A Comparison between Cooperation Learning Method and Traditional Teaching Method with the Aim to Improve the Ability of Solving Math Problems

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Abstract
Closing a teaching method is one of the important stages of instructional design. Cooperation learning approach is considered as a new approach in teaching. Cooperation learning method is one of the most interesting teaching methods. Studies show that, among various factors (environmental and individual) that affect learning and the learners' academic achievement, environmental factors play important roles. Henceforth, this issue seems necessary to enhance the quality of teaching and to increase the problem solving ability. Therefore, this study dealt with an investigation on the effect of cooperative learning method of teaching on enhancing the problem solving ability. The sample consisted of 60 students in the sixth grade elementary school, studying in city of Dezful, that through a math test, students' problem solving ability was investigated in this grade. Using independent t-test, statistical results for the independent samples, has shown that the ability of math problem solving of the students in cooperation learning is higher than this ability in traditional method.

Keywords: Mathematics, cooperative learning, problem solving, traditional method, teaching.

1 Introduction

The theoretical basis of cooperative learning goes back to the time in the early twentieth century, when Dewey encouraged teachers to form groups for investigating and problem solving. In 1980s, cooperation learning re-emerged with the approach which considers learning as a social process, and learning activities to reach the stage of production of ideas and information, vital. Cooperation learning classes can be run through various forms of students' group learning, using puzzle or dividing the topic to various areas, co-learning, group research, individual learning based on the group's support and help, group-game – competition, and cooperation writing. To create a successful learning community, mutual positive participation and interdependence must take place between different levels of learning, that is to say among the learning groups of a same grade students, the classrooms, schools, school and family, and school and
local community (Fazli, 2011) [3]. The term "cooperation learning" refers to a teaching method in which the students work together in small groups to achieve a common goal and in addition to being responsible of their own learning, they feel responsible for others and try to maximize their own learning and others' learning through achieving them (Gokhale, 1995; as cited in Keramati, 2005 [4]). Today teaching problem-solving has shifted to the approach of teaching mathematics through problem solving, and many researchers have tried to explain and define the problem-solving approach to teaching mathematics. Teaching mathematics contents in problem solving contexts and in environments mixed by inquiring is actually a help to learners in achieving a deep understanding of mathematics which is provided through involving them in doing mathematical tasks, tasks related to the fields of innovation and creativity, guessing, research and investigation. However, problem solving must become a part of any mathematical learning experience. The term "problem solving" is used with different meanings and range in the context of mathematical activities; But in the field of mathematics teaching, and particularly considering school mathematics, we are interested in situations in which students must follow certain behavioral objectives in emergence of mathematical behavior; while they do not know how to achieve these goals (Allamolhodai, 2009) [2]. The goal of teaching is to increase the learning ability. Teaching well means helping students to learn well. Effective teachers are not only the providers of knowledge, but also are those who teach their students how to use that knowledge effectively. Studies show that various factors (environmental and individual) affect the learning and academic achievement of the learners, therefore paying attention to this issue seems necessary in order to raise the quality of teaching. Henceforth, in this study we will focus on the effect of new collaborative learning method of teaching on problem-solving ability. The researchers aim to answer the following question: Does teaching in cooperation learning method of teaching in comparison to traditional methods, lead to increase the problem solving ability?

2 Review of Literature

Up to now, no study has been conducted exactly under the topic of the present study. However we point out to some studies on collaborative learning which has been done either inside or outside of the country. Talebi (2005) [6] in a study on second grade guidance school students studying in Urmia, Azerbaijan, Iran, compared the effect of traditional methods and cooperation learning method of teaching on academic achievement and learning attitudes of students toward mathematics. His research findings indicated that the academic achievement of students who were trained through cooperation learning method of teaching was significantly higher than students who were tested by traditional method. Esfandiar (2009) in his study on the relationship between students' active participation in the process of teaching and academic achievement showed that there is a positive relationship between students' participation and their academic achievement (Yosefipour, 2013) [8]. In a study entitled "The effect of cooperation learning method of teaching mathematics on enhancing students' confidence in problem-solving of Math (I) course in girls high school of Sanandaj", Mafakheri (2013) [5] showed that shifting teaching method to cooperation method alone cannot be effective on enhancing confidence and problem solving ability. Through the analysis of all extracted factors from the questionnaires, his study also revealed that, the factors of indifference and the feeling of inability to solve the problem had led to these results. Winston (2002, as cited in Yousefipour, 2013) in a study entitled "the effects of cooperation learning on progress and attitude of fifth grade students in different cultures of United States", came to this conclusion that cooperation learning has a positive effect on students' attitudes towards mathematics and their academic achievement in this course. Tracey et al. (2010) [7] conducted a large-scale study in UK and found no significant difference in learning fourth and fifth grade mathematics between classes using cooperation learning method and control classes. However, the application of this method was generally poor, and it was necessary to make this approach more consistent with the curriculum and culture of Britain. Aziz & Hossain (2010) [1] compared traditional teaching method and collaborative teaching method on Malaysian second grade high school students'
achievement in mathematics. The results showed that compared to traditional teaching methods, cooperation teaching method creates greater academic achievements in students.

