Psychology Research, ISSN 2159-5542
October 2011, Vol. 1, No. 4, 244-250

The Effect of Instructing Cognitive and Metacognitive Strategies on the Academic Progress of Ilam Medical University Students

Amir Abdolhosseini
Payame-Noor University, Tehran, Iran

Sattar Keikhavani
Medical Sciences of Ilam University, Ilam, Iran

Kourosh Mohammadi Hasel
Tehran University, Tehran, Iran

This study reviewed the effect of instructing cognitive and metacognitive strategies on the academic progress of Medical Sciences of Ilam University students. The research is quasi-experimental including a pre-test and a post-test. The population of the research includes the students of Medical Sciences of Ilam University. The sample includes 120 students selected using multi-stage random sampling method from four majors of nursing, occupational health, family health and medicine. All the participants had passed at least two semesters. The participants participated in six cognitive and metacognitive strategies classes held by the researcher. The data were analyzed using descriptive and inferential statistical methods (independent and dependent *t*-tests) and variance analysis using SPSS (statistical package for the social sciences) (version 13) software. The results showed that instructing cognitive and metacognitive strategies positively affected students' academic progress and proved to be an effective learning method. The average of GPAs (general point averages) of experimental and control groups were significantly different. Instructing the strategies was significantly different across majors and genders.

Keywords: cognitive strategies, metacognition, students, medical sciences

Introduction

Once it was held that learning ability of any person was a function of his/her intelligence and aptitude, but recently, many psychologists believe that despite of the significant role of innate factors like intelligence and aptitude, other non-intrinsic factors play important roles as well. One of the important factors is learning strategies, i.e., cognitive and metacognitive strategies which have caused great developments in educational psychology in the recent years. Cognitive strategies are defined as behaviors, thoughts or actions used by the learner in the process of learning, aiming at learning, organizing and storing knowledge and skills and easy future exploitation of them (Weinstein & Hume, 1998). Metacognition is our knowledge about our own cognitive processes and how to optimally use them to achieve learning objectives (Biehler & Snowman, 1993). Metacognitive strategies are used for selecting suitable methods intelligently and supervising on their efficacy and correction of errors and, if required, changing strategies and replacing them with new ones (Good & Brophy, 1995; as cited in Maleki, 2005).

A review of the literature on cognitive and metacognitive strategies showed that the use of the strategies improves learning process (Bechman, 2002; as cited in Maleki, 2005). The effect is especially noticeable for

Amir Abdolhosseini, Department of Psychology, Payame-Noor University.
Sattar Keikhavani, Medical Sciences of Ilam University.
Kourosh Mohammadi Hasel, Ph.D. candidate, Tehran University.

learners suffering from learning problems.

Scragges and Mastrapieri (1992), Miller and Mercer (1993), Biehler and Snowman (1993), Weinstein and Hume (1998), Ebrahimi Ghavamabadi (1998), Ebabof (1996) and Saif and Mesrabadi (2003) all showed the positive effects of instruction of cognitive strategies on students' learning. Hall (1999), Bulgren, Hock Schumaker, and Deshler (1995), Anderson (2002), Graham (1997), Motavali (1997), Ababaf (1996), Evanesian (1998), Saif and Mesrabadi (2003) all emphasized the efficacy of instruction of cognitive and metacognitive strategies on learning process.

Samadi (1995), Pintrich and DeGroot (1990) and Ekhtiari and Ardakani (1998) have shown differences between two genders in terms of cognitive and metacognitive strategies. Anderman and Young (1994) and Alborzi and Samani (1999) pointed out that males and females are similar in terms of using cognitive and metacognitive strategies. Randhawa (1991) found that females and males are different, with males surpassing females in problem-solving. Literature showed that recently gender-dependent dissimilarities have decreased due to social changes, socialization stages, changes in cultural cortexes and creation of equal opportunities for both genders (Lefrancois, 1996; as cited in Samadi, 2002).

A review of the literature shows that instruction of cognitive and metacognitive strategies can be effective in improving learning. However, previous studies mostly have emphasized the effects of such strategies on psychological variables or different course subjects and students. The researcher aimed at answering the following questions: How instruction of strategies affects academic progress? Is instruction of such strategies different in terms of major? Are the two genders different in learning the strategies?

