The Relationship between State Meta-Cognition and Creativity with Academic Achievement of Students

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Abstract: One of the important indicators to assess education system is academic achievement of students and all efforts of this system are in order to meet this factor. In other words, the community and especially the education system are interested in future growth and success of the individual they are looking for progress and excellence of individuals in terms of cognitive skills, abilities, personality, emotions, and behaviors. Due to the fact that, academic performance is one of the measures of efficiency of education system, investigating the effecting factors on academic performance can lead them to better understanding and prediction of effective factors in schools. Therefore, in this work we are going to investigate the relationship between State metacognition and creativity with academic achievement of students.

Key Words: Meta-Cognition, Creativity, Academic Achievement, Sanandaj

1. Introduction

Over the past three decades, study of factors affecting academic achievement has attracted more attention specialists. Several studies have shown that, academic achievement is affected by the structure of the knowledge and information processing and environmental factors such as family factors, and self-regulation (Butler and Winner, 1995) as well as cognitive factors, including thinking factors and metacognitive. In the past times, many researchers investigated the relationship between cognitive processes and academic performance separately, but today, most of psychologists consider cognitive components and academic performance as an intertwined set. If we carefully look at the behavior of students in a learning situation, we can see that they are acting differently in their learning process and it seems that, students' self-recognition has an important role in variety of cognitive activities including the verbal exchange information, reading comprehension, verbal comprehension, writing, language learning, perception, attention, memory, problem solving, social cognition, self-learning and so on. (Flavel, 1998). Meta-cognition is any kind of cognitive activity or knowledge that indicates or cognition or regulating cognition. It has been divided in two sections: metacognitive knowledge and metacognitive experience. Metacognitive knowledge consists of three elements knowledge on self, tasks and strategies of cognition (Setin kaya and Aktin, 2002). There are two types of connected metacognition: "knowledge about cognition" and "regulation and monitoring of cognition ". Cognition occurs when a person is aware of his/her cognitive abilities and second part is

thinking through which, it is regulated and monitored (Perfect and Schwartz, 2004).

Cognitive control is a set of conscious or unconscious decisions that we build it based on results of monitoring processes (Perfect and Schwartz, 2004). Theoretical foundations and research results indicate that, metacognition and its components are associated with academic achievement. Metacognition is has a positive relationship with learning and comprehension; and processes of metacognitive control and monitoring have interactive relationship with each other. Therefore, one's cognition from his/her abilities and his/her awareness from metacognitive and cognitive strategies will lead to improvement in learning and academic performance (August- Brady, 2005; Korial, Main, and Nasin Son, 2006; Perfect and Schwartz, 2004; Artino, 2008; Bradford and Steve, 2008; Nous, 2008 quoted by Erfani 2011).

Metacognition has a positive relationship with learning and high-efficiency students are better in cognitive and metacognitive strategies as well as better problem solving (Son 2007 and Metcalfe, 2000; Hafman and Spartio, 2008). Strong and weak students in terms of problem solving are different in terms of planning differ and monitoring metacognition.

Metacognition is defined as the conscious awareness and frequent self-checking to determine if one's learning goal has been achieved and, as necessary, selecting a more appropriate strategy to achieve that goal (O'Neil & Abedi, 1996). Metacognition involves knowledge of cognitive states and abilities, and the affective and motivational characteristics of thinking (Paris & Winograd, 1990).

Metacognition is essentially thinking about thinking and is an important countenance of academic performance, problem solving, and student learning (Corno & Mandinach, 1983). State metacognition (i.e., varying in intensity and fluctuating over time depending on the learning situation) consists of awareness (being aware of one's thoughts), planning (formulating a goal, then determining the method or procedure to successfully attain that goal), self-checking (monitoring one's work), and the use of task-relevant cognitive strategies (O'Neil & Abedi, 1996; O'Neil, Sugrue, Abedi, Baker, & Golan, 1992). However, most of the researches were focused on the role of metacognitive knowledge, monitoring strategies, and metacognitive control and paid less attention on state metacognition since, state metacognition is particular conceptualization consisting metacognitive knowledge and experience (O'Neill and Abedi, 1996). Therefore, research on the role of state metacognition in academic achievement, has important theoretical and applied aspects. From theoretical view, it can relates the theoretical foundations to findings of the researches and from applied point of view, according to the findings, state metacognition can be considered as an effective variable since it affects goals, self-regulation and planning of the students.

Another factor that affects academic achievement is creativity. Given that, creativity is one of the most complicated aspects of the human mind that can be developed, it is required to be considered in all stages of education besides convergent and divergent thinking.

Trow (1970) believes that, the advancement achievement is an actualized ability or the amount of competence which is usually measured by standard tests. Its results are expressed in terms of "age or grade" and are based on the norms obtained from broad sampling of students' performance.

