

Effect of Metacognitive Skills Training on Metacognitive Awareness, Self-Efficacy and Academic Achievement of University Students

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Abstract

Aims: Metacognition deals with active monitoring and adjusting the results and cognitive processes to gain the purpose. Academic self-efficacy is dependent on students' perception of learning and is an important factor in the success of students reasoning. This study aimed to determine the effectiveness of metacognitive skills training on metacognitive awareness, self-efficacy and academic achievement in university students.

Materials & Methods: This semi-experimental study with a pretest-posttest controlled approach was conducted in all students of Kashan University of Medical Sciences in 2014. 50 participants were selected by cluster sampling and were randomly divided into 2 intervention and control groups. Metacognitive awareness of reading strategies inventory (MARSI) and General Self-efficacy Scale were used for data gathering. Data were analyzed using ANCOVA test.

Findings: There were significant difference between the score of the pretest and posttest of the intervention group in both self-efficacy and metacognition awareness. In addition, there were significant differences between posttest scores of intervention and control groups in self-efficacy ($p < 0.001$; $F = 42.46$) and cognitive awareness ($p < 0.001$; $F = 190.99$), but there was no significant difference ($p = 0.072$; $F = 3.39$) in academic achievement between the intervention and control groups' posttest scores.

Conclusion: Metacognitive training affects metacognitive awareness and self-efficacy but it is not founded for academic achievement.

Keywords

Metacognitive Awarenesses [<https://www.ncbi.nlm.nih.gov/mesh/2009719>];
Self Efficacy [<https://www.ncbi.nlm.nih.gov/mesh/68020377>];
Educational Status [<https://www.ncbi.nlm.nih.gov/mesh/68004522>];
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Introduction

Academic achievement is a success in education that can lead to gain some skills in a particular specialty [1]. Using metacognitive strategies is useful to succeed in learning. Researches that have been done about metacognition are persuasive evidences to encourage the use of metacognition in learning and teaching process. "Metacognition" term refers to cognitive skills; processes and strategies that are used to supervise and correct individual learning [2], and is individual awareness of thinking processes and also the ability to manage cognitive processes and self-cognition [3]; in the other words, it would be awareness of the framework of own knowledge, organizing and planning, using problem solving strategies and ability in self-assessment and self-correction.

Flavell, as one of the pioneers in metacognition researches, defines it as "the person knowledge of her own cognitive processes". Also In his point of view, metacognition deals with active monitoring and adjusting the results and cognitive processes to gain the purpose [4]. Studies have shown that metacognition includes a high potential to increase student learning in different domains [5-7]. People who are involved in cognitive activities have better performance, which according to Bandera who believed experiences have effect on self-efficacy, is an essential factor in strengthening people's self-efficacy. Bandera believed that self-efficacy is person's belief about her abilities that effect on the individual performance in the learning environment [8]. Self-efficacy beliefs determine how people feel, think, motivate in themselves and behave. Expectations of self-efficacy would be effective in actual performance, emotions, behavior and, ultimately the amount of effort spent on an activity [9,10].

Pantrich explored that students' successful experiences predict their self-efficacy beliefs [11]. Academic self-efficacy is dependent on students' perception of learning [12] and is an important factor in the success of students reasoning [13]. Laitenberger *et al.* believe that individual self-efficacy plays a key role in the inhibition or stability of his behavior in various situations [14]. Karademas & Kalantzi-Azizi has reported that if students believe they

can learn with reasonable effort, they would try more and persist to face with problems [15]. They also focused on the problem and they feel relaxed and happier and use strategies that are more effective. Self-efficacy is one of the most important components to achieve success and adjustment and it is placed in the area of positive psychology [16]. Self-efficacy affects different aspects of learning behavior, e.g. activity selection, effort, and persistence in learning and progress [17-20]. Education systems can increase students' self-efficacy in different ways. One of the most important ways to develop self-efficacy is training techniques based on the principles and methods of metacognition [21].

Most researchers believe that cognitive skills play an important role in types of cognitive tasks, including verbal exchange of information, better comprehension of reading, motivation, verbal comprehension, writing, language learning, perceptions, attention, memory, problem solving, and social cognition [21]. In a meta-analysis about the factors affecting student learning, Goh has shown that among the effective factors in learning, cognitive and metacognitive processes have the most important impact on student learning [22]. In general, Metacognitive skills play an important role in different cognitive activities, e.g. exchanging information as verbal, verbal persuasion, perception and concepts of content, the need for reading, writing, attention, perception, memory, learning, problem solving, social cognition and various forms of self-study and self-control [23]. Many experts believe that any reforms in educational system need to consider the findings of the metacognitive studies and using them in educational planning.

