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The effect of cognitive and metacognitive strategies in academic achievement: A systematic review

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Abstract

The existence of different researches on the relationship between learning strategies and academic achievement indicates the positive and efficient influence of these strategies on the learning process. The present study was conducted using the systematic review method, and with the aim of investigating the effect of cognitive and metacognitive strategies on academic achievement. The population of the present study is available studies related to the effects of cognitive and metacognitive strategies on academic achievement in Iran and abroad. The period of investigation of internal articles was from 2004 to 2014, and the period of the investigation of articles published in other countries was from 2000 to 2014. The results of different research indicated that learning strategies such as cognitive and metacognitive strategies have had the most effects on academic achievement of school and university students in different courses. In general, it can be said that learning strategies, from each type (cognitive and metacognitive) in all studies (experimental, quasi-experimental, relational or correlational), in all learners (females and males) are very effective on the degree of their learning in different courses (experimental sciences, mathematics, and English Language).

Keywords: Systematic review, learning strategies, cognitive and metacognitive strategies, academic achievement.

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1. Introduction

Human achievements in all fields of science have increased the significance of training learning strategies. Main point in training is that learners be taught to how to learn, how to memorize, and how to solve problems. Learners should know the most effective methods and strategies of learning. Researchers in their studies on students have reached these conclusions that a lot of learning problems and transferring them to students are due to the lack of learning skills in them. Learning strategies covers cognitive and metacognitive strategies and help learners for achieving their desired learning aims. Oxford defines learning strategies as a set of specific activities done by a learner for easier, more rapid, more joyful, more effective, and more transferable to new situations. The application of cognitive and metacognitive strategies is very important in facilitating learning, reminding, and memorizing processes. Cognitive and metacognitive strategies have the most powerful effects on learners' learning, and there is a positive and significant relationship between learning methods and academic achievement in universities and schools (Saied and Mehrabi, 2013; Yang, 2005).

Flavell (2000) considers metacognition as a type of knowledge or cognitive knowledge whose subject is an aspect of cognitive measures and regulating them. In other words, he believes that this concept is metacognition because its main sense is re-identification of cognition. In fact, it can be said that if cognition refers to perception, processing, retaining, and transferring information, metacognition is an activity which covers the actions related to four mentioned elements and control them (Aghazadeh, 2011). Experimentally, it has been indicated that metacognition is related with studying, learning, critical thinking, solving problems and decision making and all these cases are necessary for educational successes (Scheifer and Dull, 2009).

During conducted research, different methods of learning and thinking or cognitive and metacognitive strategies indicated these strategies are learnable, i.e. teachers can independently and along with other courses, teach these learning strategies to their students and after teaching, students can voluntarily use these strategies and this measure has positive effects on learning and achievement (Saif, 1997).

Weinstein and Hume (1998) as cited in Saif (1997) have stated that teachers can help their students via teaching learning and studying skills (cognitive and metacognitive strategies) to be more successful learners and have more active roles in their academic fortunes. Flavell (1979) as cited in Saif (1997) investigated cognitive and metacognitive strategies and stated that learners apply all cognitive strategies to achieve their successes and use metacognitive strategies to have control over those successes and achievements. In addition, other studies indicated that there is a correlation between learning strategies and academic achievement (Karami, 2002). By training cognitive and metacognitive strategies, the increase in learners' learning and enhance their motivational beliefs towards training one can be assisted and their academic achievement can be provided (Beckman, 2002). Shouse, Chen and Hsieh (2007) emphasized the significance of preparing the educational system compatible with learning methods of students in schools. If educational material is compatible with students' cognitive styles, they will access better achievements and motivation. Another study indicated that using cognitive learning strategies can be effective on learning and academic achievement of learners (Meec, 1998). Training learning strategies can have positive effects on academic achievement (Fardi Yazdi, 2005). The issue of inability in appropriately acquiring and learning has extraordinarily attracted some of the educational research as well as experts and researchers of education in some school students and university students in recent years. Therefore, to access the mentioned objectives, better understanding of learnable issues is considered as one of the important educational objectives and activities. Therefore, the present study tries to investigate the effects of cognitive and metacognitive strategies on academic achievement in school and university students via a systematic review.

