

A Comparative Study on the Effectiveness of Cognitive and Metacognitive Learning Strategies in Goal Orientation

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Abstract

The study was designed and carried out to examine the comparison of the effectiveness of cognitive and metacognitive learning strategies in the goal orientation of students in Tehran in the academic year of 2022-2021. The study was carried out as quasi-experimental with pretest and posttest along with control and follow-up groups. Random sampling method was used to select the sample. Firstly, one university was randomly selected from the universities. Then, 3 classrooms were selected from that university, and 30 students were randomly selected according pre-determined inclusion and exclusion criteria from them. Then, they were placed in experiment groups 1 and 2 and the control group. Firstly, pre-test was performed for all three groups, then one group was taught cognitive learning strategies and the other metacognitive learning strategies. However, there were no intervention in the control group and in the end, post-test was administered to all three groups. Bouffard et al. (1998) goal orientation questionnaire was used for data collection and mixed-design analysis of variance for data analysis. The results indicated that the students' goal orientation had increased given the mean scores of pre-test, post-test, and comparing them with the control group. Moreover, after one month the follow-up test was administered, which showed the post-test changes remained stable and constant.

Keywords: Goal orientation, cognitive learning strategies, metacognitive learning strategies, Tehran students

INTRODUCTION

Education is an essential tool for progress and empowerment in any human society. The broad goal of education and higher education is to prepare students for a useful life in society and to prepare them for the job market. One of the main roles of teachers and professors is to develop the knowledge and skills of students to enhance their performance in society effectively (Akomolafe, Ogunmakin, & Fasooto, 2013). One of the major and significant elements in teachers' goals and education is guiding students towards increasing the goal orientation (Ataeifar and Shaghaghi, 2010). Goal orientation theory

is of the main and effective theories in learning (Elliott, 1999).

Goal orientation is an integrated pattern of beliefs guiding students towards an approach and allows students to respond to progress assignments and situations differently. Different studies indicate that success in education calls for using appropriate motivational model or goal orientation. The concept of goal orientation was introduced in the light of a study by Duke et al. in the 1980s on elementary school children. In his study, Duke found that children have various goals in dealing with different learning situations (Moghimian and Karami, 2012). Goal orientation is an integrated model of beliefs that guide

students towards an approach and causes students to respond to assignments of progress and situations differently. Goal orientation is one of the psychological variables and Ames (1992) calls it a coherent model of belief that results in adopting various ways of dealing with, engaging, and responding to learning situations. This orientation in educational situations shows a person's motivation to study and therefore affects their desires, actions, and responses in learning situations (quoted by Khademi, 2006). Pintrich and Schank (2002) have identified three types of independent goal orientation: a) learning goal orientation that revolves around increasing competency and mastery of tasks, b) performance goal orientation that focuses on reaching the desired competency evaluation – the students with a performance goal orientation want to prove their ability and personal worth to others and c) the goal orientation of failure avoidance, which focuses on the negative evaluation of competence – those with this kind of goal orientation desire to avoid their incompetence or inability in the eyes of others and just try to avoid failure. Pintrich and Garcia (2000) argue that students' goal orientation has a positive correlation with the way they learn. Undoubtedly, learning has been one of the concerns of humans throughout history, as all human achievements and progress are the product of learning (Ashaari, Shafiabadi and Sudani, 2009). Learning is a relatively sustained change in potential behavior enhanced and takes place in the light of practice (Hergtehan and Elsen, 1997).

One of the strategies that could be used for goal orientation is the development of cognitive and metacognitive self-regulatory strategies. Self-regulation of learning is of the categories that focus on the role of the individual in the learning process. The principle of self-regulated learning is that students learn more effectively when they are responsible for their own learning, and learning self-regulation means active involvement of students in their individual, behavioral, motivational, and cognitive learning efforts to reach important and valuable academic goals (Mirav and Mirana, 2013).

