The role of academic self-efficacy in improving students' metacognitive learning strategies

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Abstract

Introduction: Metacognitive strategies play an essential role in students' learning and achievement; therefore, identifying their antecedents should be considered. This study indicated how self-efficacy, as motivational beliefs, affects the meta-cognitive strategies of medical students using a SEM approach.

Method: The present study was a quantitative cross-sectional research design, using a Smart-PLS 3 approach in which 225 medical students at Shiraz University of Medical Sciences were selected, using simple random sampling. Pintrich and De Groot's (1990) students' self-efficacy for learning and performance questionnaire and metacognitive learning strategies questionnaire developed by Dowson and McInerney (2004) were used to collect data. The collected data were analyzed using SPSS 21 and PLS 3 software.

Results: The validity and reliability of research questionnaires were confirmed by confirmatory factor analysis. The results showed self-efficacy had a positive and significant relationship with planning (r=0.24, P<0.001), monitoring (r=0.30, P<0.001) and regulating (r=0.31, P<0.001). Furthermore, self-efficacy had direct, positive and statistically significant effect on metacognitive learning strategies (β=0.42, P<0.001).

Conclusion: The findings suggest students who believe they are capable to learn and to do their academic tasks are more effective in adopting meta-cognitive strategies to achieve learning objectives than students who do not maintain such optimistic beliefs. Therefore, it is recommended that the officials of Shiraz University of Medical Sciences provide opportunities for strengthening the students' self-efficacy and metacognitive learning strategies through providing training courses. In these courses students should be explicitly instructed how a specific learning strategy is adopted, why it is important and when and how it applies to the specific task.

Keywords: Self-efficacy, Meta cognition, Medical students

Introduction

In recent years, much attention has been devoted to self-regulated learning, especially to meta-cognitive learning strategies (1, 2), and much research is under way (3). Scholars believe that self-regulated learning is an important and essential element of student academic achievement (4). In this regard, several definitions of self-regulated learning are presented in the literature (5-7).

Some defined self-regulation as the process of controlling, monitoring, and reflecting on learning

the crucial factors in improving the quality of education and subsequently promoting learning (6, 8, 9). Self-regulated learners are capable of determining their study goals, evaluating their performance, and persisting longer in the face of challenges that unavoidably arise and influence their learning (5, 6). Metacognitive learning strategies are among the most crucial components of self-regulated learning (4) which enable the learners to plan, monitor and regulate their cognition (4). Metacognition refers to "an individual's knowledge about his/her own cognitive processes"(10). Today, educational psychologists believe that metacognition has an essential role in successful learning (11). In other words, metacognitive learning strategies help the students to correct and control their behaviors (12), solve problem, act more strategically in learning (10), and consequently have high-quality learning and enhance their academic achievement (2, 7, 12-17).

Nevertheless, Pintrich and Degroot (1990) argued that metacognitive strategies were not enough to increase the students' academic achievement; the student should also be motivated to utilize strategies (7). That is why self-regulated learning include behavioral and motivational elements besides cognitive and metacognitive components (5, 7) . In this regard, Pintrich and Dgroot (1990) point out that students' motivational orientations and beliefs regarding learning and performance are related to cognitive engagement and academic performance (7). Therefore, if students do not maintain enough motivation to adopt their metacognitive learning strategies, these strategies do not carry out significant functions (7). Indeed, motivational beliefs are highly related to the quality and level of the learners' metacognitive strategies (7, 18, 19). Zimmerman emphasized the importance and necessity of self-efficacy as a motivational belief for developing metacognitive strategies (5, 16). Self-efficacious students retain positive

views of the learning strategies they use, so they utilize those strategies (4). Various researches have shown that self-efficacy and metacognitive learning strategies are positively correlated (7, 18-21). Cheung (2015) found that the students' self-efficacy and their deep learning strategies, like metacognition, are correlated positively (22). According to Sangur and Caherman (2011), students with more self-efficacy are more willing to adopt metacognitive strategies, and self-efficacy has a positive relationship with metacognitive strategies (19). Similarly, Tembo and Ngwira conducted a research on undergraduate medical students and found that shallow and deep learning strategies are positively predicted by self-efficacy (18). Pajares (2002) argued that higher self-efficacy is associated with more use of metacognitive strategies (20). As noted, the literature review showed that some studies had focused on the association between self-efficacy and metacognition. However, few studies have looked at how self-efficacy beliefs may positively affect metacognitive learning strategies application. Furthermore, little research has been done in the context of medical education, especially in the context of Iran. This is a deficiency in the extant literature addressed by our study. Our model examined the unique relationships between the students' self-efficacy, and perceptions of using metacognitive learning strategies among medical students, using structural equation modeling. The research conceptual model is displayed in Figure 1.