2. Methodology

In the present study, the method of systematic review of literature was used. The population of the present study is available studies related to the effects of cognitive and metacognitive strategies on academic achievement in Iran and abroad. The period of investigation of internal articles was from 2004 to 2014, and the period of the investigation of articles published in other countries was from 2000 to 2014. Accordingly, the population includes all articles published in research journals indexed in databases of SID, Irandoc, Magiran, and Noormags in Iran, as well as those journals published at the international level indexed in databases of Science Direct, Elsevier, Google Scholar such as American Psychologies, Pythagoras journal, journal of instructional pedagogies, International Education Journal, Journal of Behavioral Development. These journals used different correlational, causal-comparative, experimental and quasi-experimental research methods and designs to investigate the effects of cognitive and metacognitive learning strategies on the indicator of academic achievement. For primary investigations, firstly valid key words were determined based on literature review for using them in searching primary studies. Key words included learning strategy, cognitive and metacognitive strategy, self-regulated learning, academic achievement, learning strategies, academic success, etc.

3. Result

The objective of the present study was to investigate the effect of cognitive and metacognitive strategies on students' academic achievement in Iran and other countries using a systematic review of literature. Table 1 and 2 indicate the results obtained from different articles about the effect of cognitive and metacognitive strategies on students' academic achievement. In this table, author(s) and the year of publication, countries or cities in which each study has been conducted, research method and design, population, and at last final conclusions are reported.

Table 1. Internal studies (in Iran)

Row	Author(s)/year	Country/city	Research type	Research method/design	Population	Final conclusion
1	Maroofi et al. 2014	Iran/Sanandaj	Primary	Quasi-experimental	girls in fifth grade in elementary schools	Teaching cognitive and metacognitive strategies has been effective on the academic achievement of girls in fifth grade in elementary schools.
2	Karami et al. 2013	Iran/Tehran	Primary	Experimental (pretest/posttest)	Boys in third grade of secondary schools	By teaching cognitive and metacognitive strategies, creativity, motivation, success, and academic Self-concept improve.
3	Salehi et al. 2013	Iran/Isfahan	Primary	Correlational	Nursing students	The results indicated that nursing students use cognitive strategies of "mental repetition and rehearsal", semantic expansion more than others. In addition, they use cases such as organizing, critical thinking at moderate levels for studying and learning Internal Surgery Courses.
4	Rasoli	Iran/Tehran	Primary	Correlational/p	BA students	Metacognition have direct effects on the

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	Khorshidi et al. 2014			math analysis		cognitive strategies, surface strategies, resources management and academic achievement. Metacognition has the most effects on achievement.
5	Teymour Fard 2012	Iran/Kohgiluyeh and Buyerahmad	Primary	Multiple regression	Male and female high school students	IQ has more than metacognition in predicting academic achievement. In addition, students with higher IT skills have more academic achievement than others do.
6	Ganji et al. 2012	Iran/Khorramabad	Primary	Correlational	Female high school students	There is a correlation of motivational believes and cognitive learning styles with students' academic achievement. And motivational believes and cognitive learning styles can predict variations related to academic achievement.
7	Atar Khameneh et al. 2009	Iran/Tehran	Primary	Experimental (pretest/posttest)	Female high school students	The results of the test after 10 sessions of training indicated that teaching learning strategies and metacognitive studies have had positive effects on students.
8	Seraji et al. 2009	Iran/Dezful	Primary	Experimental (pretest/posttest)	Female and male secondary school students	Metacognitive training are effective on improving academic performance in mathematics of female and male students and it shows that gender has no significant effects in the academic performance of students in mathematics.
9	Parviz 2011	Iran/Gilan Gharb City and its villages	Primary	Correlational	High school students	Using cognitive and metacognitive strategies are effective on academic achievement and also the place of residence (city or village) are effective in using these strategies in such a way that urban students use both strategies.
10	AbaBaaf 2008	Tehran, Khorasan, Ilam, Isfahan, Khuzestan	Primary	Descriptive	Female and male high school students	Competent students use more of metacognitive strategies than incompetent ones regarding simple and complex homework. Students of mathematics, humanities, experimental sciences, and professional-technical fields, they use differently from cognitive strategies. But, in using metacognitive strategies, they act similarly.

Row	Author(s)/ year	Country /city	Research type	Research method/design	Population	Final conclusion
1	Magogwe 2013	South Africa/Botswana	Primary	Survey/qualitative	BA students	For improving their English as the second language, students used high level skills of reading and cognitive strategies. But, there was no high different

						among them in terms of the type of skill. Students who reported their skills as high were guide by metacognitive strategies more than those who reported using this skill at low levels due to using management and supervision on reading and regulating objectives. This strategy was more effective than writing tests.
2	Zhang et al 2013	China	Primary	Survey/qualitative	School students	For learning English as a second language, students used metacognitive strategies and there was a significant difference between students who used these strategies and those who did not use them. The first group had significant achievement in their English.
3	Eluemuno and Azuka 2013	Nigeria	Primary	Experimental (pretest/posttest)	High school students	The results indicated that training cognitive and metacognitive strategies has positive effects in academic achievement of students and using these strategies have been effective in students' academic achievement particularly their English.
4	Peng 2012	China	Primary	Experimental (pretest/posttest)	Male and female MB university students	The results indicated that cognitive strategies had the most effects on students' scores. Cognitive strategies, self-regulation, and anxiety of exams are the most important indicators which were effective on the improvement of performance of

