The Study of Teaching Effective Strategies on Student's Math Achievements

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Abstract
One of the most important factors in student's learning weakness and academic failure, is their unfamiliarity or low awareness of the learning strategies and studying in mathematics. This study is performed to examine the students' math and reading skills and their study skills that impact on their academic progress. The main objective of the research is to study with emphasis on training study strategies versus usual method (teaching without emphasis on training study strategies) to increase the learning of mathematical concepts. The present method is quasi-experimental that via quasi-cluster sampling to adopt 17 guidance girly schools in grade 3th, to gauge effects of teaching reading skills on math learning of the students. The results of T-test showed that students who were taught with emphasis on study skills versus students who have been traditionally trained, had better math performance and higher academic achievement. Therefore it seems that teaching reading strategies such as cognitive and meta-cognitive will ease mathematical learning process.

Keywords: Study skills, learning strategies, meta-cognition, cognition, reading, strategy.

1 Introduction

One of the mathematics education tasks is the finding reasons of the lack of learning mathematics among students [3]. Meta-cognition strategy are weekly skills during the learning, become active, and if the person does not know how to spend enough accuracy for study or how to determine the placement of information that was previously learned, learning is done with more difficultly, so the meta-strategies facilitate learning. In other words, meta-cognitive are tools for guiding and monitoring in cognitive strategies [8]. Vang (1985) stated that many problems of students relate to weak cognitive and meta-cognitive skills in learning. Students have weak performance who have not comprehended about self-mind's performance method and not only they did not inform of useful and proper cognitive strategies for easing
self-performance but have effective beginning capacity of review for using such strategies too [8]. Garner (1990) to clarify the distinction between cognitive and meta-cognitive strategies listed the following example: suppose a student is scheduled to participate in the exam. In order to prepare for this exam, he/she readout his/her textbook previously studied in the semester and reading about tips and takes notes for a review in exam night. Readout the textbook and note taking are two types of cognitive strategies because the students through them learn taught lessons and remind them. If our students, after reading and note taking of the final chapters notes, strive to answer questions, to evaluate their learning, this personal evaluation is considered meta-cognitive strategies. The result of this evaluation shows that student is not ready for the exam, he/she will be applied same cognitive or other cognitive strategies until he/she could obtain the necessary information [1]. Usually learning and study strategies introduce with two terms; cognitive and meta-cognitive strategies. The cognition is regular thinking process that included of thinking, memory, comprehend and actions related to the use of these process and in total, cognition is the knowing. Simply meta-cognition is to the recognition of cognition or knowing for knowing. Exactly meta-cognition is that person’s knowledge about how self-learning. Cognitive strategies are learning tools. These strategies organize in three general categories; 1) rehearsal, 2) expanding or semantic expanding, and 3) organizing. Rehearsal in the simplest form defines as stating a text for self with loud or slow voice. Semantic expanding strategy helps learner that communicates between previous knowledge and whatever is going to learn as bridge. Organizing is the best and full kind of learning and study strategies. It’s the kind of semantic expanding strategy but its different is that a framework or organizational structure imposes on learner when use of organizing strategy for meaning learning structure to contents that he/she is going to learn it [8]. Meta-cognitive strategies control on cognitive strategies and direct it. There are plans for controlling on cognitive strategies and guide on them. Main meta-cognitive strategies have three categories such as 1) programming strategies that include of the determination of the aim for learning and studying, predication of needful time for studying, determination of proper speed and analysis of how it faces to learning subject and the selection of learning, 2) evaluation and supervision strategies is the evaluation of learner of self-doing for informing of self-progress, supervision and guidance such as supervision on the notification in reading text, ask self when study and control on time and speed. This strategy helps learner when faced to problem, he/she determines it rapidly and removes it, and 3) regularize strategies that make to plasticity in learner’s behavior and help till change self-learning style and method when was needed [8]. The main aim of present study is to study of effect on using learning and study strategies for math achievement among girl students.

2 Learning and Study Strategies

Regard to the kinds of cognitive and meta-cognitive strategies, researchers cited main strategies that can use to learn mathematics concepts and effect on mathematics achievement [8].

2.1 PQ4R Strategy

One of the successful methods of the study and learning is the method that is known as PQ4R. PQ4R term composed of first letter of six stages of this study method such as Preview, Question, Reading, Reflect, Recite, and Review. Preview stage is to read generally that subjects and contents of math book will be glanced. In this stage, learner must view and think to math concepts or problems in general till informs of them. Question stage can help learner that observes the circumstance of mathematical problems until noted to the main goal of problems. Reading stage is that learner can read mathematical questions or problems exactly. This stage is very important because learner can percept the content of problem. Reflect stage can relate previous information of learner to new contents of mathematics. In this stage, unessential cases will be removed. Recite stage tries that reader or learner states mathematical concepts or problems
for self in new imaging schema or frames. Review stage includes of recite previous unknown contents to respond them again and use of this stage for deep learning.

