Meta-cognitive learning strategies: The effect of training strategies on memorizing, comprehension and the speed of reading

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1.   Introduction

Learning subjects is the main aim of education. The increasing advancement of science has resulted in the learning to become remarkable. As the necessity of the effective learning is to use strategies which help the learner to store the information longer (Farmihani, & Farahani, 1999). Learning strategies help the students to handle different situations of learning more effectively so that they can obtain, store and apply the new knowledge (Wolteres, 2004). Meta cognition is defined as the "thinking about thinking" or "knowing about knowing". Meta cognition can include different shapes; knowledge about when and where to use specific strategies to solve a problem (Shamrock, 2008). The term Meta cognition refers to our knowledge about our own cognitive processes and manner to use them optimally to achieve our learning objectives (Seyf, 2007). In Liee's (2008) studies about learning strategies. He concluded that auto regulation learning strategies influenced the learners' satisfaction from education system and their academic performance. Also, Anderson (2002) reported the effect of auto regulation learning strategies and motivation strategies for learning on the learners' academic success. In a research, entitled the role of Meta cognition in education and learning, Bruce et al (2007), concluded that the application of teaching Meta cognitive skills in second language is highly appreciated. A motivation strategy for learning is the most cognitive knowledge and strategies in reading and its education makes the reading comprehension easy for student. Nijoes, Segers and Giyselers (2008), showed that Meta cognition strategies create deep processing of learning in different environments. Based on Goh's (2008) research, teachers are necessary to spread their student's Meta cognition and teach them how to use the effective

strategies for different activities. Regarding the interaction of cognitive and motivation factors, the researches show a linear relationship among the motivation factors (self-efficacy and internal value) and auto regulation components (cognitive and metacognitive strategies and resource management), meaning the rate of using meta cognitive strategies increases with the increased feeling of self-efficacy and internal value in students. In fact, the type of student's motivation beliefs influences the learning rate and use of Meta cognitive strategies significantly. Hong et al (2009) reported a significant positive correlation among the motivation dimension, cognitive abilities and accuracy level of self-assessment. The findings showed that self-assessment accuracy has a strong relationship with the level of academic performance. Using Meta cognitive strategies depends on the manner the students are assessed by. Lee (2008) showed that diagnosis and abstract experiences play important role in Meta memory judgment. Lane and Skoog (2003), showed that interest in study field and external motivation, has the strongest relationship with Meta cognitive strategies.

In Coas et al (2004), study it was found out that successful learning in educational environments under the control of language learner based of computer depends on their Meta cognition is of positive motivation factors. In Marcheschiet al (2000), Meta cognition education is considered to be infective in learning language when they are incompatible with students' capacity. Naimieet al (2010), the teaching methods must be proportional with learners' strategies. To help students to organize they believe one of the most outstanding features of meta cognitive skills is that it problems individual's awareness about the current of thoughts and application of their contemplation and helps to generalize the learnt materials in natural situations to solve the problems more effectively. More and press (2001) showed if helped to review his role as an active learner and assess his learning level, he can increase transfer and supervision skill in himself. Yaghobkhani (2010) the more successful students use Meta cognitive and cognitive learning strategies with the girls using these strategies more than boys. Also, metacognitive strategies are more effective in academic success than cognitive ones. Shirley and Larkin (2000), concluded that metacognition does not grow with age, but social environment, teacher's drills, the nature of cognitive problem and emotional states influences the person's Meta cognition. Lee,(2008)In a research, the effects of educating cognitive and meta cognitive strategies on meta problem solving in students with learning problems were studied. Catty and Kriss et al (2001), reported a significant and positive relationship between class scores and Meta cognition and positive propensity in students. Alevenet al (2006),other researchers concluded that the presence of a smart educational system which is based on Meta cognition abilities can help them to be more successful students. Sone (2010), Meta cognition control is a necessary process which must be paid attention to Ranglee (2008) another research showed that the Meta cognitive learning strategies in different environments can create deep learning processing. Nes, Midelton(2012) Auto reglation learning is a conceptual model which can be applied to design Meta

cognitive learning strategies for disabled students. The results show that this strategy can be effective in more preparation for class, assignment, scores and teacher's perception from student's activities in math classes. Dong et al (2010), the result of ore search showed that effective language learning is related to Meta cognitive learning strategies. Haedek and Song (2001), researched the effect of Meta cognitive strategies education and control resource on the learning of extension. The results showed an interactive relationship between the type of educating Meta cognitive strategies and that of control resource (internal and external).Iwai(2011)in a research   about metacognitive strategies of reading students use, the results showed that teachers teach Meta cognitive strategies of reading to students separately. Ersozlu (2010) in another research, the learning and study strategies are shared in all sections but there were some differences in organizational and emotional strategies.