The main objective of the present research is studying the effect of instructing cognitive and metacognitive instruction on the academic progress of the Medical Sciences of Ilam University students.

Methodology

The population of the present research included all the students of Medical Sciences of Ilam University in the academic year of 2008-2009.

Participation

The sample of the research included 120 students selected using multi-stage sampling method. The students were from four majors of nursing, occupational health, family health and medicine who had passed at least two semesters, all being admitted in 2007. Four classes were randomly selected including good, fair and weak students.

The quasi-experimental research was done in the natural environment and the groups were formed naturally prior to the experiment. The independent variable was instruction of cognitive and metacognitive strategies that was applied to the experimental groups in six sessions, according to a predetermined schedule.

Cognitive strategies included:

(1) Repetition and revision strategies (repetitious reading and writing, repetition of key words with loud voice, reproduction of contents, using mnemonics for simple contents, underlining and marking contents, glossing, emphasizing important parts and copying hard contents);

(2) Semantic extension strategies (using mediums, mental visualization, placement, key words, acronyms for simple contents and comparison, summarizing in one's own language, teaching contents to others, explaining and analyzing of hard contents);

(3) Organizing strategies (classification of information, hierarchical relations for simple contents, listing titles and chapters, converting texts to diagrams and figures, using trees for summarizing main thoughts and using flow charts for explaining complex production processes for complex contents).

Metacognitive strategies included:

(1) Planning strategies (determining study target, predicting the time necessary for studying and learning, determining studying pace, analyzing how to deal with learning topics and studying time and selection of cognitive strategies);

(2) Control and supervision strategies (advanced evaluation, supervision on self-attention, making questions during studying and learning processes, controlling time and pace and predicting examination items);

(3) Ordering strategies (justifying study and learning pace, amending or changing cognitive strategies).

Dependent variable was academic progress evaluated in pre-test and post-test based on the average GPA (general point averages) of participants in two semesters. *T*-test was used for comparing the averages of male and female groups and independent *t*-test and variance analysis were used for comparing the averages of different majors.

Results

The results are shown in Tables 1 to 6.

Table 1

Sample Size as per Gender

Sex	Quantity	Percentage (%)
Female	80	66.7
Male	40	33.3
Sum	120	100

Table 2

*Average and SD of Students' GAP*s *as per Major (Pre-test)*

Groups	Quantity	Average	Std. deviation
Nursing	29	14.01	1.38
Medicine	29	15.39	1.01
Occupational health	34	14.28	1.2
Family health	28	15.79	0.8
Sum	120	---	---

Table 3

Average and SD of Students' GPAs as Per Major (Post-test)

Groups	Quantity	Average	Std. deviation
Nursing	29	15.26	0.98
Medicine	29	15.90	1.07
Occupational health	34	16.27	2.1
Family health	28	16.45	1.04
Sum	120	15.98	1.49

Hypothesis 1: Instructing cognitive and metacognitive strategies affects students' academic progresses (see Table 4).

Hypothesis 2: Instructing cognitive and metacognitive strategies has different effects on males and females (see Table 5).

Hypothesis 3: Instructing cognitive and metacognitive strategies has different effects on different majors (see Table 6).

Table 4

A Comparison of Pre-test and Post-test GPA Averages

Group	Quantity	Average	Std. deviation	Degree of freedom	*T*-test	Sig.	*A*
Pre- and post- test	120	1.14	1.33	119	9.34	0.000	0.05

Table 5

Independent T-test for Comparing GPA Averages of Male and Female Students

Group	Quantity	Average	Std. deviation	Degree of freedom	*T*-test	Sig.	*A*
Female	80	16.27	1.43	118	3.15	0.02	0.05
Male	40	15.39	1.45				

Table 6

The Investigation of Variance Analysis Comparing Pre-test and Post-test GPA Averages in Different Majors

Group	Degree of freedom	Average of squares	Sum of squares	*F*	Sig.	*A*
Inter-group	3	8.09	3.7	2.043	0.011	0.05
Intra-group	116	2.08	3.6			
Sum	119	265.5				

Discussion and Conclusions

Wainstan and Hume (1998) claimed that teachers can help their students to succeed in learning and play a more significant role in their academic life by instructing cognitive and metacognitive skills to them.