Contrary to the past, when it was thought that each person's ability to learn is a function of their intelligence and talents, this theory has gained strength among psychologists in recent years that despite the decisive role of

intelligence and talent in learning, other non-intrinsic factors are considered important in these relationships as well. Maleki (2007) concluded that teaching cognitive strategies in social studies lesson as a humanities course with a memorization nature had significant effects on increasing learning and retention of its learners. Moreover, it was concluded that teaching cognitive strategies in physics (as a basic science course with a comprehensible nature) has a significant effect on increasing the learning and retention of its learners. Furthermore, teaching metacognitive strategies in social studies course increased and enhanced learning and remembering easy and difficult learning stuff of the learners (Elder and Gavel, 2010).

Cognitive strategies are used to facilitate and complete the homework and help students provide new information to combine with previous information and store it in long-term memory. These strategies include repetition or review strategies and semantic expansion and organization (Seif, 2015). Metacognitive strategies include skills enabling the learners to control and understand cognitive processes (Arji 2006; and Stick Digi, 2002). Metacognitive strategies include planning, regulation, and monitoring where self-monitoring plays an effective role in self-regulative learning. Self-regulatory interventions in students by controlling the situation, increase learning, reduce inactivity in learning and generally cause conflict with homework (Schmitz and Wiese, 2006).

The purpose of metacognitive education is self-control and self-learning so that students become independent learners who can guide, monitor, and enhance their cognitive and learning processes towards their set goals (Atarodi and Karshki, 2013). Metacognitive strategies control and direct cognitive strategies; Therefore, to succeed in learning, it is necessary to use cognitive and metacognitive strategies together (Atardi and Karshki, 2013).

Using cognitive and metacognitive learning strategies, the professors should provide effective education for students on the one hand, and by changing students' pessimistic attitude towards their abilities and by believing in their abilities to overcome problems and academic barriers and challenges, prevent its irreversible effects on various physical, cognitive, social aspects of learners and provide a context for learning goal orientation in learners to accompany students with

positive backgrounds and consequences in the field of education on the other. Moreover, it can help a lot in increasing the academic motivation of students. Given this, it is especially important for students about to enter university and the labor market.

Thus, it is necessary to carry out studies in this regard to comment on this issue with more confidence and provide solutions. Considering the above and the significance of goal orientation that brings about academic success, it is necessary to perform applied studies to compare cognitive and metacognitive learning strategies on students' goal orientation.

Methods

The study was carried out as a quasi-experimental with pretest and posttest along with control and follow-up groups. The population was the students studying in Tehran in 2021. Random sampling method was used to select the sample. Firstly, one university was randomly selected from the universities, then 3 classrooms were selected from that university, and 30 students were randomly selected according pre-determined inclusion and exclusion criteria from them. They were then placed in experiment groups 1 and 2 and the control group. There are three groups of 10 people, including experimental group 1, experimental group 2, and control group. Experimental group 1 received cognitive learning strategies and experimental group 2 metacognitive learning strategies for 8 sessions as an online class via Skype.

Introducing the tool

Table 1. The result of covariance matrix homogeneity test (Box)

Sig.	df2	df1	F	Box's
0.108	1997.128	90	1.193	218.819

As is seen in Table (1), the significance level of Box's test is 0.108. As this value is greater than the significance level (0.05) required to reject the

Goa orientation questionnaire

The study used Bouffard et al. (1998) goal orientation questionnaire to measure goal orientation. The purpose of this scale is to evaluate the type of goal that a person selects for himself in educational situations. The scale is classified into three categories: learning goal orientation, performance goal orientation, and failure avoidance goal orientation. The questionnaire has 21 questions, 8 of which are associated with the learning factor (from questions 1 to 8), 4 questions the performance factor (from questions 9 to 12) and 9 questions related to the failure factor (from 13 to 21). The tool is assessed on the Likert scale with 6 options: completely agree, agree, somewhat agree, somewhat disagree, disagree, completely disagree (1) (Khademi and Noshadi, 2006). Reliability obtained in Iran using Cronbach's alpha coefficient for learning was 0.82 for performance 0.73 and for failure avoidance 0.75. Finally, the data was analyzed in SPSS and mixed analysis of variance.