In a research in Iran, the researchers concluded that successful students use Meta cognitive strategies in their language learning (Gerami,Madani, 2011). These strategies are considered to be a tool to activity and self-assessment is of great importance (Lavasani, Faryadres, 2011). The results of surveying Meta cognitive strategies (listening) showed that students were different in awareness of Meta cognitive strategies of listening. In addition, students differ in terms of personal knowledge and translation (Rahimi, Katal, 2011). Marandi and Mokhtarnia (2010) in another research, there was seen a direct positive and significant relationship between familiarity with computer and Meta cognitive awareness of general strategies of reading e-texts, Rozomjod and saderi (2009), found a significant relationship between multiple intelligence and learning vocabulary. In addition the results showed that Meta cognitive strategies, memory and social strategies had a significant relationship with grounds of multiple intelligence.

Aghazadeh (1998), showed that if the individual could have awareness of cognitive process and what passes in his mind, he can have the most favorite form of information transfer. Abdoos (2001), showed that educating Meta cognitive strategies leads to increase creativity.In addition, there is a relationship between Meta cognitive skills and creativity. Ghorchian (1999), showed that applying Metacognitive strategies in class room brings about the ground of scientific engagement emotional joy, constructiveness, creativity and social self-responsibility and increases self-confidence. Hashemi and Hemati (2008), comparing application of motivational, attitude, time management, emotional peace, and concentration, information processing among successful and unsuccessful students concluded that there is a significant relationship between these students in using the skills and successful students used the learning strategies more than unsuccessful ones. Comprehension and reading speed can be predicted by eye movements (Skoog, 2003)

2. Methodology

a) Sample population: the sample population consisted of all first grade girl students in academic year of 2011 in high schools of zone 1 and 2, respectively.

b) Sampling: In this research, all the samples of research were 60students, 5 of them were not interested in participating in cognitive group. There was transferred to another school and 2 migrated strategy training group. Therefore, the sample reduced to 50, 25 in cognitive and 25 in control group. The multi stage cluster sampling was used. Research procedure this is a semi-experimental research in which there is no possibility of simultaneous. The Random selection and control and can control some internal validity criteria [Delavar, 1995].the most common semi experimental research is pretest and posttest plan with control group (without random selection).

1) Pretest of reading speed, memorization and comprehension.

Measurement tools

1) Chronometer: A big clock was used in the class to measure the reading speed.

2) The course content of test; 8 course texts the pretest and posttest of which had been prepared from the Persian literature and biology of the high school first grade (code A) and (code B) respectively with differ nature were chosen. Two of each for course contents was easy and difficult, respectively, for Persian literature and biology, with 30 questions for each text had 30 questions, 15of which measured memorization questions and 15 comprehensions questions. The criterion of ease or difficulty of test was:

a) Information from experienced teachers and experts based on the course structure and - academic performance
- polling from students other than sample group

Scoring: each test had 30 questions from the textbook, with 15 scores for memorization and 15 for comprehension

Test validity; the table of characteristics of test plan was used to make assured of content validity along with the opinions of experts to make sure of validity of content. The experts believed that the questions represented the content and aims of research.

Reliability of test: the reliability of a measurement tool is dependent on the stability degree which the tool measure the subject with (Razavi. et al,1960)For validity of

the test, bisection method and kuder-Richardson test were used. MesrAbadi and other the validity of the questionnaire in 2001 and 2014, respectively, as reported in (table 1).

Table 1: reliability coefficient of

Researcher	Difficult biology	Easy biology	Difficult literature	Easy literature
MesrAbadi 2001	0.97	0.95	0.95	0.94
2014	0.81	0.89	0.82	0.81

Execution method: first, pretest was done for two groups. The students read the texts and recorded the time spend. Then, the students answered 30 questions of 4 choices extracted from the texts to transfer their memorization and comprehension. This general trend of testing was used in both stages of testing (pretest-posttest). In each stage of measurement, 4 testes were given to subjects (pretest and posttest). After completion of pretests, the cognitive underwent a training program in 14 sessions of 45minutes each and the control group received training about learning strategies and reading speed. The cognitive learning strategies included (review, expansion, organization and ordering) and reading speed included (reading aloud, lip reading, silent reading and eye reading). The both groups were tested after the completion of training.