Hypothesis 1: Instructing Cognitive and Metacognitive Strategies Affects Students' Academic Progresses

The results of independent *t*-test (see Table 4) show that t is significant ($t = 9.34$) ($p < 0.05$) rendering hypothesis reliability percentage 95%. It is proved that instructing cognitive and metacognitive strategies can result in academic progress. In other words, the students instructed cognitive and metacognitive strategies had better GPAs in comparison with others. This finding conforms to the findings of other researchers.

Shaghaghi (2003) in his Ph.D. thesis titled "The Effect of Instructing Learning Strategies Skills on Payame Noor University Students" concluded that academic progress of experimental groups improved due to instruction of study and learning strategies.

Palinscar and Brown (1984) instructed learning skills to first grade secondary students and found that learning level and transfer level were improved after instruction of the skills.

Tamadoni (2003) in her research titled "The Effect of Instruction of Cognitive and Metacognitive Strategies on Technical High School Students' Academic Progress and Learning" found that instructing cognitive and metacognitive strategies can result in academic progress.

Garner (1990), Tobias and Everson (1998), Scot and Oka (1986), Cross, and Paris (1998), Motavali (1997), Ebrahimi Ghavamabadi (1998), Karami (2002), Ansari (2001), Abdollahpour (2003), and Bshavrd (2000) have confirmed the significant relationship between cognitive and metacognitive strategies on the one hand and academic progress on the other hand.

The results of this research and other similar ones in terms of the first hypothesis proved that having resources and studying them are not sufficient for academic success and progress. How to use the resources, studying method, how to memorize contents and learning method are also important. Successful students have obtained the strategies and used them optimally. It is important that such strategies can be instructed. Any person including weak students can economize their learning though learning the strategies and doing exercises in employing them can improve the quality of their theoretical and practical knowledge and skills in different situations by exact, deep and significant studying. The strategies can be cognitive, i.e., related to manner of learning and transferring them from short-term memory to long-term memory (memory processes), categorized as repetition and revision strategies, semantic expansion and organization. Any of the strategies has specific guidelines for simple and complex assignments. The strategies may be metacognitive i.e., related to one's understanding of one's own, assignment and suitable strategies (metacognitive or cognitive), yielding a vast understanding, helping the person in different situations and offering suitable solutions in different situations. In principle, it is found that people with high metacognition are usually successful, surpassing others in comprehension, problem-solving, reading, memorization, motivation and academic progress. Thus, if the students learn cognitive and metacognitive strategies and use them effectively, they can achieve progress in learning and doing assignments.

Hypothesis 2: Instructing Cognitive and Metacognitive Strategies Has Different Effects on Males and Females

Independent *t*-test results (see Tables 4 and 5) show that the difference between males and female is significant ($p < 0.05$). Thus, gender affects academic progress and the hypothesis is confirmed. The finding does not conform to the findings of some of the previous researchers. Derakhshan (2003), Niazi (2004), Bshavrd (2000), Anderman and Young (1994) and Alborzi and Samani (1999) found males and female are similar in using cognitive and metacognitive strategies. Some other studies, such as Samadi (1995), Pinteich and DeGroot (1990) and Ekhtiari and Ardakani (1998) have shown that the two genders are different in using cognitive and metacognitive strategies. Randhawa (1991) not only found the two genders different, but also discovered that males surpass females in problem-solving category. The literature showed that recently gender differences in using the strategies have decreased due to social changes, stage of socialization, changes in cultural textures and creation of equal opportunities for both sexes (Lefrancois, 1996; as cited in Samadi, 2002).

Since the present research was done on university students, it should be studied if the sexual differences are due to academic competition and care or other intervening factors. Further research may illuminate the findings. In the present research, the GPA average of females was higher than that of males.

Hypothesis 3: Instructing Cognitive and Metacognitive Strategies Has Different Effects on Different Majors

Variance analysis test ($F = 3.89$, $p < 0.05$) shows that the differences of GPA averages are significant and the hypothesis is confirmed.

