

THE IMPLEMENTATION OF LEARNING TOGETHER MODEL IN TEACHING AND LEARNING MATHEMATICS

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ABSTRACT

This research study investigated the effects of Learning Together model of group learning on students' mathematics achievement and attitudes toward mathematics, and identified teachers' perception on the implementation of Learning Together in secondary mathematics classrooms. The mood of triangulation, a combination of quantitative and qualitative methods for data collection and data analysis, was employed in the study. The researcher administered a quasi-experimental 'Equivalent control group with pre-test and post-test' design on a sample of 112 students to find out the effects of Learning Together, and conducted interview with experimental teachers to identify the teachers' perception. Data were collected using students' mathematics achievement test, attitudes toward mathematics questionnaire and teachers' interview. The independent-sample t-test was used to analyze the quantitative data while the content analysis was used to analyze the qualitative data. The results showed that the effects of Learning Together on students' mathematics achievement and attitudes toward mathematics were significant, and the teachers' perception on the implementation of Learning Together was positive. The findings revealed that Learning Together model contributed to the development of students' mathematical performance due to proper formation of groups, group members' cooperation to each other's learning and their sincerity to teachers' incentives during the treatment period.

INTRODUCTION

Learning Together model of group learning is well documented as an effective teaching and learning method in mathematics education at primary, secondary and tertiary level. According to Johnson and Johnson (1994), group learning is an instructional method in which students are grouped in small learning teams and work in cooperation with each other to perform a task presented by the teacher. Group learning is a mood of learning in which students of different levels of ability work together in small groups to reach a common goal, that is, all will go together and nobody will be behind. Group learning is a Learning Together to help each other, share each other and facilitate each other's learning to achieve a shared goal. Johnson and Johnson (year) indicate that Learning Together requires elements of positive interdependence, individual accountability, face-to-face promotive interaction, appropriate use of group skills and group processing to achieve the best group results by means of mutual assistance among the group members. All the members of the group must work on the task assigned by the teacher and each is aware that the success or failure of each individual will affect the result of the whole group. Rimmerman (2004) referred to Johnson and Johnson's (year) work as the modern era of group learning. Their model of group learning is known as Learning Together can be applied to any discipline and grade level.

Learning Together is a group learning strategy developed by Johnson and Johnson (1994) to improve students' mathematics achievement and attitudes toward mathematics. The Learning Together model consists of five elements such as positive interdependence, individual accountability, face-to-face promotive interaction, interpersonal and small-group skills, and group processing. Positive interdependence means all members in a group cannot succeed unless everyone succeeds. Individual accountability means everyone is responsible toward contribution of sharing his or her part in the group. The purpose of individual accountability is to make each member a stronger individual, that is, students learn together so that they can perform better as individuals. The group itself is accountable for achieving its goals and each member is responsible toward contributing his or her share of work. Group members should continue help, share, encourage, and support each other's efforts to do well through promotive interaction within their groups. Further, to make the group work fair and congenial, Johnson and Johnson develop group members' interpersonal and small-group skills of leadership, decision making, trust building, and conflict management in case of any conflict among group members for the benefit of greater success. Furthermore, they stressed that group members should act upon group processing to check their degree of success and reflect how well the group is functioning to reach a common goal. Every group member should acknowledge each other's effort in the group work to achieve a shared goal.

To examine the effects of Learning Together of group learning on students' mathematics achievement and attitudes toward mathematics, and to identify the teachers' perception on the implementation of Learning

Together, the researcher conducted this research study in selected secondary schools in Natore, Bangladesh. In Bangladesh, secondary school certificate (SSC) is the first major public examination faced by the students after completion of two years of secondary education. The SSC is an indicator of the quality of secondary education but no students from 24 schools passed in SSC examination in 2014 (BISE, 2014) and in which most of them failed in mathematics. This failure rate indicates deficiency in teaching of mathematics. According to Hossain et al. (2013), to minimize the failing rate in SSC examination, teachers should find ways to enhance students' learning. In their study they found group learning is effective in teaching and learning mathematics. Samad (2005) reported based on a sample of Bangladesh secondary students' mathematical performance that teachers are familiar with conventional mode of thought and teaching; teachers' teaching strategies based on their individual creativity. He commented that this traditional teaching strategy has negative impact in students' performance in SSC examination. He stresses the need of involvement of secondary teachers with those methods of teaching which have positive impact in students' academic performance.

