Effect of Instruction and Application of Meta-Cognitive Skills in Mathematics on Self-Regulation Growth

1Akram Daryae; 2Parvaneh Amiripour; and 1Ahmad Shahvarani

Department of Mathematics, Science and Research Branch, Islamic Azad University, Tehran, Iran

Corresponding Author: Parvaneh Amiripour

Abstract
In present research is evaluated the effect of instruction and application of meta-cognitive skills in mathematics on self-regulation growth. Statistical society of this research is all girl first grade students of high school at zone 4 of Tehran who are studying 2010-2011 and statistical sample is 198 girl students who are selected among 21 schools and they have divided to two control and experiment groups. Research method is quasi-experimental. Also for data analysis and study of relation between meta-cognition and self-regulation, it is used of One-Sample Kolmogorov-Smirnov test for normality of data, Leven's test for the equivalence of variances and independent samples test for the comparison of means in meaningful level of 0.05. Results are shown that students' self-regulation rate who had taught through meta-cognitive method is more than students who had not taught through this method.

Keywords: mathematics education, meta-cognitive skills, cognition, self-regulation, mathematics learning.

INTRODUCTION
It often know the cognition synonymous to think and then meta-cognition can know meta-thinking or thinking about thinking in fact meta-cognition is the acquaintance on its thinking process, direction and controlling. Since cognition includes of receiving, process, maintenance and transformation of information also meta-cognition encompasses elements of cognition and therefore control on it (Salehi, 2001). In instruction process and help to students for corrective thinking, bringing thinking skills and on time and corrective making-decisions when event problem and even crisis, it can ease the quality and quantity of learning. Also, the application of meta-cognitive skills help to bring transformation's skills of taught to various situations and others items. Meta-cognition term is the person's knowledge about self-cognition process and how optimum use of it for attaining aims of learning. In other words, meta-cognition is the person's acquaintance or knowledge of self-cognitive system (Saif, 2008). Meta-cognitive experience or regulation and controlling process is the one of the meta-cognition processes which directs person's thinking process in learning situation (Rebi, 2010).

Flavell (1976) have divided meta-cognitive controlling functions to this form; I) forming problem and consideration to its probable solutions, II) acquaintance of necessary cognitive process, III) operating, principles and cognitive strategies, IV) increased supple in searching corrective solutions for problem, V) avoiding confuses and stress in problem solving and VI) control on problem solving process. Shabani (2007) was believed that controllers of meta-cognition or self-regulation are such as; I) programming: programming need to identify of aim for studying, selecting proper strategies and setting resources which effect on performance of learners, II) supervision strategy: this element is included of pursuit and notification to study of text, ask of self about subjects and supervision on speed and times which need to study of a text and III) regulation strategy: this strategy help to students until how correct self-study and remove self-deficit and comprehend. Students should accept increasing responsibility to self-regulation of learning and programming. When learning controlled and programmed via other person, it is difficult to learners that directs to self-affairs then it can instruct to students until construct program to activities of learning such as estimation of timing needs and organizing subjects and programming necessary methods to complete the activity of program.

The evaluation criteria should proceed and develop along students as when do learning activity, students should learn about thinking and ask of self (Poursharif, 2004). Support of self-regulation process of students via teacher is the device which made promote cognitive behavior and finally meta-cognition or increasing their motivation in using teacher's notification (Annenieke et al., 2009). Students as self-regulator comprehend changing aim and consider to change of proper strategy to changing aim and ignoring unrelated information and correct and change self-using for attain to self-aims and accept risks in usage of cognitive strategies.
(Lotfabadi, 2005). Providing circumstance and professional and multi-motivational structures play key role in growing skills and self-regulations that it needs to do actions for it. The purpose of this paper is to indicate the effect of instruction via meta-cognitive skills in mathematics classes.