According to Maltby *et al.*, metacognitive training is done in order to help students to organize their thinking patterns, social behavior, self-assessment, oral practices, self-learning, self-direction, self-awareness and self-reinforcing [24]. The use of metacognition compels people to try more and use learning strategies to process deeply problems, as a result leads to better performance, and increases self-efficacy. Those who have high self-efficacy and motivation, use metacognitive activities in order to learn and improve their performance [25]. Pellas found

out that with controlling previous progress, personal self-efficacy and learning objectives are independent predictors of using learning strategies. He also has reported that with controlling previous progress, self-efficacy would be independent predictor of academic achievement [26]. Niemiec *et al.* has shown that self-concept and academic self-efficacy variables have predictive strength in academic achievement in groups of Mathematics and Humanities in girls, and whatever their attitude about themselves is deeper and feel to have better and stronger efficacy they will have more prominent academic achievement [27]. Eccles *et al.* have shown that metacognitive strategies significantly are effective in successful task completion and academic achievement of students [28]. Fouladchang *et al.*, have shown that a successful education performance is dependent on cognitive skills training and the students who received cognitive training are able to read and understand more than the others [29].

Accordingly and based on the role of teachers in using metacognition, Maleki examined the impact of cognitive and metacognitive strategies to increase learning in different subjects. His study led to the conclusion that teaching cognitive and metacognitive strategies in nearly all the cases have significant effect on learning enhancement and increase reminding and teachers should try teaching these strategies [30], which has been shown in other similar studies [31, 32]. Therefore, focusing on development goals, engaging in cognitive activities and using strategies would increase academic achievement [33].

Many studies have shown that self-efficacy and goal orientation is associated with the use of learning strategies. These studies have shown that there is a positive relationship between self-efficacy and cognitive strategies [19, 34-36] and students who have self-efficacy especially high academic self-efficacy in comparison with the students, who have low academic self-efficacy, use more cognitive and metacognitive strategies. Various studies have shown different results about the relationship between academic self-efficacy and selection of personal goals in learning and academic affairs. Self-efficacy and its perceived usefulness directly and through self-

regulation learning affect academic achievement [26]. Zaharakar *et al.*, have explained that self-efficacy in students who received problem-solving skills, is more than students who do not receive training in problem solving [37] and Kharrazi has shown that metacognitive strategies are effective in one's self-efficacy [38].

Considering the importance of concepts such as metacognitive awareness and self-efficacy in students' academic achievement, this study aimed to determine the effectiveness of metacognitive skills training on metacognitive awareness, self-efficacy and academic achievement in university students.

Materials & Methods

This semi-experimental study with a pretest-posttest controlled approach was conducted in all students of Kashan University of Medical Sciences in 2014. The sample size was estimated as 44 students by Cohen's formula ($\alpha=0.05$; $\beta=0.9$; $d=0.34$) and 50 participants were selected by cluster sampling among male and female students and were randomly divided into 2 groups; 25 in the intervention group and 25 in the control group.

2 instruments were used for data gathering:

Metacognitive Awareness of Reading Strategies Inventory (MARSII): that was developed by Richard & Mokhtari [39] measures students' metacognitive awareness of reading strategies in 3 scales; general reading strategies (13 items), problem-solving strategies (8 items) and strategies to support the study (9 items). All responses are based on a 5-item Likert scale. The validity of the Persian version has been confirmed by specialists and experts in this field and its reliability has determined 0.89 by Cronbach's alpha coefficient [40].

General Self-efficacy Scale: has developed by Sherer and has 17 items. Sherer & Maddux believed that this scale measures 3 aspects of behavior; the desire to start behavior, the desire to expand the effort to complete the task and be different to cope with obstacles [41]. The reliability and validity of the Persian version of the scale has been confirmed in Iran. Cronbach's alpha coefficient was used to evaluate the reliability which was 0.83 [42].

After obtaining informed consent, participants were asked to complete the data gathering instruments. Then the experimental group

was trained for 8 sessions of metacognition training for 2 hours based on the Fogarty theory [43, 44] (Figure 1), while the control group took part in psychology sessions with public issues except metacognitive awareness. At the end of the eighth session, participants in both groups answered the instruments again. Academic achievement was measured with the average scores of students.