There are many methods of teaching and learning, of them, group learning is important because group learning has been a subject of interest to many researchers and at the secondary school level, there is a substantial body of literature supporting the idea that students can attain higher achievement, especially in mathematics, through Learning Together in groups. Zakaria et al. (2010) embarked on a study to determine the effects of group learning on students' mathematics achievement and attitudes toward mathematics. They found group learning improved students' achievement in mathematics and attitudes toward mathematics. They concluded that student-centered approaches such as group learning improved mathematical performance, and teachers in schools who teach mathematics need to be aware of the benefits and importance of group learning and thus changing the practice of teacher-centered teaching method to student-centered teaching and learning method. Alabekee et al. (2015) examined the effects of group learning on students' achievement in mathematics. They found that the performance of experimental students of group learning was better than the conventional students of traditional way of teaching in improving their achievement in mathematics. Ozsoy and Yildiz (2004) among others conducted an experimental research on the use of group learning in mathematics. They investigated the effects of Learning Together, a group learning strategy, on mathematics achievement. In the study, the control group received traditional mathematics instruction, while the experimental group received mathematics instruction using Learning Together model of group learning. The researcher used the pre-test and post-test design and compares mean scores. Results revealed a significant difference in favor of the Learning Together of group learning techniques. Other studies had similar findings that group learning has produced positive effects on mathematics achievement and attitudes toward mathematics reported by Barbato (2000), Effandi (2003), Gubbad (2010) and Martin (2005). Hence this research study aimed at identifying the effects of Learning Together model of group learning on students' mathematics achievement and attitudes toward mathematics, and investigating teachers' perception on the implementation of Learning Together in selected secondary schools in Natore, Bangladesh. The objectives of this study were:

1. To examine the effects of Learning Together on students' mathematics achievement.
2. To identify the effects of Learning Together on students' attitudes toward mathematics.
3. To identify the teachers' perception on the implementation of Learning Together.

METHODOLOGY

Research Design

The research study employed both the quantitative and qualitative methods for data collection and data analysis. To obtain the research objectives, the researcher utilized the mode of triangulation. Social science researchers like Miles and Huberman (1994), and Sechrest and Sidani (1995) have supported the combination of quantitative and qualitative data collection techniques in conducting research, and noted that both could be complement and supplement each other. Cohen et al. (2002) also emphasize the advantages of triangulation by stating that triangular techniques attempt to explain more fully the richness and complexity of human behavior by making use of both quantitative and qualitative data.

To obtain the three research objectives, the research study was conducted into two parts: (i) quantitative research method and (ii) qualitative research method. In the first part, the quantitative research method used was a quasi-experimental design. The quantitative research method was used to obtain the first two research objectives.

The second part of the study focused on the qualitative research method that involved interviewing the mathematics teachers. The qualitative research method was used to address the third research objective.

To investigate the effects of Learning Together model of group learning in comparison to conventional teaching, the study employed a quasi-experimental ‘Equivalent control group with pre-test and post-test’ (Berg & Latin, 1994; Campbell & Stanley, 1963) design. The equivalent control group refers to the elements that no characteristics between two groups had a different expected value. Prior to the experimental treatment, two groups should be similar in every respect. An initial observation (e.g., a pre-test) can confirm that the two groups are at least similar in terms of the dependent variables under investigation. If, after one group has received the experimental treatment, we then find group differences with respect to the dependent variable, we might reasonably conclude that the post-treatment differences probably the result of that treatment (Leedy & Ormrod, 2001). In this study, the preliminary pre-test was conducted on students’ mathematics achievement and attitudes toward mathematics in both the control and experimental groups, and the results illustrated that both groups were equivalent in terms of the students’ mathematics achievement and attitudes toward mathematics prior to the treatment. In addition, the respondents for both groups were equal, at the pre-treatment stage, their performance in both experimental and control groups were equivalent, and they started out equal before the treatment strategy was given.

The quasi-experimental design compared a control group of conventional teaching method with an experimental group using group learning based on the Learning Together model of Johnson and Johnson (1994). Table 1 shows a quasi-experimental design and Figure 1 shows the mode of triangulation. In Table 1, A represented the experimental group while B represented the control group. O₁ represented the pre-test while the post-test was represented as O₂ for the experimental and control groups respectively. The Learning Together treatment was represented as X.