Results

From among the people present in the study, 10 people were in the control group, 10 in the cognitive learning strategy group and 10 in the metacognitive learning strategy group. In the control group, 6 people were girls and 4 boys. In the cognitive strategy group, there were 8 girls and 2 boys, and in the metacognitive strategy group, 7 girls and 3 boys. Analysis of variance test with repeated measures was used to compare the effectiveness of teaching cognitive and metacognitive learning strategies on students' goal orientation. The results of performing this test and examining its assumptions are given below.

null hypothesis, the null hypothesis based on the covariance matrix homogeneity is confirmed.

Table 2: Levene's test result for examining the homogeneity of variances

Variables	F	1 degree of freedom	2 degrees of freedom	Sig.
Learning orientation pretest	2.919	2	27	0.071
Learning orientation post-test	2.077	2	27	0.145
Learning orientation follow up	1.890	2	27	0.170
Performance orientation pretest	0.538	2	27	0.590
Performance orientation post-test	2.791	2	27	0.079
Performance orientation follow up	1.997	2	27	0.155

Failure avoidance orientation pretest	2.909	2	27	0.072
Failure avoidance orientation post-test	1.235	2	27	0.307
Failure avoidance orientation follow up	2.474	2	27	0.103

As Table (2) shows, the results of the Levene's test are not significant. Thus, the assumption of variance homogeneity of variables is confirmed.

Table 3. Mauchly's sphericity test result

Variable	Mauchly's statistic	Chi square	df	Sig.
Learning orientation	0.531	16.452	2	0.001
Performance orientation	0.390	24.484	2	0.001
Failure avoidance orientation	0.165	46.871	2	0.001

As is seen, Mauchly's sphericity test is statistically significant, showing a violation of the sphericity assumption. Failure to make this assumption increases the probability of type two error; therefore, the obtained significant values

(p values) in the multivariate test are not reliable. Thus, Greenhouse- Geisser and Huynh-Feldt estimations that adjust the degrees of freedom are used.

Table 4. The results of multivariate intra-subject effects test to compare the goal orientation of control and experimental groups

Effect		Values	F	Effect degree of freedom	Error degree of freedom	Sig.	Effect size
Repetition	Pillais Trace	0.681	9.117	6	106	0.001	0.340
	Wilks	0.321	13.252	6	104	0.001	0.433
	Hotelling's Trace	2.108	17.914	6	102	0.001	0.513
	Roy's	2.105	37.183	3	53	0.001	0.678
	Largest Root						
Repetition * group	Pillais Trace	0.518	2.820	12	162	0.002	0.173
	Wilks	0.509	3.337	12	137.871	0.001	0.201
	Lambda	0.909	3.838	12	152	0.001	0.233
	Hotelling's Trace						
	Roy's	0.845	11.407	4	54	0.001	0.458
	Largest Root						

Table (4) shows the results of multivariate tests to examine the difference between the mean scores of the goal orientation of the control groups, and cognitive and metacognitive

learning strategies during the treatment process. The information in the above table indicates that all multivariate tests are significant, which shows the existence of the main effect of the repetition

factor (pre-test, post-test, and follow-up) as well as the interactive effect between groups and

repetition (the difference between groups during the measurement process).

Table 5. The results of univariate intra-subject effects test to compare the goal orientation of control and experimental groups

Source	Dependent variables		Sum of squares	Degrees of freedom	Mean square	F	Sig.	Effect size
Repetition	Learning orientation	Sphericity assumption	194.600	2	97.300	16.200	0.001	0.375
		Greenhouse-Geisser	194.600	1.362	142.923	16.200	0.001	0.375
		Huynh-Feldt	194.600	1.515	128.432	16.200	0.001	0.375
		Lower band	194.600	1	194.600	16.200	0.001	0.375
	Performance orientation	Sphericity assumption	237.422	2	118.711	35.640	0.001	0.569
		Greenhouse-Geisser	237.422	1.242	191.128	35.640	0.001	0.569
		Huynh-Feldt	237.422	1.369	173.408	35.640	0.001	0.569
		Lower band	237.422	1	237.422	35.640	0.001	0.569
	Failure avoidance orientation	Sphericity assumption	1132.022	2	566.011	34.014	0.001	0.557
		Greenhouse-Geisser	1132.022	1.090	1038.715	34.014	0.001	0.557
		Huynh-Feldt	1132.022	1.185	955.563	34.014	0.001	0.557
		Lower band	1132.022	1	1132.022	34.014	0.001	0.557
Repetition * group	Learning orientation	Sphericity assumption	93.733	4	23.433	3.902	0.007	0.224
		Greenhouse-Geisser	93.733	2.723	34.421	3.902	0.019	0.224
		Huynh-Feldt	93.733	3.030	30.931	3.902	0.015	0.224
		Lower band	93.733	2	46.867	3.902	0.032	0.224