![PQ4R Diagram](image)

Figure 1: Cognitive and meta-cognitive strategies (1) for learning mathematics

### 2.2 MURDER Strategy

Other strategy in the cognitive and meta-cognitive strategies is MUERDER that is included as following [8]:

- **Mood:** For learning new mathematics concepts, you have to think positively and relax. Learners who have stress, cannot learn new concepts because they fear that did not learn. In general, ready to learn and don't worry about new mathematical concepts. You can learn all mathematics concepts with motivation.

- **Understand:** For learning new mathematics concepts, it needs that think deeply and if you did not percept concepts of math, did not follow the newest concepts and or problems. You have to determine key points in mathematical problems.

- **Recall:** Remind previous contents in math books, mathematical problems solving need to refer to known knowledge. Learners can analysis and find new mathematical concepts that related to present mathematical problems.

- **Detect and Digest:** Back to problems which you cannot solve already, find and discover key cases which related to unknown knowledge or information for problem solving in mathematics. Compose steps of problem solving and then relate all steps till find new solution for mathematical problems.

- **Expand:** Ask self about mathematics contents which have read already. You can study whether previous contents are applied in routine living or not. It's important that you related contents that learned to define for other learners and cited that new mathematics contents can useful for living. Through this strategy, learning process works deeply.

- **Review and Respond:** Focus on the goals of learning mathematics. You can remove mistakes in problem solving and focus on what is learned. If you have not learned properly, you can apply other strategy because whatever you have learned, are not effective and deep. Respond to your questions which have not response them yet.

There are other strategies for learning process that can effect on mathematics achievement but it's important that teachers/instructors introduced these methods for learners and they applied these strategies to improve learning mathematics.
3 Literature Review

Here there are many researches for learning and study strategies that are similar to present study. The study of backgrounds helps to remove lacks of previous researches. Nolthing (1990) considered the impact of education on mathematics achievement levels. His research focused on emotional characteristics that could affect the achievement. In his study, students were divided into three groups: the first group, teaching study skills, and the second group received both counseling related to academic achievement and teaching study skills, the third group received no training or counseling. Exam scores and final course grades of students was measured. Results showed that the student that received both types of training programs, as well as study skills and counseling (five one-hour sessions), particularly those had severe high anxiety and poor study skills, developed their study skills and reduced their anxiety, and final exam scores and their scores was much higher compared with the control group (group III). Only students who had received training study (group II) showed improvement in study skills and reduce anxiety. They did not show a significant change in position relative to the control group (group III) that compared with the control group. In general, experiment groups (groups I and II) of those who successfully passed their math lesson, was 66%, while the rate was 33% in the control group [3]. Hamersama (1992) studied the impact of study skills on academic performance of students in a university mathematics department. Students were divided into two groups. The first group participated in both the math classroom and in the laboratory for
study skills, but the second group, just participated in the classroom. At the end of the math teaching course, the first group passed with 80%, and 60% rate passed in the second group [2]. Kinkanon, Gilber and Kim (1999) examined the effects of meta-cognitive instruction about 60 students make to the conclusion that teaching to use meta-cognitive strategies affects the learning and performance [7].

4 Research Hypothesis

Teaching with an emphasis on reading strategies versus the traditional method, increases the learning of mathematical concepts.

5 Methodology

Since this study has occurred in real environment and human's behaviors has under controlled quietly then it may be that all real behaviors of human did not occur. Then, study method is quasi-experimental method and researcher selected control and experiment groups randomly. It is used of traditional method in control group and new instructional method or teaching study strategies method is used for experiment group. Finally the effects of new instructional method has studied and compared against control group.

6 Participants

The population of this study is the students of the third grade of junior guidance at girly school in the academic years; 2012-2013 at Kahrizak city of Tehran province. Via quasi-cluster sampling method, was selected a school from 17 schools in the Kahrizak. Since selected school has 9 classes in third grade, via quasi-cluster sampling method, two classes were randomly selected that one of two classes have been received training reading skills (experiment group) but in the other class, students were taught in the traditional method (control group). It is selected 72 students as sample generally.

7 Research Instrumentations

For control and experiment groups, math exam as pretests are implemented with 15 questions that are designed through Education of Tehran that total score was 20. For posttests, 16 questions as final math exam have designed that included whole math book for control and experiment groups that total score was equal 20. Respected math exams are performed for students before present research until are studied validity. Its validity are studied via spilt-half method. Coefficient of Guttman equals 0.75 that is proper.