Table 2: Teaching Meta cognitive learning strategies

. 1-Diterminig the aim of stady

Planning strategies	Survalance and control strategies	Organizing strategies
2-Prediching reawrid time for stady 3-Determining stady speed 4-Anatyzeng how to address the issue 5-Selechhing learning strategies	1-Evaluation of prograss 2-Spervision on attention 3-Aslang queshens during stady and learning 4-Controlling hime and speed of stady	1-Modifying stady speed 2-Correchry or ehanying cognihive strategies

3. Results

Table 3,4 and 5 report the descriptive characteristics of reading speed, memorization of texts and comprehension, easy or difficult.

Table 3: descriptive indices of reading speed for easy and difficult courses

Variable	Groups	Pretest		Post test	
		mean	SD	Mean	SD
Reading speed of easy literature	Test	19.79	1.98	15.63	2.88
	Control	23.48	2.62	24.84	4.53
Reading speed of Difficult literature	Test	21.83	1.86	15.54	2.89
	Control	24.60	3.08	23.84	2.49
Reading speed of Easy biology	Test	20.83	3.87	18.67	2.18
	Control	29.28	3.66	26.26	4.37
Reading speed of Difficult biology	Test	35.13	3.78	21.48	1.56
	Control	33.56	3.53	31.26	3.32

Table 4: descriptive indices of memorization of easy and difficult courses

Variable	Groups	Pretest		Post test	
		mean	SD	Mean	SD
Memorization of easy literature	Test	8.71	1.49	13.67	1.66
	Control	8.38	1.93	8.16	3.22
Memorization of Difficult literature	Test	7.87	2.25	10.33	2.14
	Control	7.12	2.58	5.36	2.69
Memorization of Easy biology	Test	6.29	1.87	13.00	2.10
	Control	5.84	2.39	5.80	2.10
Memorization of Difficult biology	Test	5.83	2.04	12.50	1.62
	Control	5.36	2.69	5.16	3.02

Table 5: descriptive indices of comprehension for easy and difficult courses

Variable	Groups	Pretest		Post test	
		mean	SD	mean	SD
Reading speed of easy literature	Test	8.58	2.83	13.08	1.35
	Control	9.24	1.54	8	2.45
Reading speed of Difficult literature	Test	7.79	2.02	13.21	1.77
	Control	7.16	2.25	6.44	2.36
Reading speed of Easy biology	Test	6.63	2.37	12.92	1.35
	Control	6.36	1.63	5.96	1.99
Reading speed of Difficult biology	Test	6.64	1.99	13.06	1.45
	Control	6.56	2.80	6.28	2.13

In the investigation of hypotheses of covariance analysis i.e. normality of dependent variable, homogeneity of regression line slope, the existence of linear relationship between auxiliary random variable (pretest) and dependent variable (post-text) and equality of variances, it was found that two hypotheses of nonlinearity and homogeneity of regression line slope do not hold and the conditions of using multivariable covariance analysis test is not met. Therefore, the differentiation scores (the differences between scores of (posttest and pretest) were used to balance the effects of pretest and remove the primary differences of subjects in control and test groups. MANOVA was used for differentiation scores of memorization, comprehension, and reading speed of easy and difficult courses, as a tool for the conditions of more than one dependent variable [Adelaide& Pexman, 2001   ]. in the present research to reduce the first type error, Bonferroni correction, , was divided by the number of dependent variables and the significance of 0.025 was considered.(0.05/12=0.0041) Dependent variables have collinear and significant relationship while there is not multiple nonlinearity among the variable pairs. Therefore one of the main assumptions of multivariable variance analysis. As the variables of memorization, comprehension reading speed of easy and difficult courses are interrelated, their correlation rate is remarkable. In addition, other conditions of homogeneity of variance-covariance matrices with box test and Simonov's distribution normality hold. (Table 5) reports the summary of multivariable variance analysis for differentiation scores of memorization, comprehension and reading speed of easy and difficult courses.

Table 6: summary of multivariable variance analysis for differentiation scores of memorization, comprehension and reading speed in easy and difficult literature and biology

Statistical power	η^2	Sig.	F	d.f	Test
1	0.932	**P <0.0001**	40.79	12 , 36	Test of Pilli's Trace
1	0.932	**P <0.0001**	40.79	12 , 36	Test of Wilks Lambda
1	0.932	**P <0.0001**	40.79	12 , 36	Test of Hoteling's Trace
1	0.932	**P <0.0001**	40.79	12 , 36	The test of Roy's Largest root

The result of (table 6) show that there is a significant different between education level (cognitive versus lack of education) in the vanables of m, c, rs [F(12,36)= 40/799, P<0/0001, = 0/932] . Therefore, educating cognitive learning strategies had significant effect on m, c, and rs. Of easy and   difficult courses.