Figure 1) The content of 8 sessions of the experimental group training [43]

Session 1	An overview of Meta-cognitive skills training, Develop a plan before approaching a learning task, such as reading for comprehension or solving a math problem
Session 2	Monitor their understanding; use "fix-up" strategies when meaning breaks down
Session 3	Evaluate their thinking after completing the task
Session 4	Teach learners to use mnemonics to recall steps in a process
Session 5	Teach learners the importance of using organizers such as KWL charts, Venn diagrams, concept maps, and anticipation/reaction charts to sort information and help them learn and understand content
Session 6	use a Venn diagram to identify similarities and differences between two related concepts
Session 7	use a Venn diagram to identify similarities and differences between two related concepts
Session 8	Model pre-writing strategies for organizing thoughts, such as brainstorming ideas using a word web, or using a graphic organizer to put ideas into paragraphs, with the main idea at the top and the supporting details below it

Data obtained before and after the intervention from both groups were analyzed using descriptive (the measure of central tendency) and ANCOVA, by SPSS 22 software.

Findings

The average age of participants was 20.7±2.4 (ranged from 18 to 24) years and 29 of them (58.0%) were females (14 in intervention group and 15 in control group).

There were significant difference between the score of the pretest and posttest of the intervention group in both self-efficacy and metacognition awareness. In addition, there were significant differences between posttest scores of intervention and control groups in

self-efficacy ($p < 0.001$; $F = 42.46$) and cognitive awareness ($p < 0.001$; $F = 190.99$), but there was no significant difference ($p = 0.072$; $F = 3.39$) in academic achievement between the intervention and control groups' posttest scores (Figure 2).

Figure 2) Comparison of the mean of pretest and posttest scores of intervention and control groups

Parameters	Pre-test	Post-test	p Value (ANCOVA)
Self-efficacy			
intervention	31.08±10.92	45.96±13.71	$p > 0.05$
Control	29.24±10.61	29.80±11.02	$p > 0.05$
p Value (ANCOVA)	$p > 0.05$	$p < 0.0001$	-
Metacognition awareness			
Intervention	68.68±18.79	99.16±25.17	$p > 0.05$
Control	70.60±15.21	72.12±14.53	$p > 0.05$
p Value (ANCOVA)	$p > 0.05$	$p < 0.0001$	-
Academic achievement			
Intervention	15.52±2.00	15.88±1.79	$p > 0.05$
Control	14.60±1.91	14.86±1.53	$p > 0.05$
p Value (ANCOVA)	$p > 0.05$	$p = 0.072$	-

Discussion

This research aimed to examine the effect of metacognitive trainings on metacognitive awareness, self-efficacy and academic achievement in students. The results showed that cognitive skills training improve and increase students' cognitive awareness and self-efficacy, but the difference in academic achievement scores in the intervention group was not significant than the control group.

Considering the short time of the study that was for 8 sessions and since these skills require more practices to master them, it seems that for the effectiveness of cognitive skills on students' academic achievement are needed for future researches that groups follow up in longer courses. The results are similar to studies that show metacognitive skills training affect metacognitive awareness and self-efficacy. Saeid & Mehrabi have shown that cognitive strategies and metacognitive strategies training have been effective to strengthen strategies, increase the scores of self-directed learning and self-efficacy and they caused to improve them [45]. Yusef-Zadeh *et al.*, have shown that self-efficacy in students who have received training of metacognitive skills is more than students who have not experienced the training [21]. In the study by Hejazi & Salari who examined the role of

cognitive components in academic achievement, their findings showed that metacognitive components (knowledge about the person, task, and strategy) are important variables in academic achievement [46]. Kajbaf *et al.* believe that the use of high-level cognitive strategies with high academic self-efficacy predicts 32% of academic achievement changes [47]. Studies show that self-efficacy and motivation affect learning, improvement and academic achievement [48-51].

Kramaski *et al.*, studied the effect of metacognitive training (one-dimensional and multidimensional metacognition training) on understanding and solving math problems. The results showed that the students who were trained multidimensional metacognition significantly had better ability to solve and understand math problems than those who were trained one-dimensional metacognition. Also those who were trained one-dimensional metacognition were significantly more able to solve and understand math problems than the control group who were not trained none of these training courses [52]. Swanson believes that metacognition is an acquisitive issue and it can be taught to teachers. He concluded in his study that metacognitive skills are independent processes from people talents and students with low talents had higher metacognitive aspects than students with high talents [53]. Therefore, it can be helpful to teach cognitive skills to students and teachers and improve students' academic achievement and self-efficacy. Using of metacognition compels people to try more and use learning strategies that lead to deeper processing of issues, and thus lead to better performance. Those who have high self-efficacy, use cognitive activities in order to learn and improve their performance [54]. In addition, Metacognitive awareness make a sense of self-confidence in a person that consequently the person feels himself as a capable learner and it strengthens his motivation [25, 55].

The limitations of this study include the lack of follow-up for a long time. Therefore, studies with long term follow ups are suggested in future studies. In addition, more researches on other populations, such as non-medical and paramedical students are recommended.

Conclusion

Metacognitive training affects metacognitive awareness and self-efficacy but it is not founded for academic achievement.

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