Table 1: Equivalent pre-test and post-test control group design

| Group | Pre-test | Treatment | Post-test |
|-----------------|----------------|-----------|----------------|
| A (n = 56) | O ₁ | X | O ₂ |
| B (n = 56) | O ₁ | - | O ₂ |

To identify the mathematics teachers’ perception on the implementation of Learning Together of group learning in the mathematics classrooms, the researcher conducted interview with the experimental teachers. Figure 1 shows the mode of triangulation where qualitative data were triangulated with quantitative data to find out the effects of Learning Together on students’ mathematical performance.

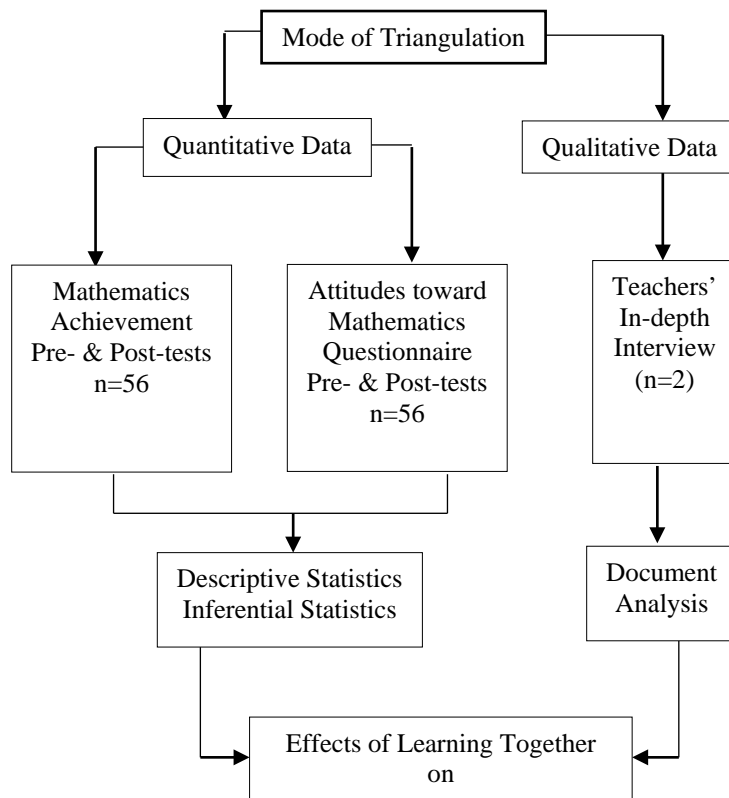


Figure 1: Mode of triangulation

Participants

The participants under this research study were the grade IX students of selected secondary schools in Natore, Bangladesh. Prior to implementation of the study, the researcher obtained permission from the District Education Officer of Government of the People's Republic of Bangladesh for conducting this study. Dharabarisha High School and Sher-e-Bangla High School were approved by the District Education Officer to carry out this study. A total of 112 full-time students (56 students for experimental group and the other 56 students for control group) from 2 secondary schools constituted the sample. Each experimental school comprised two sections in which Section-I was represented as the experimental group while Section-II represented the control group in Grade-IX mathematics classrooms as per the directives of the Headmasters of the sample schools. The duration of this study was five months from 1st of January to 31st of May 2015.

Instruments

The instruments used in this study were students' mathematics achievement test, attitudes toward mathematics questionnaire and teachers' interview. Content validity for the instruments, ie, students' mathematics achievement test, students' attitudes toward mathematics questionnaire and teachers' interview were determined through the consensus of the experts in the relevant field. The instruments in this study were content validated by the District Education Officer of Government of the People's Republic of Bangladesh; a professor of mathematics, University of Dhaka; and a professor of mathematics, University of Rajshahi.

The reliability of the items in the students' attitudes toward mathematics questionnaire was determined by computing the Cronbach's Alpha reliability index. The item analysis was also carried out to measure the correlation coefficient of all the items. The Cronbach's Alpha reliability coefficient of the students' attitudes toward mathematics questionnaire was 0.81.