Methods

This is a quantitative cross-sectional research design in which 225 medical students at Shiraz University of Medical Sciences were selected using simple random sampling. The data were collected using two questionnaires. The first questionnaire comprises the students' self-efficacy for learning and performance adopted from the motivated strategies for learning
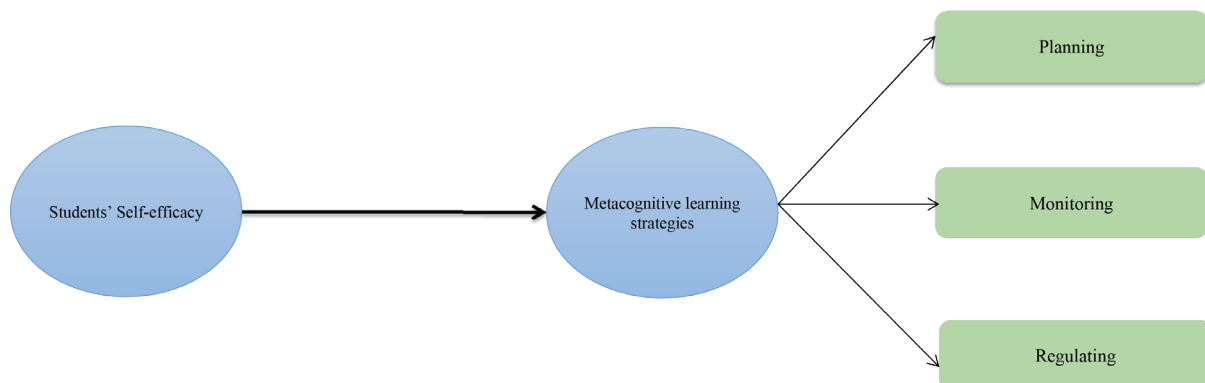

Figure 1: Research conceptual model

questionnaire (MSLQ)(7). It is a self-report questionnaire on the perceived competence and confidence in performance of class work (7). This scale consists of eight items that are measured through a 5-point Likert scale, which is widely employed in more recent studies (14, 18). The reliability of this scale was acceptable.

The second scale was the metacognitive learning strategies questionnaire that consists of three dimensions (Planning, Monitoring, Regulating) with 14 items (23). These items were scored on a five-point Likert scale and its reliability was acceptable.

The inclusion criteria were medical students at Shiraz University of Medical Sciences and willingness to participate in the study. Also, exclusion criteria included incomplete response to the questionnaires and lack of willingness to participate in the study.

Ethical considerations: After explaining the goals of the study, informed consent was obtained. The questionnaires were anonymous and the participants were convinced that their information would remain confidential and would be published totally. The Ethics Committee of Shiraz University of Medical Sciences approved the project to be done.

SPSS 21 was used to calculate the mean, standard deviation, and correlation coefficients between variables and the Smart-PLS version 3.0 was applied to test the reliability and the validity and to calculate path coefficients between variables. PLS-SEM focuses on two processes including the measurement model and the structural model (24). PLS indices in both measurement model and structural model are displayed in Table 1.

Results

The mean and standard deviation of self-efficacy were found to be 2.72±0.926 and the mean and standard deviation of metacognitive strategies and planning, monitoring, and regulating as the components were 2.94±0.578, 2.88±0.984, 3.03±0.500, and 2.93±0.712, respectively.

