), self-efficacy for learning and performance (SELP), time and study environment management (TSEM) subscales were used. The reliability of the subscales and sample items are presented in Table 1.

Table 1. Sample Items and Reliability for the Subscales

Scale	Sample item	Cronbach's alpha
CLB	If I study in the appropriate way, I will be able to learn the material in this course.	.52
SELP	Considering the difficulty of this course, the teacher, and my skills, I think I will do well in this class.	.86
MSR	I try to think through a topic and decide what I am supposed to learn from it rather than just reading it over when studying for this course.	.75
TSEM	I often find that I don't spend very much time on this course because of other activities.	.61
ER	I often feel so lazy or bored when I study for this class that I quit before finishing what I planned to do.	.41

Data Analysis

The data obtained in the present study was analyzed by using both descriptive statistics and path analysis. Descriptive statistics such as mean values, standard deviations, correlation coefficients, skewness, and kurtosis values were used to investigate the preservice teachers' profiles, normal distribution of scores and relationships between variables of the study. The Pearson product-moment correlation coefficients were used to determine the relationships between variables. After the determination of relationships among the variables by correlation analyses, path analysis was used to test the predictive role of effort regulation, control of learning beliefs, metacognitive self-regulation, self-efficacy for learning and performance, and also mediational role of effort regulation and metacognitive self-regulation in time and study environment management. The proposed and alternative structural equation models based on the hypotheses were analyzed using LISREL program.

RESULTS

Correlations between the variables in the present study, together with mean, standard deviations, skewness, and kurtosis values are given in Table 2. This shows that there is a negative and insignificant relationship between the control of learning beliefs and self-efficacy for learning and performance with effort regulation, while there is a positive and significant relationship between the other variables.

Table 2. Descriptive Statistics and Bivariate Correlations between Variables of the present Study (n = 506)

Variables	1	2	3	4	5
1. CLB		.459**	.234**	-.024	.215
2. SELP			.319**	-.004	.278**
3. MSR				.269**	.510**
4. ER					.245**
5. TSEM					
Mean	21.4960	42.9921	59.8913	17.7213	38.3992
SD	3.29371	6.62159	7.62344	3.45142	5.61458
Skewness	-.671	-.484	-.480	-.146	-.242
Kurtosis	1.298	.412	.870	.484	.233

**Correlation is significant at the 0.01 level (2-tailed).

Path analysis was used to control this study's hypotheses. The fit indices are given in Table 3. When the fit indices that belong to the conceptual model were analyzed, it was understood that the model did not fit the data very well. Moreover, it indicated that the paths between the control of learning beliefs and effort regulation (Hypothesis 2 was rejected) and the ones between self-efficacy for learning and performance and effort regulation were not found to be meaningful (Hypothesis 4 was rejected). By taking these modifications into consideration, after the analyses was completed, a new model was created. The paths that did not exist in the model (non-significant paths) were excluded from the model and a new additional pathway was added to the model (from SELP to TSEM); therefore, instead of the conceptual model, an alternative model was created and this new model was tested (Fig. 2).

Table 3. The Fit Indices of Alternative Model

Model	χ^2	df	χ^2/df	RMSEA	CFI	GFI	AGFI	NFI	NNFI
Conceptual Model	14.78	2	7.39	.113	.97	.99	.91	.97	.85
Alternative Model	9.09	3	3.03	.064	.99	.99	.96	.98	.95

RMSEA: Root mean square error of approximation
CFI: Comparative fit index
GFI: Goodness-of-fit statistic
AGFI: Adjusted goodness-of-fit statistic
NFI: Normed-fit index
NNFI: Non-normed fit index

The result of the conducted path analysis indicated that the alternative model had better fit indices (Table 3). Fit indices from the alternative model (χ^2 = 9.09 (P=.028) χ^2/df=3.03 RMSEA=.064, CFI=.99, GFI=.99, AGFI=.96, NFI=.98, and NNFI=.95) were accepted to meet the criteria of acceptable fit indices. Garver and Mentzer (1999) suggested that values of NNFI, CFI, and RMSEA could be taken into consideration for acceptable fit indices. For this reason, the fit indices that are used mostly are: NNFI and CFI (>.90 indicating a good fit to data), RMSEA (<.08 indicating a good fit to data) and an addition χ^2/df statistic, which could be used as a value (χ^2/df rate is required to be less than 3) (Hoe, 2008). As a result of this, in the current study, it could be said that model shows fit to all data, as NNFI, CFI, RMSEA and χ^2/df rate had acceptable values. Standardized path coefficients (direct, indirect and total effects) are calculated for all the variables that were in the alternative model. The results of the analysis are demonstrated in Table 4. Path coefficients of alternative model are shown in Fig.2.