Statistical power	η^2	P	F	M.S	d.f	S.S	Dependent Variable
0.999	0.361	P <0.0001	26.510	374.009	1	374.009	Reading speed of easy literature
				14.108	47	663.093	Error
1	0.431	P <0.0001	35.539	374.686	1	374.686	Reading speed of Difficult literature
				10.543	47	495.518	Error
0.950	0.224	P <0.001	13.559	271.450	1	271.450	Reading speed of Easy biology
				20.20	47	940.958	Error
1	0.716	P <0.0001	118.372	1587.63	1	1587.63	Reading speed of Difficult biology
				13.412	47	630.373	Error
1	0.563	P <0.0001	60.666	403.44	1	403.44	Memorization of easy literature
				6.65	47	312.56	Error
1	0.543	P <0.0001	55.733	461.127	1	461.127	Memorization of Difficult literature
				8.274	47	388.873	Error
1	0.626	P <0.0001	78.819	548.307	1	548.307	Memorization of Easy biology
				6.957	47	326.958	Error
1	0.648	P <0.0001	86.652	583.825	1	538.825	Memorization of Difficult biology
				6.738	47	316.665	Error
1	0.474	P <0.001	42.424	325.817	1	325.817	Compression of easy literature
				7.680	47	360.959	Error
0.998	0.339	P <0.0001	24.123	217.890	1	217.890	Compression of Difficult literature
				9.032	47	454.518	Error
1	0.591	P <0.0001	67.913	557.633	1	557.633	Compression of Easy biology
				8.211	47	385.918	Error
1	0.555	P <0.0001	58.667	577.361	1	577.361	Compression of Difficult biology
				9.856	47	463.333	Error

Table 7 summarizes the statistical analysis of one variable variance analysis for differentiation scores of dependent variables.

Table 7: the summary of one variable variance analysis for differentiation scores of dependent variables of research difficult literature [F(1,47)= 60/666, P<0/0001, = 0/563] were obtained which show educating cognitive learning strategies influences the memorization of easy and difficult literature significantly. For the memorization of easy biology [F(1,47)= 55/733, P<0/0001, = 0/543] and difficult biology [F (1,47)= 78/819, P<0/0001, = 0/626] were obtained which show educating cognitive learning strategies influences the memorization of easy and difficult biology significantly. For the comprehension of easy literature [F (1, 47)= 86/652, P<0/002, = 0/648] and difficult literature [F(1,47)= 42/424, P<0/001, = 0/474] were obtained which show educating cognitive learning strategies influences the comprehension of easy and difficult literature significantly. For the comprehension of easy biology[F(1,47)= 24/123, P<0/0001, = 0/339] and difficult biology[F(1,47)= 67/913, P<0/0001, = 0/591   ] were obtained which show educating cognitive learning strategies influence the comprehension of easy and difficult biology significantly. For reading speed of difficult   biology. [F(1, 47) =58/587, P<0/047, = 0/555] were obtained which show educating cognitive strategies does not influence the reading speed of difficult biology.

4. Discussion

The analysis of data from memorization test in easy and difficult literature and biology in pre-and posttest stages show that there is a significant difference. The efficacy of teaching meta Meta cognitive learning strategies on memorization has been confirmed by authors such as Android, Hiuobard,Wilkson(1990);Koars,Fiuor,Bavers,Salas(2004);Alovin,Maklaren RolKodinger(2006);Nijohs,Segroz,Gijelser,(2008);Lee,(2008)Lam(2009);Cheng(2009);Marandi,Mokhtarniya,(2010);Sone(2010);Jing,Sharping(2011)has been reported and confirmed. These findings are confirmed with those of researchers in Iran such as TavakoliZadeh and Ebrahimi, (2011); Alibakhshi & Zare (2010); Abdkhoday& Ghafari (2010); Abedini (2009); Moeini kia &Nokhostin doost (2009); Seyf & Atar (2009); Pishavard (2001);Abdos (2001) has been reported and support the findings of our research.

Meta cognition is a method to make learning significant and is the skill of thinking and person's ability to think about his own thinking process. This knowledge helps the students to supervise the progress of learning and its efficacy, retrieve the information in his memory and promote his recitation.

 Memorization involves attention to aim and attention is the starting point of memory process. Meta Cognitive strategies help the students to combine the fresh information with the old information and restore it in the memory. What is stored in long-term memory is never lost. Therefore, the students can increase their

memorization by applying meta cognitive strategies in retrieving information and improve their own academic skills.