The findings showed that cognitive and metacognitive strategies are activated during learning and instructing process. If one does not know how to analyze one's responses or fails to allocate enough time or does not want to know whether one has obtained enough knowledge on a specific topic, any learning assignment seems to be a new one. Although many of the strategies are learnt implicitly, direct instruction of cognitive and metacognitive strategies are very important in academic progress.

Cognition and metacognition of the teacher are also important. Since the part of metacogntiition is one's cogitation of one's own assignment, in terms of the teacher, the assignment relates to the teacher's cognition of students, academic situation and curriculum contents. Thus, it is better: First, the official teacher of the class who is aware of the course contents and the specifications of the receivers instructs strategies; Second, the teacher should try to improve his/her own cognitive and metacognitive capacities and then teach them to the students; Third, the teacher should employ studying and learning strategies in his/her teaching methodology. Otherwise, instructing strategies through lecture may not be so effective and the students shall resist against it as they do against obligatory course contents and they just learn them theoretically and answer the related questions but will not use the strategies in practice.

However, the research shows that instructing cognitive and metacognitive strategies can improve students' academic progresses.

References

Ababaf, Z. (1996). A comparison of learning strategies in weak high school students at districts 2, 4 and 11 of Tehran (Master's thesis, Tabatabai University).

Abdollahpour, M. A. (2003), Relationship between cognitive styles (field dependent, field independent), learning strategies (cognitive and metacognitive) and academic achievement of first grade state high school students of the area 6 of Tehran (Master's thesis, Teacher Training University).

Alborzi, Sh., & Samani, S. (1999). A comparison of self-esteem of male and female guidance school students in Shiraz brightness centers, human and social sciences. *Journal of Shiraz University, 14*(2).

Anderson, N. J. (2002).*The role of metacagnition in second language teaching and learning.* Brigham Young University Eric Digest.

Anderman, E. M., & Young, A. J. (1994). Motivation and strategy use in science: Individual difference and classroom effect. *Journal of Research in Science Teaching, 31,* 811-831.

Ansari, M. (2001). The effects of metacognitive strategies on the level of academic achievement and self-control of students in the first year high school biology lessons at the 19th district of Tehran (Master's thesis, Allameh Tabatabaei University).

Asemian, F. (2004). Relationship between cognitive styles and self-regulating learning and academic progress factors of 2nd grade secondary students of Tabriz city (Master's thesis, University of Tabriz).

Avanesian, E. (1998). *The role of metacognition on comprehension strategies, training, supervision.* M. A.: University of Allameh Tabatabai.

Bechman, P. (2002). *Strategy instruction.* Eric Digest.

Biehler, & Snowman, J. (1993). *Psychology applied to teaching*. Houghton: Mifflin.

Bulgren, J., Hock, M. F., Schumaker, J. B., & Deshler, D. D. (1995).The effects of instruction in a paired associates strategy on the information mastery performance of students with learning disabilities. *Learning Disabilities Research and Practice, 19*(1), 22-37.

Bshavrd, S. (2000). Cognitive strategies and metacognition training impact on performance problems: The problem (Master's thesis, Tehran University).

Cross, D. R., & Paris, S. G. (1998). Developmental and instructional analysis of children's meta-cognition and reading comprehension . *Journal of Educational Psychology, 80*(2), 131-142.

Derakhshan, N. (2003). A comparison of learning strategies of successful and unsuccessful pre-university male and female students of Mianeh (Master's thesis, University of Tabriz).

Ebrahimi Ghavamabadi, S. (1998). The effect of three educational methods of learning and mutual education strategies (Direct and cyclic illustration on reading comprehension, problem solving, metacognitive knowledge of educational self-concept and learning speed in tehran female second-grade guidance school students having the average below 15). (Doctoral dissertation Allameh tabatabaii University).

Ekhtiari, & Ardakani, F. (1998). An investigation into the effect of the teaching of meta-cognitive strategies on motivation and the performance of math problem solving of shiraz five-grade elementary school students (Master's Thesis, Shiraze University).

Flavel, J. H. (1988). *Cognitive development* (F. F. Maher, Trans.). Tehran: Rosh Publication.