3 Methodology

The methodology used in this study must be consistent with the aims of the study which is to evaluate the performance of sixth grade students in solving problems using collaborative learning method. According to the aim and nature of this study, population included all sixth grade elementary male students studying in Fath al- Mobin school in Dezful city during the academic year 2014-2015. To select the sample in this study, we used non-random sampling method, the type of using available samples, that is to say, the researcher chose the school he was teaching there which was consisted of three sixth grade classes. Two classes were selected randomly from among these three classes. These two classes were then randomly chosen to be used as control and experimental groups. The control group consisted of 30 students and the experimental group also consisted of 30 students. The Standard math test was used as research instrument. This test was developed by experts and teachers of mathematics and the total score is 20.

3.1. Procedure

In this study, study cards-based approach was used and the study conducted as follow:

- Most of the time students were trained in larger groups consisting more than 4 students.
- Each student was required to explain to his partner about the way he solved the exercise, in which the student relying on and based on the previous card had gained experience to solve, listening to the explanations provided by one of the members in his group and also the way to deal with new card based on the already solved exercise.
- Each student was required to solve the already solved exercise which his friend was explained to him and called upon, and if necessary to ask his friend if he could handle finding the solution to the question he is helping him to solve before or not.
- After the completion of work on a pair of cards, students joined their partners in the group, which helps the members of each group to have the opportunity to play both the roles of student and teacher.

3.2. Study Card Preparation

Since, in this study, the collaborative learning method is based on the use of study cards in the group, following issues can be raised to explain the content of these cards and the way they were prepared: Each set of cards makes a learning unit. Each set consists of 2, 4 or 6 study cards. The order in which the cards can be used is not important. Each card contains 2 or 3 parts. Part 1 contains a solved example. The descriptions on the card depends on the students’ level and their learning -based experience in the subject. Part 2 contains a problem/exercise similar to the solved example in the first part of the card, serving for individual and separate solutions of the students.Part 3, if necessary, includes an additional problem to be solved by more advanced students. For each study card there exists a homework card as well. In collaborative learning method based on the use of study cards, the learning environment can be grouped into two main forms: groups of experts, and groups for the exchange of knowledge, which are elaborated below:

3.3. Group of Experts

The number of students in this group is not more than 6 students. Each student in a particular group achieves a similar card. Number of students who receive different cards are equal. All these groups include students with different levels of success. The instructor makes sure that a student is at the highest level of success. Through this way, the students can help the teacher to monitor the issue and the precision of teamwork. The teacher also monitors the work of these students, so that the person is responsible for reviewing the work of all members of the group. Students must understand the solved problem in the first part of the card, and are
needed to solve the questions in second part individually. Each student may seek any needed help. Students compare their solutions in their groups and correct their solutions. The work in expert group is completed when students agree upon their answers to questions in part 2 of the cards in their group. Then students work in new groups to continue their scientific exchange.

3.4. Group of Knowledge Exchange
The number of students in one group must be equal to the number of cards in the learning unit. Like in Puzzle method, each student has experienced the information on the card differently from the cards of the other students in the group of knowledge exchange. For example, if four cards be in a card series, the group consists of 4 students. Each student has a different card. Those students with high success rate work and learn in homogeneous groups, while low-level and intermediate students learn and work in heterogeneous groups to work according to their needs. This arrangement enables students with low achievement to feel more comfortable and believe that they can succeed in mathematics. Those with high success rate can learn additional subjects through the exercises in part 3 of the cards. Intermediate students can enhance their self-trust and confidence in their math abilities with the help of other students. In the group of knowledge exchange, students work as full time partners.

4 Findings

4.1. Descriptive Statistics
To analyze the findings in this section, we first deal with the calculation of the descriptive parameters such as mean, standard deviation and mode for scores of pre-test and post-test for the two methods of traditional teaching method and cooperation learning method of teaching in the control and experimental groups, results of which are shown in Table 1:

<table>
<thead>
<tr>
<th>Teaching method</th>
<th>Traditional method</th>
<th>Cooperation learning method</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-test</td>
<td>Post-test</td>
</tr>
<tr>
<td>Number</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Mode</td>
<td>4.25</td>
<td>9</td>
</tr>
<tr>
<td>Mean</td>
<td>12.31</td>
<td>10.02</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>4.8</td>
<td>4.45</td>
</tr>
</tbody>
</table>

As shown in Table 1, it is clear that in the pre-test of both cases of traditional and cooperation learning, the mean of the scores in both control and experimental groups, had no significant difference. In the post-tests as shown above, the score mean of collaborative learning method is higher than traditional method. Moreover, the highest mode belongs to the posttest of the group trained through cooperation learning method. The lowest score distribution also belongs to the post-test of the group trained through cooperation learning method.