As the means cores of memorization pretest of easy and difficult literature and biology were compared in both test and control groups with ANOVA and it was concluded that there is significant relationship between two groups. Teaching meta cognitive learning strategies increases the students' memorization in literature and biology. On the other hand, controlling field of study, sex, age of subjects increases the validity of this conclusion.

The analysis of data from the test of comprehension in literature and biology shows a significant difference. The efficacy of teaching meta cognitive learning strategies on memorization has been confirmed by authors such as Ness and Middleton(2012); Lee (2008); Lam (2009); and Aershos (2010); Dong, Ling, Jovang (2010); Rahimi, Katal(2012); Gerami, Madani (2011); Son(2010);Hanter, Lindez(2005)has been reported and confirmed.

These findings are confirmed by those of other researchers in Iran such as Haghani and Khadivzadeh (2009); AliBakhshi & Zare (2010); Karshaki (2010); Abdkhoday & Ghafari (2010) ;Aghazade (1998); Seyf & Atar (2009); Maher&Bahari (2007)has been reported and support the findings of our research.

Comprehension is one of the basic academic skills which promote academic achievement. The students who understand the content better have more skills in responding the questions and present better progress. Students are usually aware of learning strategies but due to lack of supervision on learning process fall in to trouble in comprehension and cannot use them to retrieve the information. Meta cognitive strategies help the students to control and supervise the learning process and organize their study.

The analysis of data from test of reading speed in As the means cores of reading speed pretest of easy and difficult literature and biology were compared in both test and control groups with ANOVA and it was concluded that there is significant relationship between two groups. Teaching Metacognitive learning strategies increases the students' reading speed in literature and biology.

The efficacy of teaching meta cognitive learning strategies on reading speed has been confirmed by authors such as Koars, Fiuor, Bavers, Salas(2004);Lee,(2008); Sone (2010) has been reported and support the findings of our research. To explain this, it can be said that learning includes reading, retaining and reciting. The first condition of learning is reading accurately. Implementing meta cognition strategies and using the principles of fast reading can help to increase the speed of reading properly without having any effect on learning and comprehending by students.

As the means cores of reading speed pretest of easy and difficult literature and biology were compared in both test and control groups with ANOVA and it was concluded that there is significant relationship between two groups. Teaching Metacognitive learning strategies increases the students' reading speed in literature and biology. On the other hand, controlling field of study, sex, age of subjects increases the validity of this conclusion.

Learning includes reading, story and reciting. The first requirement of learning is reading correctly. Applying Metacognitive strategies can help the students to increase their reading speed. As the means cores of memorization pretest of easy and difficult literature and biology were compared in both test and control groups with ANOVA and it was concluded that there is no significant relationship between two groups. Teaching Metacognitive learning strategies increases the students' memorization in literature and biology. The analysis of data from the test of reading speed in difficult biology in pretest and posttest stages shows no significant difference between two groups. To increase the reading speed along with comprehension the students need to spend a lot of time while special terminology and time limitation can play a role in not increasing speed of study. Base on Seyf and Shaghashi (2009), the important factor in study speed is processing speed of information cognitively rot the eye movement on the lines. Also, forcing individual to increase speed though increasing eye movement on words leads to decrease understanding the content. The results of the researches show lack of relationship between the speed and understanding. In this research, there was not seen any significant relationship between educating cognitive strategies and increase of reading speed in easy and difficult biology. The findings of the research showed that educating cognitive learning strategies influence the student's performance in literature and biology (easy and difficult significantly).

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Summary

Meta-cognitive learning strategies: The effect of training strategies on memorizing, comprehension and the speed of reading

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The aim of this study was to determine the effect of Meta-cognitive learning strategies training on memorizing, comprehension and the speed of reading easy and difficult courses for the high school first grade male students of Hamadan. To do so, 60 students were chosen in random cluster sampling and were randomly replaced in two experiment and control groups. The research designed, the pre- test post-test with control group in the curry study pre-tested was done for both group by using research-made academic achievement test that reliability and validity of it was confirmed. The experimental group was educated with cognitive learning strategies in 14 sessions, each 45 minutes, while control group did not receive any education. Then, the post-test of research-made academic achievement was carried out. The data analysis with MANOVA for differentiation scores showed that teaching cognitive learning strategies have increased memorizing and comprehension of student in easy and difficult literature and biology at the level of, while having a significant positive affection on the reading speed in easy and difficult literature and easy biology with significant no effect on the reading speed of difficult biology.