Error	Performance orientation	Sphericity assumption	89.378	4	22.344	6.708	0.001	0.332
		Greenhouse-Geisser	89.378	2.484	35.975	6.708	0.002	0.332
		Huynh-Feldt	89.378	2.738	32.640	6.708	0.001	0.332
		Lower band	89.378	2	44.689	6.708	0.004	0.332
	Failure avoidance orientation	Sphericity assumption	490.711	4	122.678	7.372	0.001	0.353
		Greenhouse-Geisser	490.711	2.180	225.132	7.372	0.002	0.353
		Huynh-Feldt	490.711	2.369	207.110	7.372	0.001	0.353
		Lower band	490.711	2	245.356	7.372	0.003	0.353
	Learning orientation	Sphericity assumption	324.333	54	6.006			
		Greenhouse-Geisser	324.333	36.763	8.822			
		Huynh-Feldt	324.333	40.910	7.928			
		Lower band	324.333	27	12.012			
	Performance orientation	Sphericity assumption	179.867	54	3.331			
		Greenhouse-Geisser	179.867	33.540	5.363			
		Huynh-Feldt	179.867	36.967	4.866			
		Lower band	179.867	27	6.662			
	Failure avoidance orientation	Sphericity assumption	898.600	54	16.641			
		Greenhouse-Geisser	898.600	29.425	30.538			
		Huynh-Feldt	898.600	31.986	28.094			

		Lower band	898.6 00	27	33.28 1			
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Based on the results presented in Table (5), F values related to the interactive effects between groups and repetition (the existence of differences between groups during the measurement steps) are significant for all

components of goal orientation at the alpha level of 0.01 ($p < 0.01$). The significance of interactive effects shows the difference between the trend of changes in goal orientation scores of control groups, cognitive and metacognitive learning strategies during the measurement process.

Table 6. Bonferroni post hoc test

Group	The dependent variable	Step	Step	Mean difference	Standard error	Sig.
Control	Learning orientation	Pre-test	Post-test	-0.700	1.321	1
			Follow-up	0.400	1.210	1
		Post-test	Follow-up	1.100	0.628	0.274
	Performance orientation	Pre-test	Post-test	-0.300	0.936	1
			Follow-up	-0.800	0.987	1
		Post-test	Follow-up	-0.500	0.386	0.618
	Failure avoidance orientation	Pre-test	Post-test	-0.800	2.193	1
			Follow-up	-0.300	2.211	1
		Post-test	Follow-up	0.500	0.536	1
Cognitive learning strategy	Learning orientation	Pre-test	Post-test	-4.300	1.321	0.009
			Follow-up	-4	1.210	0.008
		Post-test	Follow-up	0.300	0.628	1
	Performance orientation	Pre-test	Post-test	-5	0.936	0.001
			Follow-up	-4.200	0.987	0.001
		Post-test	Follow-up	0.800	0.386	0.143
	Failure avoidance orientation	Pre-test	Post-test	-11.100	2.193	0.001
			Follow-up	-10.200	2.211	0.001

		Post-test	Follow-up	0.900	.536	0.314
Metacognitive learning strategies	Learning orientation	Pre-test	Post-test	-4.900	1.321	0.003
			Follow-up	-5.100	1.210	0.001
		Post-test	Follow-up	-0.200	0.628	1
	Performance orientation	Pre-test	Post-test	-5.500	0.936	0.001
			Follow-up	-4.800	0.987	0.001
		Post-test	Follow-up	0.700	0.386	0.242
	Failure avoidance orientation	Pre-test	Post-test	-11.200	2.193	0.001
			Follow-up	-11.500	2.211	0.001
		Post-test	Follow-up	-0.300	0.536	1