**LITERATURE REVIEW**

Three cases of researchers’ descriptive researches have more considered in cognitive and self-regulation skills among mass of researches: I) Lester and Garfalo (1985) were believed that cognitive knowledge is the result of communication of existential acquaintances about person, task and strategy, that is, while person communicates to task, both task and person communicate to strategy. Following instance shows this dynamic; person estimates difficult of task in contact to task firstly that this case is the kind of communication between person and task. Acquaintance of all problems in class solve through heuristic procedure and long word problem which need read more once, also this case is the symbol of communication with strategy. Person’s acquaintance with a strategy and knowledge of using strategy leads to usage of it that this is demonstrator of person’s communication with strategy. Cognitive knowledge was the result of these communications and finally these communications effect on person’s self-regulation behavior, II).

Birch and Ladd (1997) cited that cognitive knowledge told to the attainment of around knowledge of cognitive process and knowledge about using method of cognitive process that person founds how knows self-learning, also cognitive knowledge introduces to person how use of existent information for getting a aim, capacity of judgment about cognitive process in particular task and the acquaintance of what use of strategy for attaining to what aims and III) Flavell et al (1993) stated that cognitive knowledge has key role in setting person’s cognitive activities and it gets moment that person acquaints of self-cognitive capacities and also self-cognitive disabilities. Despite that there are differences and separations among kinds or various categories of cognitive knowledge, but elements of cognitive knowledge are not separate of another; but these elements act as whole and its performance depends to communications and conversions of these categories and kinds of cognitive knowledge. Because the lack of research in this field, necessary of research about effects of cognitive skills in mathematics lessons need to self-regulation growth of students.

**Hypothesis**

Students’ self-regulation rate who had taught through meta-cognitive method is more than students who had not taught through this method.

**METHODOLOGY**

In regard to research’s subject, research method is the quasi-experimental that we consider to study of data’s quality and quantity for the effect of cognitive skills on self-regulation rate of students through periodic quasi-experimental method. This method is suitable because participants were human then human will not indicate the real behavior. Therefore it is used of quasi-experimental method. In this implementing method, it has used of control and experiment groups. In experiment group, it implemented meta-cognitive skills on students in mathematics lesson. Independent variable is the effect of instruction and application of meta-cognitive skills in mathematics on self-regulation growth for first grade students in high school.

**Participants**

In regard to present research’s subject about effects of cognitive skills in mathematics education, statistical society includes of all first grade girl students in high school who are studying in academic year; 2010-2011 and numbers of all are 26964 girl students. In present research, resulted samples are selected via Cochran formula and through cluster sampling and equal to 198 students of high schools at zone 4 of education of Tehran randomly. Both control and experiment groups are include of 99 students which of groups are included of three classes with 33 students.

**Research Instrument**

In present research is used of self-regulation rate test which is provided of Tangney et al (2004) and this test has 36 points that responses of these 36 points is considered of five Likert scales; “no analogy”, “low analogy”, “natural”, “very analogy” and “extremely analogy”. General marks in this test was 36 and 180 at the least and highest status respectively. Content reliability of this instrument have acceptable via psychological expert; Mohammad Madjiyan (2008) and the validity of questionnaire is implemented on two license course’s students groups. The results in two first and second studies is proved with Cronbakh’s alpha; 0.89 that this value is acceptable.

**COLLECTING DATA METHOD**

In this method, it is considered to implement of pretest and posttest in launching self-regulation test for control and experiment groups. Self-regulation test have implemented before final exam in experiment group and also experiment group was under meta-cognitive skills instruction in mathematics learning and control group have taught mathematics learning thereby usual procedure. Finally results of this research had studied.
DATA ANALYSIS
For study of descriptive statistic, it have used of mean and Std. deviation and in deductive statistic part, it is used of nonparametric test; One-Sample Kolmogorov-Smirnov test for the normality of data and for testing hypothesis, it is used of parametric test; Leven’s test and independent samples test in meaningful level of 0.05.

FINDINGS
In Table 1, mean and Std. deviation of self-regulation's marks is identified in control and experiment groups. As shown in following, mean of self-regulation's marks in experiment group (M=126.36) are higher than mean of self-regulation's marks in control group (M=85.45).