Data Collection

The students in both the experimental and control groups completed the pre-test and post-test of students' mathematics achievement and attitudes toward mathematics. These quantitative data were coded using statistical software SPSS. These quantitative data were treated as interval scale in this research. As for qualitative data, the researcher conducted semi-structured interview with 2 experimental teachers (T1 & T2) in the form of verbatim transcript.

Data Analysis

Descriptive and inferential statistics were used to analyze the quantitative data while content analysis was employed to analyze the qualitative data. Demographic information of the participants such as frequency, mean and standard deviation were summarized using descriptive statistics. And to test the hypothesis, inferential statistics, ie, independent-sample t-test was administered.

RESULTS

The results are reported in light of the objectives of this research study as mentioned earlier. To examine the effects of Learning Together of group learning on students' mathematics achievement, independent-sample t-test was used to analyze pre-test and post-test mean scores of students in experimental and control groups. As depicted in Table 2, the pre-test mean score for the experimental group was 10.98 (SD = 0.70) and that of control group was 10.94 (SD = 0.72). The difference between mathematics achievement pre-test mean scores of two groups [$t(110) = 0.26, p > 0.05$] is not significant at 0.05 alpha level. This suggests that performance of both groups were equivalent at the start of this study.

Table 2: Students' mathematics achievement pre-test mean scores between experimental and control groups are compared using independent-sample test

| Group | n | Mean | SD | t | df | Sig(2-tailed) |
|--------------------|----|-------|------|------|-----|---------------|
| Experimental Group | 56 | 10.98 | 0.70 | 0.26 | 110 | 0.79 |
| Control Group | 56 | 10.94 | 0.72 | | | |

Table 3 shows the post-test mean score of experimental group is 22.05 (SD = 1.63) which is higher than the post-test mean score, 17.16 (SD = 1.53) of control group. The difference between these two post-test means was significant [$t(110) = 16.33, p < 0.05$] in favor of the experimental group which revealed that the students' mathematics achievement of experimental group was significantly better than control group.

Table 3: Students' mathematics achievement post-test mean scores between experimental and control groups are compared using independent-sample t-test

| Group | n | Mean | SD | t | df | Sig(2-tailed) |
|--------------------|----|-------|------|-------|-----|---------------|
| Experimental Group | 56 | 22.05 | 1.63 | 16.33 | 110 | 0.00 |
| Control Group | 56 | 17.16 | 1.53 | | | |

To identify the effects of Learning Together of group learning on students' attitudes toward mathematics, independent-sample t-test was also used to analyze pre-test and post-test mean scores of students in experimental and control groups. As pre-test mean scores of experimental and control groups are described in Table 4, the mean score for the experimental group was 2.87 (SD = 0.71) and that of control group was 2.89 (SD = 0.75). The difference between students' attitudes toward mathematics pre-test mean scores of two groups [$t(110) = -0.12, p > 0.05$] is not significant at 0.05 alpha level. This indicates that students' attitudes toward mathematics of both groups were similar at the beginning of this study.

Table 4: Students' attitudes toward mathematics pre-test mean scores between experimental and control groups are compared using independent-sample t-test

| Group | n | Mean | SD | t | df | Sig(2-tailed) |
|--------------------|----|------|------|-------|-----|---------------|
| Experimental Group | 56 | 2.87 | 0.71 | -0.12 | 110 | 0.89 |
| Control Group | 56 | 2.89 | 0.75 | | | |

As shown in Table 5, the mean of the experimental group, $M = 4.46$ (SD = 0.50) was greater than that of the control group, $M = 3.55$ (SD = 0.50) which indicates a significant difference [$t(110) = 9.59, p < 0.05$] between these two post-test mean scores in favor of the experimental group that reveal that the experimental group showed improvement in students' attitudes toward mathematics in comparison to control group.