8 Collecting Data Method

To obtain data for this study, the pretests were held for both control and experiment groups. Then for teaching new mathematical contents, researchers were trained the study strategies such as PQ4R and MURDER to students for experiment group while other group were taught same contents via the traditional method. Finally, posttests held for both control and experiment groups. After carrying out research, researchers indicated descriptive and inferential statistics for both groups.

9 Data Analysis Method

Statistical methods have been used to data analysis for this research. At descriptive statistics, indexes such as mean and standard deviation are indicated and in inferential statistics, Kolomogorov–Smirnov test
is used to the study of normality of means and comparison for both groups. For determining the differences between variances and means, Leven and independent samples T–tests at $\alpha=0.05$ are used.

10 Findings

Here the data are achieved via the research are analyzed in two parts of descriptive and inferential statistics. In the first part as shown in Table 1, the mean of experiment and control groups in pretest and posttest have been compared. As it is shown, the mean of posttest of experiment group is more than posttest of control group. The lowest Std is related to the posttest of experiment group.

<table>
<thead>
<tr>
<th>Groups</th>
<th>N</th>
<th>Mean</th>
<th>Std</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest of control group</td>
<td>37</td>
<td>13.79</td>
<td>2.74</td>
</tr>
<tr>
<td>Pretest of experiment group</td>
<td>35</td>
<td>13.86</td>
<td>2.88</td>
</tr>
<tr>
<td>Posttest control group</td>
<td>37</td>
<td>14.19</td>
<td>2.79</td>
</tr>
<tr>
<td>Posttest of experiment group</td>
<td>35</td>
<td>15.36</td>
<td>1.48</td>
</tr>
</tbody>
</table>

Table 1: Descriptive statistics of control and experiment groups

To study of the normality and selection of proper hypothesis test, Kolmogorov–Smirnov test is used. Regard to Table 2, since P-values are more than 0.05, so data are normal and parametric tests can be used.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Pretest of control group</th>
<th>Pretest of experiment group</th>
<th>Posttest of control group</th>
<th>Posttest of experiment group</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-value</td>
<td>0.56</td>
<td>0.6</td>
<td>0.63</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Table 2: The result of Kolmogorov–Smirnov test

Before testing hypothesis, it is studied the difference between level for both groups in pretests. As shown in Table 3, the results of Leven test reveals that variances are equal ($P=0.21 > 0.05$) in pretests. According to Independent Samples T-test, there is no meaningful difference between the mean of control and experiment groups in pretests ($P=0.98 > 0.05$). Therefore control and experiment groups are obviously in an equal level.

<table>
<thead>
<tr>
<th>Pretests</th>
<th>Leven test</th>
<th>T-test for Equality of Means</th>
<th>Mean Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>P-value</td>
<td>t</td>
</tr>
<tr>
<td>Equal variances assumed</td>
<td>1.52</td>
<td>0.21</td>
<td>0.02</td>
</tr>
<tr>
<td>Equal variance Not assumed</td>
<td></td>
<td></td>
<td>0.02</td>
</tr>
</tbody>
</table>

Table 3: The results of T-test for pretests

Regard to Table 4, it indicates that variances of posttests equal through Leven test ($P=0.08 > 0.05$). In addition, it obvious that means of posttests do not equal that is there are significant difference between posttests in T-test ($P=0.00 < 0.05$). This result shows that teaching with emphasis on trainig study strategies versus traditional method (teaching without an emphasis on trainig of learning and study strategies) to increase the learning of mathematical concepts.
11 Conclusion

Cognitive strategies help us that prepared new information in order to relate to known information and saving in long-term memory. Cognitive strategies are essential instrumentations for learning contents but meta-cognitive strategy supervise cognitive strategies and guide them. In other words, it can teach many cognitive learning strategies to learners but if they did not inform of when and which cognitive strategies have to apply in determined status and change it, then will not success. Then cognitive and meta-cognitive strategies have to work altogether. Cognitive and meta-cognitive can new issue and revolution in teaching-learning process in mathematics. Since mathematical concepts and subjects are abstract therefore it needs that learners inform of effective strategies for deep learning because mathematical concepts have the relations altogether and if learners forget previous concept, he/she cannot learn and get to new concepts. Therefore it seems that cognitive and meta-cognitive strategies improve learning quality in mathematics. Conducted research on strategies or learning strategies (cognitive and meta-cognitive strategies) have shown that the use of these method improved learning and learning achievement. In this study, the results showed that in the mean of control and experiment groups were significant differences. It concludes that students who trained with an emphasis on study strategies than students who are traditionally trained had better math performance and higher educational achievement (highest grade). Some suggestions has been made as follows to further studies:

- Some research must conduct on the kind of attitude and motivation of students concerning teaching study skills,
- Research with same subject on large number of girl and boy students must conduct and their performances have to compare.
- This research must do on several subjects of textbooks.

There are limitations in this research such as; this research is limited for mathematics textbook and it is implemented to girl students of guidance school.
References