4.2. Inferential Statistics
Using Kolmogorov-Smirnov test, we first examine the normality of the scores in both groups. Since the obtained P-values are greater than 0.05, therefore, the hypothesis of normality of the data is supported. According to the normality of the data, in order to carry out this hypothesis, the t-test for independent samples is used, which results are shown in Table 2:
Table 2: The results of the pre-tests

<table>
<thead>
<tr>
<th>Pretests</th>
<th>Levene’s Test for Equality of Variances</th>
<th>t-test for Equality of Means</th>
<th>95% Confidence Interval of the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>Sig.</td>
<td>t</td>
</tr>
<tr>
<td>Equal variances assumed</td>
<td>0.000</td>
<td>0.99</td>
<td>-0.3</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td></td>
<td></td>
<td>-0.3</td>
</tr>
</tbody>
</table>

As the Results of Table 2 shows, the obtained P-value is greater than 0.05 (0.76 > 0.05), and there is no significant difference between the pre-test scores in both traditional and cooperation learning methods. Therefore, it can be concluded that the problem-solving ability of the students are the same for both groups of cooperation learning method and traditional method in the pre-tests. Finally, the test for comparison of students' problem-solving ability in these two groups will be studied for post-tests. As is clear, in order to analyze this test, the independent samples t-test method was used, which results are shown in Table 3:

Table 3: The results of the posttests

<table>
<thead>
<tr>
<th>Posttests</th>
<th>Levene’s Test for Equality of Variances</th>
<th>t-test for Equality of Means</th>
<th>95% Confidence Interval of the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>Sig.</td>
<td>t</td>
</tr>
<tr>
<td>Equal variances assumed</td>
<td>3.52</td>
<td>0.06</td>
<td>-3.88</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td></td>
<td></td>
<td>-3.88</td>
</tr>
</tbody>
</table>

According to the P-value obtained in Table 3, which is smaller than 0.05 (0.000 < 0.05), therefore, the null hypothesis is rejected, that is, the students' ability to solve math in post-tests has significant difference in two methods of traditional and cooperation learning.

5 Discussion and Conclusion

According to the obtained results, it was shown that the students' ability of solving math problems in post-tests, in both traditional and cooperation learning methods are significantly different (P<0.05). In other words, it was shown that cooperation learning methods can affect the students' ability of solving math problems. This conclusion has been derived out of some reasons. One of the major concerns of all Theorists of mathematics is the creation of the ability of problem solving in learners of mathematics. Mathematical problem solving has achieved new and substantial theories in the way of teaching and learning the ways of solving mathematical problems, through combining and modifying the theories of Piaget, Vygotsky, and so on. The main and ultimate goal of teaching any concept in mathematics, is nurturing the talent of problem-solving ability in students. Lack of attention to the problem solving teaching method and understanding it, will make the students unable to use their previously learnt knowledge in solving problems when they face a new situation or practical activities. Every math teacher or learner recognizes that problem solving ability requires something more than a set of skills and techniques. The ability of monitoring the progress during
problem solving process and the awareness of the capabilities and limitations of the individuals are important. To enhance this ability in mathematical problems, conditions and environmental factors can provide progress or failure. What can be seen in schools is the passive teaching-learning process. One of the factors that can lead to the progress in the ability of solving math problems is the use of active teaching-learning methods. One of these methods is collaborative learning. Teaching in small groups, is one of the main components of learning and problem solving. Students learn to monitor and evaluate the accuracy of their work, while working in small groups. At a time when students are engaged in problem solving in their small groups, the teacher should make sure that each of them are engaged in math activity, everyone knows his responsibility and everyone puts his responsibility into action. Placing the learners in groups of three or four to work on a problem, is a very useful strategy for encouraging predicted discussions and interactions in a math class. In small groups, learners have more permission and power to talk, explore ideas, explain things to their group members, ask and learn from each other, reasoning and having personal ideas which are challenged in a friendly environment. Hence in the present study, the reason for the enhance in students' ability in solving math problems, was due to the implementation of cooperation learning which led to the efficient thinking of the group of students in solving math problems. The results of this study are to some extent consistent with the results obtained by Talebi (2005) [6], Mafakheri (2013) [5], and Aziz & Hossein (2010) [1]. Suggestions for further research are listed below:

- It is suggested that a study on cooperation learning method of teaching be conducted on female and male students in higher grades in order to investigate and analyze the differences that exist between them in their performance, motivation, anxiety and problem-solving abilities based on their gender.
- It is suggested that a study on cooperation learning be conducted and investigated for other subjects that require careful disposal of students' learning problems, such as science, social science, history, etc.
- It is suggested that a study on problem solving ability be conducted and investigated for other subjects being taught in high school, such as physics, chemistry and etc.; and
- It is suggested that the effectiveness of cooperation learning method of teaching be investigated in higher educational levels such as high school level (in new educational period) since it is likely that cooperation learning be effective in higher levels.

References