The measurement model

The measurement model was evaluated with regard to internal consistency reliability, convergent validity, and discriminant validity. Internal consistency reliability was assessed through composite reliability (CR) and Cronbach's alpha (α) scores. The CR and α of 0.7 or greater was considered acceptable (25). The findings showed that the α and CR scores of research constructs surpassed the suggested criterion of 0.7, suggesting appropriateness of the scales applied in the current study (Table 2).

Afterwards, to confirm the convergent validity of the constructs, the factor loadings and average variance extracted (AVE) were evaluated. Item loadings that were bigger than 0.7 were considered to be adequate (25). According to the findings (Table 1), all items displayed loadings surpassing 0.7 with acceptable AVE, varying from 0.58 to 0.78. The findings also showed satisfactory discriminant validity because all the square roots of AVE were bigger than the inter-construct correlations (25). Therefore, all research constructs showed an acceptable validity and reliability and both of them were confirmed.

According to the first order confirmatory factor analysis, all items were loaded on their respective constructs and no items were removed from the final analysis. Hence, descriptive analyses and correlation matrix were firstly presented and then the main hypothesis of the research was analyzed.

Moreover, the results of Pearson correlation indicated that self-efficacy positively and significantly influenced planning, monitoring, and regulating as metacognitive learning strategies components (P<0.001) (Table 3).

The structural model

To examine the hypothesized relationship between self-efficacy and metacognitive strategies, the structural model assessment was implemented (Figures 2 and 3). To determine to what extent the data support the assumed associations in the research model, the path coefficients and coefficient of determination were applied (26). Moreover, the researchers made use of path-analysis of bootstrapping to discover whether the path coefficients for the assumed associations are significant or not.

The calculated path coefficients are shown

Table 1: PLS indices in both measurement and structural models

	Index	P
Measurement model	α	>0.70
	CR	>0.70
	AVE	>0.50
Structural model	GOF	>0.25
	Q^2	>0.02
	f^2	>0.02

Table 2: Factor loadings, α, CR, and AVE (n=225)

Construct	Items	Loadings	α	CR	AVE	Convergent validity
Self-efficacy	s1	0.91	0.95	0.96	0.77	Yes
	s2	0.89				
	s3	0.84				
	s4	0.94				
	s5	0.66				
	s6	0.93				
	s7	0.85				
	s8	0.93				
Planning	q1	0.95	0.93	0.95	0.78	Yes
	q2	0.85				
	q3	0.93				
	q4	0.77				
	q5	0.90				
Monitoring	q6	0.87	0.80	0.87	0.62	Yes
	q7	0.80				
	q8	0.77				
	q9	0.71				
Regulating	q10	0.76	0.82	0.88	0.58	Yes
	q11	0.73				
	q12	0.71				
	q13	0.81				
	q14	0.80				

α=Cronbach's alpha (α>0.70), CR=composite reliability (CR>0.70); AVE=average variance extracted (AVE>0.50)

Table 3: Association between self-efficacy and metacognitive strategies

	Mean±SD.	1	2	3	4	5
Self-efficacy (1)	2.72±0.926	1				
Metacognitive strategies (2)	2.94±0.578	0.36**	1			
Planning (3)	2.88±0.984	0.24**	0.85**	1		
Monitoring (4)	3.03±0.500	0.30**	0.64**	0.41**	1	
Regulating (5)	2.93±0.712	0.31**	0.72**	0.34**	0.32**	1

**P<0.001

in Figure 2. According to the obtained results, the research hypothesis was supported and self-efficacy showed a direct and positive effect on metacognitive strategies (β=0.42). To specify the significance of the hypothesized relationship, we carried out a bootstrap resampling procedure (27). Based on the t-test statistics (Figure 3), self-efficacy showed a direct, positive and statistically significant effect on metacognitive strategies (P<0.001).

The R^2 of the latent endogenous variables as a goodness-of-fit index was utilized to calculate the usefulness of the research model. According to the findings, self-efficacy can explain 17.7% of the variance of metacognitive strategies. Hair et al. (26) suggest that, in addition to the basic parameters, researchers should report on the predictive relevance (Q^2) and effect size (f^2). According to Fornell and Cha (1994), a Q^2 larger than zero indicates that the research model has a predictive relevance, whereas Q^2 lesser than zero implies the model is lacking predictive relevance.