According to the results obtained in the training groups of cognitive and metacognitive learning strategy, the difference between the mean scores of pre-test stage and post-test and follow-up stages is significant ($p < 0.01$). The goal orientation score has significantly increased in the post-test and follow-up stages compared to the pre-test stage. The difference

between the post-test stage scores and the follow-up stage scores was insignificant ($p < 0.05$), showing the stability of treatment effects over time. In the control group, the difference between the scores of the pre-test stage with the post-test and follow-up stages and the difference between the scores of the post-test stage and the follow-up scores were insignificant ($p < 0.05$).

Table 7. The results of inter-subject effects test to compare the mean scores of the goal orientation of the groups

Source of changes	Variables	Sum of squares	Degrees of freedom	Mean square	F	Sig.
Group	Learning orientation	198.867	2	99.433	2.872	0.074
	Performance orientation	290.022	2	145.011	10.010	0.001
	Failure avoidance orientation	1934.956	2	967.478	21.830	0.001
Error	Learning orientation	934.867	27	34.625		
	Performance orientation	391.133	27	14.486		
	Failure avoidance orientation	1196.600	27	44.319		

According to the results, F values associated with performance orientation and failure avoidance orientation are significant ($P < 0.01$).

Table 8. Bonferroni post hoc test

The dependent variable	Group 1	Group 2	Mean difference	Standard error	Sig.
Learning orientation	Control	Cognitive strategy	-3.067	1.519	0.161
		Metacognitive strategy	-3.233	1.519	0.128
	Cognitive strategy	Metacognitive strategy	-0.167	1.519	1
Performance orientation	Control	Cognitive strategy	-3.300	0.983	0.007
		Metacognitive strategy	-4.167	0.983	0.001
	Cognitive strategy	Metacognitive strategy	-0.867	0.983	1
Failure avoidance orientation	Control	Cognitive strategy	-7.633	1.719	0.001
		Metacognitive strategy	-11.100	1.719	0.001
	Cognitive strategy	Metacognitive strategy	-3.467	1.719	0.161

According to the results, the difference between the mean scores of performance orientation and avoidance of failure of cognitive strategy and metacognitive strategy groups with the control group is significant ($p < 0.01$).

Conclusion

According to the results obtained in cognitive and metacognitive learning strategy the training groups, the difference between the mean scores of the pre-test, the post-test, and follow-up stages is significant. By comparing the mean scores in the three stages, one can observe that the mean scores of goal orientation in the post-test and follow-up stages have increased significantly compared to the pre-test stage. The difference between the post-test and the follow-up stage scores is insignificant, which indicates the stability of the treatment effects over time. In the control group, the difference between the scores of the pre-test stage with the post-test and follow-up stages and the difference between the scores of the post-test stage and the follow-up scores are insignificant.

In explaining the results, the effect test between the subjects is presented to study the mean scores of the target orientation of the control groups, cognitive and metacognitive

learning strategies. According to the results, F values associated with performance orientation and failure avoidance orientation are significant. The results of multivariate tests are given to study the difference between the mean scores of the goal orientation of the control groups, cognitive and metacognitive learning strategies during the treatment process. The information in Chapter 4 reveals that all multivariate tests are significant, showing the existence of the main effect of the repetition factor (pre-test, post-test and follow-up) and the interactive effect between groups and repetition (the difference between groups during the measurement stages).

In explaining the results, pairwise comparisons are presented to examine the mean scores of the object orientation of the control groups, cognitive and metacognitive learning strategies. According to the results obtained, the difference between the mean scores of performance orientation and avoidance of failure of cognitive strategy and metacognitive strategy groups with the control group is significant. In explaining the results, one can state that the mean scores of goal orientation in both groups of cognitive and metacognitive learning strategies have increased during the treatment process.

As the study has been carried out on students, one should be careful in extending the results to other communities. It is suggested that in future studies, other educational approaches should be used besides these approaches to compare and assess the effectiveness of new therapeutic approaches.

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