Table 5: Students' attitudes toward mathematics post-test mean scores between experimental and control groups are compared using independent-sample t-test

| Group | n | Mean | SD | t | df | Sig(2-tailed) |
|--------------|----|------|------|------|-----|---------------|
| Experimental | 56 | 4.46 | 0.50 | 9.59 | 110 | 0.00 |
| Control | 56 | 3.55 | 0.50 | | | |

To identify the teachers' perception on the implementation of Learning Together, the researcher conducted interview with two mathematics teachers who taught the experimental group of Learning Together. In order to address the ethical issues of preserving anonymity of the two participants and maintaining confidentiality of data, they were identified as Teacher 1 (T1) and Teacher 2 (T2) in the following report. The data which derived from the interview are discussed below:

The mathematics teachers in the experimental schools made comments on the students' characteristics that the students in the mathematics classrooms to be generally shy and inactive in the beginning of the experiment. According to them, the students were unwilling to talk. T1 pointed that the students were shy during the group activity. Below are the excerpts made by the teachers:

"... they were hesitate to speak" (T1). Because they did not facilitate each other's learning in the form of groups to solve their mathematical problem earlier.

"... they look inactive ... they don't understand" (T2). Because they are not given incentives to help each other's knowledge to achieve a shared goal under Learning Together condition earlier.

The mathematics teachers of experimental schools agreed that the students lacked confidence especially at the start of the Learning Together treatment. The experimental teachers, both of them, agreed that the condition was transitory. T1 said that once they are familiar with Learning Together of group learning "... they get confidence" (T1). Similarly, T2 agreed that "... after Learning Together introduction I found them active" (T2). So although the students started with being shy at the beginning, they changed after they became familiar with Learning Together and had more confidence. The teachers commented that Learning Together of group learning contributed to the change of students' quality from being shy to becoming more confident students. Low-ability students faced problems in performing their tasks in mathematics. After being familiar with Learning Together they were able to overcome their problems. Below are the excerpts that described the teachers' comments.

"in the beginning they were unable to do..." (T1).

"...when they came in touch with Learning Together, it contributes to them to solve their problem..." (T2).

Based on these statements, many of the students in the experimental group of this study had underachieved in their mathematics achievement. But when they were familiar with Learning Together of group learning and aware of their responsibility, they solved their mathematical problem.

The teachers' perception toward Learning Together of group learning were positive. When asked to comment on Learning Together, one of the teachers said that it was "I want Learning Together model of group learning to be implemented in secondary school context"(T1). This remark was positive. The following are the records from the interview as to teachers' perception on Learning Together:

"with Learning Together... students can contribute to ... can talk without feeling shy"(T2).

"... students improved their mathematics achievement"(T1).

"... students increased their attitudes toward mathematics"(T2).

DISCUSSION

This study was conducted to examine the effects of Learning Together model of group learning on students' mathematics achievement and attitudes toward mathematics along with an examination of teachers' perception on the implementation of Learning Together in selected secondary schools in Natore, Bangladesh. Findings from this study indicated that Learning Together had significant effects on students' mathematics achievement

and attitudes toward mathematics. Students in the experimental group showed significant improvement in their mathematics achievement and attitudes toward mathematics in comparison to control group. The result suggests that the increase of the students' mathematics achievement and attitudes toward mathematics post-test mean scores for the experimental group was due to the significant effects of Learning Together treatment. The findings of the study, therefore, are consistent with the results as reported by Ozsoy and Yildiz (2004), Zakaria et al. (2010) and Alabekee et al. (2015). The findings of this study are also consistent with studies by Barbato (2000), Effandi (2003) and Martin (2005). The findings of this research study is also in line with the findings of Gubbad (2010) who found group learning was better than the traditional way of teaching in improving students' performance in mathematics.

Data generated from the interview illustrated that the teachers were very positive with their comments toward the implementation of Learning Together model of group learning in the mathematics classrooms. With Learning Together, students who were initially shy gained confidence to speak and improved their confidence in classrooms. The comments highlighted from the interview sessions showed that the implementation of Learning Together in the mathematics classrooms encouraged students to be supportive and had more ideas to share with their group members to solve their mathematical problem. The teachers commented that their students could speak without being shy when they worked together in the experimental group. The benefits that were described by the teachers were shared responsibility and helping one another. When the students worked in the experimental group, teachers found that they have more information to contribute to the group. They were always active to share their knowledge to their group members. Based on the interview, the teachers perceived that the elements of Learning Together model were well received by the students which contributed to the improvement of their mathematics achievement and attitudes toward mathematics.