Based on the Smart PLS 3.0 results, the obtained cross-validated redundancy was found to be 0.10 for metacognitive strategies. According to Chin (1998) f^2 values of 0.35, 0.15 and 0.02 reveal large, medium and small effect, respectively (28). According to the findings, self-efficacy exerted a medium to large effect (0.22) on metacognitive strategies at the structural level.

Discussion

The present research was conducted among medical students of Shiraz University of Medical Sciences with the aim of examining the association between self-efficacy and metacognitive strategies. Foremost, to verify the validity and reliability of the research tools, researchers employed a first-order confirmatory factor analysis which documented that the tools employed in the current research were reliable and valid and all items were loaded into their respective constructs.
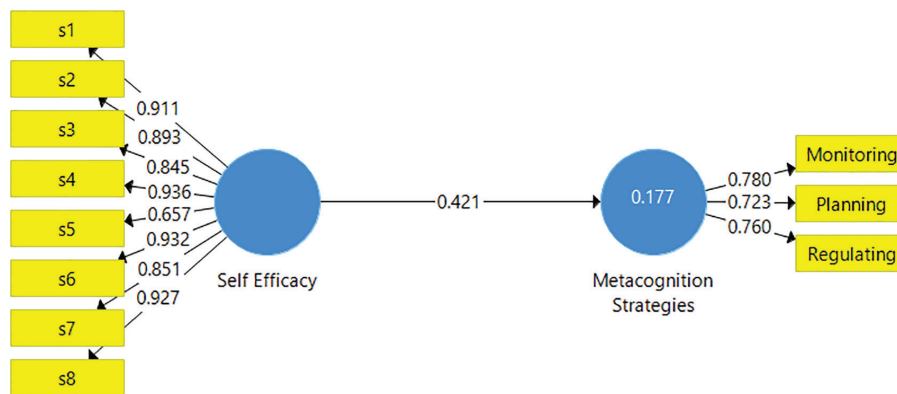
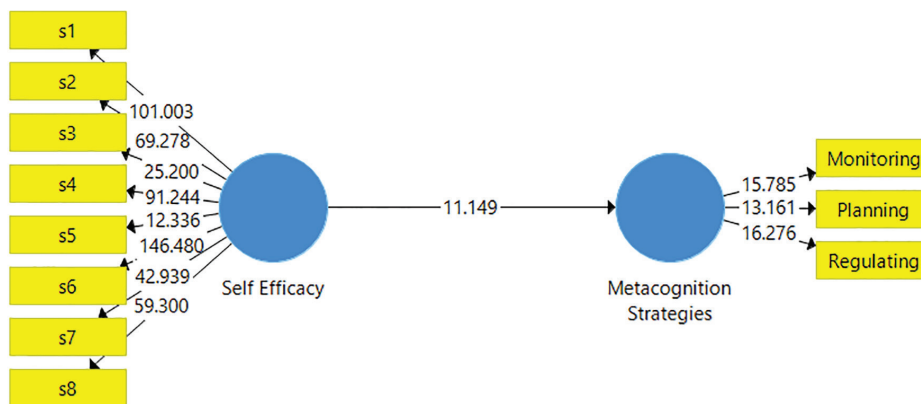**Figure 2:** PLS-Path Analysis of Beta Value

Figure 3: PLS-path Analysis of t-values (n=225)

The results of Pearson correlation showed that self-efficacy held a positive and significant relationship with planning, monitoring, and regulating as metacognitive strategies components. Moreover, the findings suggested that self-efficacy significantly and positively predicted metacognitive strategies which support the findings of previous research (18-20, 29-31). Obviously, self-efficacy beliefs impact the students' thoughts and behavior and affect the amount of effort and perseverance they have for learning. It can be stated that students who possess more self-efficacy beliefs are more effective in adopting meta-cognitive strategies. According to Perry and Vandekamp, students who believe they can carry out their own academic assignments are more likely to implement cognitive and metacognitive strategies to achieve their learning objectives (32). Published studies have demonstrated that the students who possess superior self-efficacy take advantage of more metacognitive strategies compared to those with limited self-efficacy (33) and the level of the students' engagement in cognitive and metacognitive strategies is affected by their level of self-efficacy (20). In other words, a strong sense of self-efficacy increases the individuals'

motivation, well-being and accomplishment (34).