Table 1- Descriptive statistic of self-regulation’s marks in control and experiment groups

<table>
<thead>
<tr>
<th>Self-regulation</th>
<th>N</th>
<th>Mean</th>
<th>Std.deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control group</td>
<td>99</td>
<td>85.45</td>
<td>23.78</td>
</tr>
<tr>
<td>Experiment group</td>
<td>99</td>
<td>126.36</td>
<td>28.87</td>
</tr>
</tbody>
</table>

In Table 2, for the selection of proper test for analysis of research hypothesis, we evaluated the normality of self-regulation's marks in control and experiment groups through One-Sample Kolmogorov-Smirnov test in meaningful level of 0.05. Results of this test in both groups show that self-regulation's marks are normal (P>0.05). Therefore, we can use of parametric tests; Leven’s test and independent samples tests for the evaluation of variances’ equivalence and comparison of self-regulation’s marks both two groups. In Figures 1, it clears that bars of self-regulation’s marks in experiment groups are higher than bars of self-regulation’s marks in control groups.

Figure 1- Self-regulation's marks of control and experiment groups

Table 2- Normality of self-regulation's marks of control and experiment groups

<table>
<thead>
<tr>
<th>Groups</th>
<th>Control group</th>
<th>Experiment group</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>99</td>
<td>99</td>
</tr>
<tr>
<td>Z</td>
<td>1.21</td>
<td>1.32</td>
</tr>
<tr>
<td>Sig</td>
<td>0.1</td>
<td>0.06</td>
</tr>
</tbody>
</table>

Table 3- Results of independent samples test for self-regulation’s marks of control and experiment groups

<table>
<thead>
<tr>
<th>Groups</th>
<th>Leven’s Test for Equality of Variances</th>
<th>T-test for Equality of Means</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>Sig</td>
</tr>
<tr>
<td>Equal Variances Assumed</td>
<td>7.76</td>
<td>0.00</td>
</tr>
<tr>
<td>Equal Variances Not Assumed</td>
<td>10.87</td>
<td>189.06</td>
</tr>
</tbody>
</table>

In Table 3, results of Leven’s test and independent samples test have shown in meaningful level of 0.05. As it is shown, results of Leven’s test show that variances of self-regulation's marks are not equal in control and experiment groups (F= 7.76, P<0.05). Also in above Table, results of independent samples test show that self-regulation's marks of experiment group are higher than self-regulation's marks of control group (T= 10.87, P<0.05). That is, there are meaningful differences between control and experiment groups.

CONCLUSION AND DISCUSSION
Capacity of human is the one of the powerful capacities for self-regulation activity and led to benefit consistency in human’s mind extremely. People will have the highest healthy and succulent conditions and when could create harmony and cooperation between self and their circumference, and this consistency could improve through self-changing in direction of accord to around global. Even today, it seems that many main social and personal problems resulted of weak in self-regulation. Through self-regulation, students forward low thinking level to high thinking level that is same meta-cognition. In regard to certain results which attain via respected hypothesis, it is adequate that instruction method base on meta-cognition consider seriously. Suggestion introduced to next researches; 1) in present research is used of self-regulation questionnaire (in relate to hypothesis) on students, in regard to this importance that learning is communicational process, it is adequate that this questionnaire shall implement for participated students.
teachers in this research also in addition to spread of statistical society in view of researcher. Because it expects that self-regulation of teachers increase in end of this research, 2) in regard to more emphasizes of theorists such as Vygotsky who considered the effect of environment, cultural and language on learning growth, in next researches in other zones of country shall note to meta-cognition and results of this research should generalize to the others instructional zones and 3) instructional material which use to teach of meta-cognitive skills, it shall accord and consistency to instructional programs that students force to it both interior and exterior of school, else results of evaluation will have not necessary validity. Limitations of this research include of 1) limitation of statistical society to girl students sexually, 2) it is difficult to launch of sessions base on explains and cooperation to teachers and attaining their consents for corrective and regular implement of design in identified timing in regard to their problems.

REFERENCES