Fouladchange, M. (1996). The role of metacognitive processes in problem solving performance (Master's thesis, Shiraz University).

Glavr, J., Ronting, R., & Bronding, R. (1998). *Cognitive psychology for educators* (Alinaghi Kharrazi, Trans.). Tehran: Pre-university Center.

Good, T., & Brophy, J. (1995). *Contemporary educational psychology* (5th ed.). New York: Harper Collins.

Graham, S. (1997).Telecommunications and the future of cities :Debunking the myths.cities,14(1),21-29.

Hall, R. (1999). The organization and development of discursive practices for "having a theory". *Discourse Processes, 27*(2), 187-218.

Karami, A. (2002). Developing a tool for assessing learning strategies and studying the relationship between the strategies and academic progress of Tehran high school students (Doctoral dissertation, Allameh Tabatabaei University).

Lefrancios, G. R. (1996).*The life span* (5th ed.). Belmost USA:Wadsworth Publishing CO..

Maleki, B. (2005). Effect of instructing cognitive and metacognitive strategies on development of course contents learning and memorization. *New Cognitive Findings, 3*.

Miller, S. P., & Mercer. C. D. (1993). Using a graduated word problem sequence to promote problem-solving skill, learning. *Disability Research and Practice, 8*(3), 174-196.

Niazi, E. (2004). The effect of cognitive strategy training on academic achievement of fifth grade elementary students with learning disabilities in written expression (Master's thesis, University of Teacher Education).

Scott, G. P., & Oka, E. R. (1986). Children's reading strategies, metacognition and motivation. *Developmental Review, 6,* 25-56.

Palinscar, A. S., & Brown, A. L. (1984). Reeciprocal teaching and comprehension monitoring actives. *Cognition and Instruction, 2,* 117-175.

Pintrich, P. R., & DeGroot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology, 82,* 32-40.

Rahimpour, B. S. (2001). The role of metacognitive knowledge elements in solving mathematical problems (Master's thesis, Shiraz University).

Randhawa, B. S. (1991). Gender differences in academic achievement: A closer look at mathematics. *The Albert Journal of Educational Research, 37*(3), 241-257.

Reforse, M., Lille, L., & Dufabo, L. (1993). *Learning strategies and memorization* (K. Alinaghi, Trans.). Ghatreh Publication, Tehran.

Saif, A. A. (2001). *Educational psychology* (5th ed.). Tehran: Agah Publication.

Saif, A. A., & Mesrabadi, J. (2003). Efficacy of instructing learning strategies on the speed of reading memorization and comprehension of different texts. *Journal of Education, 19*(2), 54-37.

Samadi, M. (1995). Metacognition and mathematical problem solving in students: The role of gender and academic performance. *New Cognition Findings, 4*(3), 42-49.

Scraggs, T. E., & Mastrapieri, M. A. (1992). Classroom application of mnemonic: Acquision, maintenance and generalization. *Exceptional Children, 58*(3), 219-229.

Solso, R. L. (1998). *Cognitive psychology* (F. Maher, Trans.). Tehran: Roshd publication.

Shaghaghi, F. (2003). Effect of learning and studying strategies on learning of Payame Noor University students (Doctoral dissertation, Allameh Tabatabaei University).

Tamadoni, F. (2004). Effects of cognitive strategy training in learning and academic achievement technical high school students of Sabzevar (Master's thesis, Islamic Azad University, Central Tehran Campus).

Taheri Khorasani, P. (1999). The relationship of self-regulated strategies and academic progress in literature and mathematics courses in a sample of 1st grade students of the area 2 Shiraz high schools (Master's thesis, Shiraz University).

Tobias, S., & Everson, H. T. (1998, April). Research on the assessment of metacognitive knowledge monitoring. Paper presented at a *Symposium on "Metacognition: Assessment and Training" at the Annual Convention of the American Educational Research Association*. San Diego, C. A..

Vali Mohammadi, M. (2002). The relationship between goal orientation and test anxiety strategies in the second year male and female students in Tehran (Master's thesis, University of Al-Zahra (SA)).

Weinstein, C. E, & Hume, L. M. (1998). Study strategies for lifelong learning. Washington, D.C.: American Psychology Association.