It is well-established that the students who demonstrate self-efficacy are more inclined to use metacognitive skills in fulfilling their duties than others (35), which, in turn, enhances the quality of their performance. The more self-efficacious the students are , the more they will possess better learning habits including cognitive engagement, more profound cognitive processing, perseverance in experiencing academic problems, carrying out challenging assignments, and utilizing self-regulating strategies (33). It can be declared that students who possess a more profound understanding of self-efficacy are more successful in handling university-related tasks and more effectively adopt learning strategies (6, 16). Bandura and Wood (1989) showed that self-efficacy affects the performance directly and indirectly via its influences on analytical strategies which illustrate that the association between self-efficacy and performance can be mediated via metacognition (36).

In another research, Coutinho (2007) documented that self-efficacy can be predicted by metacognition and the association between metacognition and performance can be completely mediated via self-efficacy. He argued that

students who maintained good metacognitive strategies retained a deeply held belief in their abilities to favorably carry out their tasks (29). Furthermore, Ghonsooly et al. (2014) revealed that there was a positive and significant association between self-efficacy and metacognition (30). Landine and Stewart (1998) found that there was a positive association among the utilization of metacognition, self-efficacy and motivation (31). Put differently, students who employ more metacognitive strategies naturally keep more intrinsic motivation and more self-efficacy, which, in turn, leads to academic success. Nasri et al. (2014) in their research showed that self-efficacy correlated with meta-cognitive strategies of students and can explain 25% of the variance of meta-cognitive strategies, that is, students with high self-efficacy levels choose deep and complex meta-cognitive strategies and are more successful in their problem-solving abilities and skills than their counterparts (37) @G,¹C. In other words, it can be said that the students who feel self-efficacious are more likely to adopt deep learning (18) and meta-cognitive strategies which can naturally lead to improvement in their academic performance (19). Put differently, self-efficacy beliefs through increased commitment, effort, and more perseverance lead to superior performance (38). According to Zimmerman (1990), students' self-efficacy reinforces the routine learning strategies needed to succeed and influences the motivation and consequently the academic success (39).

Limitations

Firstly, in this research, we adopted a cross-sectional approach to examine the casual relationships which could merely explain a phenomenon at a period of time. Therefore, it is recommended that a longitudinal study should be conducted which will provide a more profound understanding of the phenomenon. Secondly, researchers merely used a questionnaire for data collection and, clearly, self-expressed data tend to have a potential bias. Thirdly, the findings of this research may not reflect the views of students studying in other universities in Iran. Therefore, the generalizability of our results may be limited to students who studied at Shiraz University of Medical Sciences.

Implications

It is recommended that the officials of Shiraz University of Medical Sciences should hold training courses for the students. In this way, we can enhance the students' self-efficacy and strengthen their metacognitive strategies and

skills. In these programs, students should be explicitly instructed about how the strategy is adopted, why it is important and when and how it applies to the specific tasks. Additionally, for the instruction to be more fruitful, teachers should be adequately prepared in strategy instruction and assessment. In order for the students to properly employ metacognitive strategies, they should no longer apply teacher-centered education because they need to be free to develop their own learning strategies. It is advisable to provide a challenging and supportive environment for college students to collaborate with professors who utilize teacher-centered methods like lectures in the classroom less. Moreover, students should be informed to know not only what strategies to use, but also when and how to employ them. Put differently, students should be assisted to learn quicker, easier and adopt metacognitive strategies into their activities and tasks more effectively.

Conclusion

The findings of this study highlighted the significance and the unique role of the students' self-efficacy on metacognitive learning strategies. Based on literature and learning theories, we can conclude that students who maintain effective metacognitive learning skills are more successful than their counterparts. In other words, these students are talented to properly monitor, plan, manage, and regulate their academic performance. Hence, students must have faith in their academic abilities to display brilliant performance. This naturally implies that improving the students' self-efficacy beliefs may undoubtedly lead to more application of these metacognitive learning strategies.

Acknowledgment

Conflict of Interest: None declared.

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