CONCLUSION

Learning Together model of group learning had significant effects on students' mathematics achievement and attitudes toward mathematics, and the experimental teachers were positive in terms of their comments on the implementation of Learning Together in the mathematics classrooms. The findings revealed that the improvement of students' mathematics achievement and attitudes toward mathematics for the experimental group was due to the significant effects of the Learning Together treatment. It was found that students' mathematics achievement and attitudes mathematics were affected by exposure to the Learning Together in this research study. Students in the form of groups seemed to prefer to learn mathematics by sharing, helping, encouraging and facilitating each other's learning to reach a shared goal. The experimental teachers were of the same opinion with Learning Together model to be implemented in the secondary school context to improve students' mathematical performance. The findings based on the teachers' responses illustrated that Learning Together model was well received by both the students and the teachers, and Learning Together were effective in improving students' mathematical performance in the secondary mathematics classrooms. Therefore, Learning Together of group learning can successfully be implemented in secondary schools to promote students' mathematical performance in SSC examination, and education authorities in Bangladesh should encourage secondary teachers to practice Learning Together regularly and effectively, and teacher education institutions to make it part of their curriculum content.

On the whole, Learning Together model of group learning contributed to the development of students' mathematical performance due to proper formation of groups, group members' cooperation to each other's learning and their sincerity to teachers' incentives during the treatment period, with this, this research study came to a conclusion that teachers' expertise on implementing Learning Together model can make our students mathematics loving and develop their interest in mathematics.

REFERENCES

- Alabekee, E. C., Samuel, A., & Osaat, S. D. (2015). Effects of cooperative learning strategy on students' learning experience and achievement in mathematics. *International Journal of Education Learning and Development*, 3(4), 67-75.
- Barbato, R. (2000). *Policy implications of cooperative learning on the achievement and attitudes of secondary school mathematics students*. Ph.D. Thesis, Fordham University, New York.
- Berg, K., & Latin, R. (1994). *Essential of modern research methods*. Englewood Cliffs, Prentice- Hall, Inc, NJ.
- BISE (2014). *Board summary of the secondary school certificate examination-2014*. Ministry of Education, Dhaka, Bangladesh.
- Campbell, D.T., & Stanley, J.C. (1963). *Experimental and quasi-experimental design for research*. Rand McNally College Publishing Company, Chicago.
- Cohen, L., Manion, L., & Morrison, K. (2002). *Research method in education*. TJ International Ltd, Cornwall.

- Effandi, Z. (2003). *The effects of cooperative learning on students in a matriculation mathematics class*. Ph.D. Thesis, Universiti Kebangsaan Malaysia, Bangi.
- Gubbad, A.A.M.A. (2010). The effects of cooperative learning on the students' academic achievement and retention of the mathematics concepts at the primary school in Holy Makkah. *Journal of King Saud University – Educational Sciences and Islamic Studies*, 22(2), 13-23.
- Hossain, A., Termizi, R. A., Aziz, Z., & Nordin, N. (2013). Group learning effects and gender differences in mathematical performance. *Croatian Journal of Education*, 15(2), 41- 67.
- Johnson, D.W., & Johnson, R.T. (1994). *Learning together and alone*. Allyn and Bacon, London.
- Leedy, P. D., & Ormrod, J.E. (2001). *Practical research planning and design*. Merrill Prentice Hall, New Jersey.
- Martin, R.L. (2005). *Effects of cooperative and individual integrated learning system on attitudes and achievement in mathematics*. Ph.D. Thesis, Florida International University, Florida.
- Miles, M., & Huberman, A.M. (1994). *Qualitative data analysis*. SAGE Publications, London.
- Ozsoy, N., & Yildiz, N. (2004). The effect of learning together technique of cooperative learning method on student achievement in mathematics teaching 7th class of primary school. *Turkish Online Journal of Educational Technology*, 3, 49-54.
- Rimmerman, H. (2004). *Resources in cooperative learning*. San Clemente, Kagan Publishing, CA., USA.
- Samad, M.A. (2005). *Ganit shikkha-o-prashikkhon*. Dhaka: Samad Publication and Research.
- Sechrest, L., & Sidani, S. (1995). Quantitative and qualitative methods: is there an alternative? *SYSTEM*, 18(1), 77-87.
- Zakaria, E., Chin, L.C., & Yosoff, D.M. (2010). The effects of cooperative learning on students' mathematics achievement and attitudes towards mathematics. *Journal of Social Science*, 6(2), 272-275.