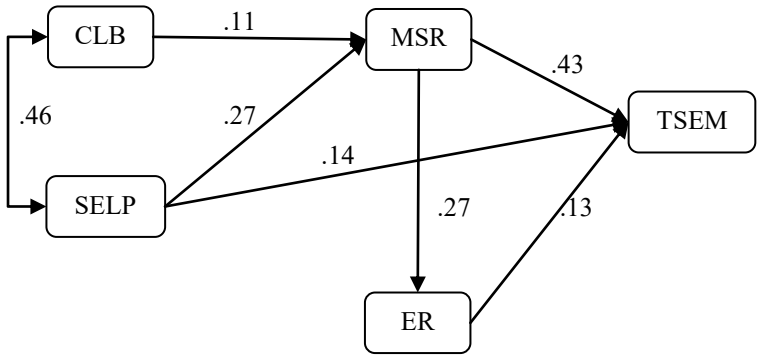

Figure 2. Path coefficients in alternative model.

As can be seen in Figure 2, there was a positive and significant correlation between the control of learning beliefs and metacognitive self-regulation. The standardized path coefficient from control of learning beliefs to metacognitive self-regulation was found to be .11 (Hypothesis 1 was accepted). There existed a positive and significant correlation between self-efficacy for learning and performance and metacognitive self-regulation (Hypothesis 3 was accepted). There was a significant and positive relationship between self-efficacy for learning and performance and time and study environment management. Also, the standardized path coefficients from self-efficacy for learning and performance to metacognitive self-regulation and to time and study environment management were found to be .27 and .14, respectively. Moreover, it was

confirmed that metacognitive self-regulation and time and study environment management correlated positively and significantly (Hypothesis 6 was accepted). It was confirmed that there was a positive and significant relationship between metacognitive self-regulation and effort regulation (Hypothesis 5 was accepted). The standardized path coefficients from metacognitive self-regulation to time and study environment management and to effort regulation were found to be .43 and .27, respectively. Finally, there existed a positive and significant relationship between time and study environment management and effort regulation, the standardized path coefficient from effort regulation to time and study environment management was found to be .13 (Hypothesis 7 was accepted). Furthermore, the covariance coefficient between self-efficacy for learning and performance and control of learning beliefs was .46.

Table 4. Standardized Direct, Indirect, and Total Effects in the Alternative Model

Variables	MSR			ER			TSEM		
	D.E.	I.E.	T.E.	D.E.	I.E.	T.E.	D.E.	I.E.	T.E.
SELP	.27	-	.27	-	.07	.07	.14	.12	.26
MSR				.27	-	.27	.43	.04	.47
CLB	.11	-	.11	-	.003	.003	-	.05	.05

D.E. : Direct Effect, I. E. : Indirect Effect, T. E. : Total Effect

In Table 4, the standardized direct, indirect and total effects' coefficients for variables found in the alternative model are presented. The results of the study indicated that self-efficacy for learning and performance has a direct effect on time and study environment management and it has also an indirect effect (β=.12). Self-efficacy for learning and performance is indirectly associated with effort regulation (β=.07). Likewise, metacognitive self-regulation has a direct effect on time and study environment management and it also has an indirect effect (β=.04) through effort regulation (Hypothesis 8 was accepted). Control of learning beliefs have a small indirect effect on time and study environment management (β=.05).

DISCUSSION

The results of the current study show that there is a significant relationship between motivational variables (CLB and SELP) and learning strategies (MSR, TSEM, and ER). This finding supports the results of studies found in the literature (Pintrich & De Groot, 1990; Yumuşak, Sungur, & Çakıroğlu, 2007; Zusho, Pintrich, & Coppola, 2003).

When path analysis is considered, the results indicate that there is a significant and positive relationship between the control of learning beliefs and metacognitive self-regulation; self-efficacy for learning and performance and metacognitive self-regulation; metacognitive self-regulation and time and study environment management; time and study environment management and effort regulation; metacognitive self-regulation and effort regulation. Likewise, the results show that metacognitive self-regulation has not only direct effect on time and study environment but also indirect effect through effort regulation. Nevertheless, there is no significant relationship between the control of learning beliefs and effort regulation; self-efficacy for learning and performance and effort regulation.