						students for being successful in English courses.
5	Toit et al 2009	South Africa	Primary	Survey research	Grade 11 students and math teachers	Teachers and students in the process of teaching and learning math used metacognitive strategies and the degree of students' satisfaction with math courses was much more than before the time they had not used them. In addition, teachers used these strategies and their satisfaction with students' achievement in math courses was high.
6	Lee, 2008	South Korea	Primary	Correlational	BA students	The results indicated that self-regulative learning strategies are effective on the learners' stratification with the educational system and on their academic performance. Learners of learner-centered environments enjoyed more from self-regulative learning strategies than those in content- or teacher-centered environments.
7	Dignath, et al 2008	Germany/France	Review	Meta-analysis	30 primary articles	Training programs or strategies of self-regulative strategies has the most effects even on the academic achievement of primary school students. Analyzing after testing indicated the effects of some moderate variables such as studying and training characteristics. Regarding factors related to the content of treatment, the effect of theoretical literature regarding intervention domains

						were experimented. In addition, cognitive and metacognitive strategies or the trained motivation and teamwork as training methods were used. They had the most effects on students' academic achievement.
8	Berthold et al 2007	Germany/France	Primary	Experimental	Students of psychology	The results of the research indicated that cognitive strategies by themselves and in combination with metacognitive strategies had the most effects on promoting and accessing success in learning.
9	Mohd Kosnin 2007	Malaysia	Primary	Survey study	BA students of engineering	The results indicated that self-regulative learning strategies are effective on students' academic achievement and the results of MSLQ indicated that in students who have had high academic achievement, used more from metacognitive strategies and students who have had lower achievement, did not use these strategies. In addition, self-efficacy in them was lower, but internal valuation, exam anxiety and motivational believes were high in them.
10	Phakiti 2006	Australia/Sydney	Primary	Correlational	Male and female university students	The results indicated that there is a significant and positive correlation between using cognitive strategies (repetition and rehearsal) and metacognitive (organizing, planning and supervising) in

learning English among students nonnative of English language and their academic achievement.

Table 2. International studies in other countries

4. Discussion and conclusion

In the present study, a systematic review of literature with the aim of determining the learning strategies (cognitive-metacognitive) on academic achievement. Learning strategies have a significance role in explaining the variance of academic achievement. The results of the present study indicated that the two cognitive and metacognitive strategies need each other, and in order that academic performance can be maximized, the two strategies should be applied. In addition, the results indicated that without having dominance over cognitive strategies, using metacognitive strategies has low effects (Mesrabadi, Erfani & Adab, 2014). The results of the different studies indicate that both cognitive and metacognitive strategies are highly effective on academic success and achievement. The results of the research conducted by Maroofi (2014) and Karami (2013) indicated that cognitive and metacognitive strategies are the most effects on academic achievement in students for the courses of experimental sciences, and students who use these strategies have been mostly much more successful than those who do not use them. In addition, the results of the research of Salehi (2013) indicated that nursing students use strategies of repetition and rehearsal and semantic expansion more than strategies of organizing and critical thinking. It can be said that because these methods cause the activation of readers and cause them to mentally process information actively, learning enhances. Training cognitive strategies for example mental rehearsal firstly help students to select the points which are important and worthy to be reminded. Secondly, it is highly probable that the important points find their ways into memory and consequently be processed and studied (Sifert, 1991). The findings of the research done by Magogwe (2013), Zhang (2013) and Eluemuno (2013) indicate that cognitive and metacognitive strategies are significant for training students' English and academic achievement in this course. Metacognitive strategies are very constructive for attaining success in learning and academic achievement and this issue is due to metacognitive strategies are considered in learning process as one of the important cognitive action, and their roles are to increase students' abilities in realizing their potentials. Henk and Graaff (2004) believe that in metacognitive strategies, learners are trained with self-regulation, understanding learning subjects, and the sense of knowing. The self-regulating learner identifies his aims himself and when he is deviated from accessing these aims, manages learning actively. Research done by Peng (2012) and Lee (2008) indicated that cognitive and self-regulative strategies are effective on students' satisfaction with educational system and their academic performance. Regarding the results of different studies, it can be observed that cognitive and metacognitive strategies have high positive effects on students' academic achievement. It is recommended that cognitive and metacognitive strategies concurrently be considered as the priorities of curricula in schools and educational institutes.

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