Stephen (1960) states that, none of the other aspect of the educational goals is ignored, but the reality is that, academic achievement is the only responsibility of all educational institutions that the community established to promote beneficial academic achievement of student. It is an abstraction of specific behaviors of the children that is related to the mastery or task-related words, solving mathematical problems, painting, etc.

According to the issues above, our hypotheses are as follows:

1) There is a relationship between state metacognition and academic achievement of students.

2) There is a relationship between creativity and academic achievement of students.

3) There is a relationship between creativity and state metacognition.

4) Through state metacognition and creativity, academic achievement of students can be explained.

5) Through state metacognition and creativity, academic achievement of students can be predicted.

2. Material and Methods
2.1. Sampling

The statistical population of this study was all first-grade of high school students of all public school in Sanandaj city, Iran at academic year of 2011-2012 which, according to the statistics obtained from the Department of Education, their number was 3113.

We have used Cochran formula (quoted by Hafez Nia, 2009) to calculate the sample size. Then, since n/N was less than 0.05, we used adjusted sample size formula (quoted by Sarmad Bazarga, Hejazi, 2008).

Finally, 341 students were selected via cluster sampling after selecting 8 high schools via random sampling (4 male and 4 female high schools). Then, randomly, 46 students were selected from first grade students of each male high school and 41 students were selected from one of them; and then, randomly, 40 students were selected from first grade students of each female high school and 42 students were selected from one of them.

2.2. Data Collection Tools

Academic achievement: we used last year average scores of students to calculate this variable.

State metacognition inventory: The questionnaire was developed by O'Neill and Abedi in 1996. It has 20 items and four subscales of awareness, cognitive strategies, planning and self-checking. 5 items are allocated to each subscale, and the subject must express his/her agreement or disagreement on each item in a 4- point Likert scale (from very low to very high).

In the present work, through a preliminary study using Cronbach alpha, the reliability coefficient has been found equal to 0.89 which is appropriate for a research.

2.3. Creativity Test

The test was introduced by Abedi and Spielberger and O'Neill in 1992 and has 60 three-option multiple choice questions in which, 22 items are on fluency, 11 items on elaboration, 16 items on inventiveness and 11 items on flexibility.

In order to calculate the validity of the test (1986), we distributed the Abedi creativity test and Torrance creativity test among 200 students at third grade middle school simultaneously. Torrance creativity test was used as simultaneous validity index. The correlation coefficient between total scores of Torrance test and the new test was 0.46.

The reliability coefficients of the test for fluency, inventiveness, flexibility, and elaboration of primary

form of Abedi creativity test, were 0.85, 0.82, 0.84, 0.80, respectively (Abedi, 1993).

In addition, in this study, through a pilot study using Cronbach alpha, the reliability coefficient has been calculated to be 0.89 which is appropriate for a research.

2.4. Statistical method

In this work, in order to describe the data, we have used the frequency and percentage tables and graphs, central tendency, measure of variation, and descriptive statistics. Moreover, to test the hypotheses, we have used Pearson correlation, multiple regression analysis, stepwise method, and the independent t-test. Of course, we initially examined outlier and extreme values via drawing box plot. Then, before applying

parametric test, we have investigated the normal distribution of the data and homogeneity of variances via Kolmogorov-Smirnov test and Levene statistic, respectively. Furthermore, we have benefitted SPSS software SPSS for statistical analysis.

3. Results

In order to explain and predict academic achievement of first grade high school students based on state metacognition and creativity in Sanandaj city at 2011-2012 academic year, the questionnaires were completed by the samples and then, we extracted and analyzed the data. In the following we will present the obtained data on hypotheses in two descriptive and analytical sections.

Table 1: Frequency distribution and percentage of the sample group by gender

Gender	F	P
Male	179	52.5
Female	162	47.5
Total	341	100

Table 2: Descriptive indicators of variables

Variable	N	$\overline{X}$	S
State metacognition	336	56.58	9.24
Creativity	337	76.46	14.74
Academic achievement	336	17.23	1.72

The data were analyzed in order to test the research hypotheses and are presented in the following tables.

Table 3: Relationship between state metacognition and academic achievement

Variable	r	P
State metacognition	0.35	0.0001**
Academic achievement		

P**<0.01, n=334

In order to test the first hypothesis, the results of Pearson correlation coefficient show that, there is direct and significant relationship between the state

metacognition and academic achievement of students (P<0.01, r=0.35). Therefore, the first hypothesis is confirmed.

Table 4: Relationship between creativity and academic achievement

Variable	r	P
Creativity	0.257	0.0001**
Academic achievement		

P**<0.01, n=335

In order to test the second hypothesis, the results of Pearson correlation coefficient show that, there is direct and significant relationship between the

creativity and academic achievement of students (P<0.01, r=0.257). Therefore, the second hypothesis is confirmed.