Path analysis indicate that there is a significant relationship between control of learning beliefs and metacognitive self-regulation scores (β=.11). When studies in the literature are taken into consideration, it can be seen that similar results have been obtained (Johnson, 2013; Sungur, 2007; Sungur & Tekkaya, 2006). The study conducted by Sungur (2007) shows that highly motivated learners make more effort to learn in spite of the difficulties they experience. Therefore, motivational beliefs (such as control of learning beliefs and self-efficacy for learning and performance) can explain why some learners are successful in the process of learning, whereas some others are not. Highly motivated learners can use learning strategies that facilitate learning and coding processes in a more effective way. If learners are successful in the use of learning strategies, their academic success will also be enhanced.

Another important finding in the present study is that there is a positive and significant relationship between self-efficacy beliefs and metacognitive self-regulation. This finding is similar to other studies in the literature (Dembo, 2000; Fallon, 2006; Johnson, 2013; Pintrich & Schunk, 2002; Schunk, 2001; Sungur & Tekkaya, 2006; Wu, 2006). Students who have high self-efficacy beliefs and control over learning beliefs are able to determine their learning goals, use different learning strategies, make more effort to perform any task and try out new strategies, even though the strategies they use are insufficient. Also, their determination is long lasting (Hoy, 2004). Zimmerman (2000a) claims that students with high self-efficacy beliefs do not give up easily when faced with hard tasks, they can manage their anxiety, and make better use

of self-regulation processes, such as self-monitoring, goal setting and self-evaluation.

In this study, it is maintained that metacognitive self-regulation scores predict effort regulation scores. Pintrich and De Groot (1990) assert that self-regulation, which involves metacognitive and effort management strategies, is the most effective variable in predicting performance. In those analyses where cognitive strategies and self-regulation predict academic performance the researchers suggest that cognitive strategies and academic performance are negatively correlated, even though there is a high correlation between self-regulation and cognitive strategies. Therefore, the researchers propose that cognitive strategies are not effective without self-regulatory strategies for academic achievement.

Another finding of this study is that metacognitive self-regulation scores can predict preservice teachers' time and study environment management. Eilam and Aharon (2003) state that high achievers use self-regulation strategies more than low achievers, and that they are more effective when planning and time management issues. The use of effective metacognitive strategies can be helpful when regulating and monitoring time and effort (Covington, 1985).

The results of this study also indicate that effort regulation is positively associated with time and study environment management. Similarly, in the literature, the study conducted by Johnson (2013) maintains there is a significant relationship between effort regulation and time and study environment management. In the model proposed by Pintrich (2000a), apart from the processes of cognition and motivation, self-regulation is also emphasized. In this context, both time and effort regulation is accentuated. The learner who is expected to perform a learning task monitors himself and takes various precautions in order to use individual effort effectively through planning how much time and effort s/he needs to perform that task. At the end of self-assessment, the learner can decide whether to increase, decrease or give up on help and effort. Final assessment are predictive of the performance of similar tasks (Özbay, 2008).

In addition, another finding is the relationship between self-efficacy and time and study environment management. The study conducted by Berger and Karabenick (2011) maintains that students' self-efficacy beliefs can predict use of elaboration cognitive strategies and metacognitive learning strategies and time and study environment management; however, it also indicated that self-efficacy beliefs do not predict the rehearsal and organization of cognitive strategies. In order to study within a determined schedule, self-regulating learners must be able to manage internal and external environments. These students state their intentions clearly, determine the effort they need and know who they should ask for help (Pintrich, 2004). Findings of studies by Credé and Phillips (2011) and

Fallon (2006) indicate that the time and study environment is related to effort regulation.

This study, unlike other studies found in literature, states there is no significant relationship between effort regulation and the control of learning beliefs or self-efficacy beliefs and effort regulation (Johnson, 2013; Komarraju & Nadler, 2013; Sungur & Tekkaya, 2006). For instance, the study by Komarraju and Nadler (2013) indicates that there is a relationship between effort management and self-efficacy beliefs. Moreover, it pointed to effort management partially mediating the relationship between self-efficacy and grade point average (GPA). Johnson (2013) acknowledged that learners' self-efficacy beliefs are related to effort regulation.

To conclude, metacognitive learning strategies and effort regulation have a significant and important effect on preservice teachers' time and study environment management. It is also clear that there is a direct effect of metacognitive learning strategies on time and study environment management, in addition to its indirect effect through effort regulation. Furthermore, self-efficacy beliefs have a direct effect on time and study environment management, as well as an indirect positive effect through metacognitive learning strategies.

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