Table 5: The relationship between state metacognition and creativity of students

Variable	r	P
State metacognition	0.462	0.0001**
Creativity		

P**<0.01, n=335

In order to test the third hypothesis, the results of Pearson correlation coefficient show that, there is direct and significant relationship between the creativity and state metacognition of students ($P<0.01$, $r=0.257$). Therefore, the third hypothesis is confirmed.

Table 6: the List of variables entered in the regression analysis of academic achievement of student

Model	Variables before Between imported	The variable	Method
1	State metacognition	Academic achievement	Stepwise
2	Creativity		

The results of above table show that, state metacognition and creativity have been entered to regression analysis at first and second steps, respectively.

Table 7: Summary of academic achievement regression model based on the state metacognition and creativity

Model	R	R^2	AR^2	SE
1	0.350	0.122	0.120	1.619
2	0.365	0.133	0.128	1.611

In order to test the fourth hypothesis, the results of the adjusted square multiple correlation coefficient indicates that, based on the first model, 0.120 of the variance of academic achievement of students is explained by their state metacognition; and based on the second model, 0.128 of variance of academic achievement of students is explained by their state metacognition and creativity. Therefore, the fourth hypothesis of the study is confirmed.

Table 8: Analysis of variance of predictor factors of academic achievement of students

Model	Source of variation	S.S	d.f	M.S	F	P
1	Regression	120.740	1	120.740	46.077	0.0001**
	remainder	867.352	331	2.620		
	total	988.091	332			
2	Regression	131.355	2	65.678	25.298	0.0001**
	remainder	856.736	330	2.596		
	total	988.091	332			

$P**<0.01$

In order to test the fifth hypotheses the results of ANOVA indicate that, based on the first model, state metacognition of students ($P<0.01$, $F_{(1,331)}= 46.077$) and based on the second model, state metacognition and creativity of students ($P<0.01$, $F_{(2,330)}= 46.077$) have a significantly ability to predict academic achievement.

Table 9: Regression coefficients of predicting academic achievement of student based on their state metacognition and creativity

Model	Coefficient	B	SE	Beta	t	P
1	Constant	13.500	0.556		24.303	0.0001**
	State metacognition	0.066	0.010	0.350	6.788	0.0001**
2	Constant	13.024	0.601		21.669	0.0001**
	State metacognition	0.056	0.011	0.296	5.135	0.0001**
	Creativity	0.014	0.007	0.117	2.022	0.044*

$P**<0.01$, $P<0.05$

The results of above table show that, given the standardized beta weight of first model, a standard deviation in state metacognition of students, results in 0.35 of standard deviation in their academic achievement. Moreover, the standardized beta weight based on second model indicate that, a simultaneous standard deviation in the state metacognition and creativity of students, results in 0.296 and 0.117 of standard deviation in their academic achievement, respectively.

3.1. Secondary results
Here, we present secondary results of research.

Table 10: Comparison of male and female students in terms of state metacognition

Gender	N	$\overline{X}$	S	d.f	t	P
Male	174	56.25	8.80	334	-0.679	0.468
Female	162	56.94	9.71			

n=336

As a side result, the independent t test results showed that, there is no significant differences between males and females in terms of state metacognition (P=0.468, t $_{(334)}$=-0.679). Therefore, it can be said that, the state metacognitive of male and females is of a equal level.

Table 11: Comparison of male and female students in terms of creativity

Gender	N	$\overline{X}$	S	d.f	t	P
Male	175	76.73	13.72	335	0.344	0.731
Female	162	76.17	15.81			

n=336

As a side result, the independent t test results showed that, there is no significant differences between males and females in terms of creativity (P=0.731, t $_{(334)}$=0.344). Therefore, it can be said that, the creativity of male and females is of a equal level.

Table 12: Comparison of the academic achievement of male and female students

Gender	N		S	d.f	t	P
Male	176	17.24	1.55	306.505	0.004	0.996
Female	160	17.23	1.90			

n=336

As a side result, the independent t test results showed that, there is no significant differences between males and females in terms of academic achievement (P=0.996, t $_{(306/505)}$=0.004). Therefore, it can be said that, the academic achievement of male and females is of a equal level.

4. Discussions

Given that, there were no researches on state metacognition and its impact on academic achievement, our results are novel. However, according to the similar conducted works on metacognition and other components, our results are consistent with them.

Therefore, given the obtained results and citing the regression model of academic achievement based on metacognition and creativity as well as variance analysis of predictors variables of academic achievement, it can be said that, academic achievement can be explained and predicted though state metacognition and creativity and thus, this work, generally, is approved.

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