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## **A Comparison of Cooperative and Traditional Learning Methods on Learning Mathematics in the 4<sup>th</sup> and 5<sup>th</sup> Grades in Holaelan, Ilam, Iran**

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### **Authors' contributions**

*This work was carried out in collaboration between all authors. Authors SK, SS, MM, MA, HB and MH designed the study, wrote the protocol and supervised the work. Authors SK, SS, MM, MA and HB, carried out all data gathering and data entry. Authors MA and SB managed the statistical analyses of the study. Author MA wrote the first draft of the manuscript. Authors SK, SS, MM, MA, HB, EHT and SB managed the literature searches and edited the manuscript. All authors read and approved the final manuscript.*

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## ABSTRACT

**Aims:** The study aimed to evaluate the effectiveness of cooperative learning and traditional learning methods with respect to the achievement of fourth and fifth grade students in the field of mathematics. Research on this topic in non-western countries remains scarce. The present study seeks to investigate cooperative learning in a non-western country, Iran.

**Study Design:** This involved an intervention pretest-posttest design in which the effectiveness of a cooperative learning method was compared with traditional learning methods. Ninety-four students in the field of mathematics (47 in the intervention group and 47 in the control group) were included in the study.

**Place and Duration of Study:** The study was conducted in an elementary school in (Hollaalan) Ilam city (Iran) between October and December 2013.

**Methodology:** A program of planned cooperative learning (STAD) was provided for the intervention group while the control group was taught using traditional learning methods, each for a period of six weeks.

**Results:** The intervention group significantly outscored the control group on the posttest, demonstrating the superiority of cooperative learning over traditional learning methods.

**Conclusion:** A cooperative learning method is more effective in teaching mathematics than traditional methods. Furthermore, cooperative learning appears to benefit students learning mathematics in non-western countries such as Iran.

*Keywords: Cooperative method learning; students; individually method; mathematic.*

## 1. INTRODUCTION

Human life is meaningless without cooperation. Human beings escape loneliness and find themselves in the crowd. More than 90 percent of work roles require cooperation. Despite this, this basic principle has been neglected in education [1]. In recent years, there has been an increased focus on the improvement of education across the world. Moreover, it is clear that key to learning is people's motivation to learn, and teaching methods have a major impact on the motivation of learners [2]. Today, the mutual teaching method is one of the most widely accepted and used methods among teachers [3]. Cooperative learning was developed in the late 1970s and 1980s. This period saw the production and design of various cooperative learning models, which could be applied in a real world setting. Among its leading proponents, which included Roger and David Johnson, Robert Slavin, Neel Davidson and Spenser Kagan, particular emphasis was placed on the active exchange of views amongst the members of small groups [4]. Cooperative learning is an educational approach, which aims to organize classroom activities into academic and social learning experiences. There is much more to cooperative learning than merely arranging students into groups and it has been described as "structuring positive interdependence" [5,6]. Students must work in groups to complete tasks collectively in working toward academic goals.

Unlike individual learning, which can be competitive in nature, students learning cooperatively can capitalize on one another's resources and skills (asking one another for information, evaluating one another's ideas, monitoring one another's work, etc.) [7,8]. Furthermore, the teacher's role changes from one of giving information to facilitating students' learning [9,10]. Everyone succeeds when the group succeeds. Ross and Smyth [11] describe successful cooperative learning tasks as intellectually demanding, creative, open-ended and involving higher order thinking tasks. This method motivates students to work together to achieve a common goal; seeking to learn, students work as members of an interdependent team [12]. It is in this cooperative atmosphere that students show particular interest in learning and in this friendly climate and working together they discover how to learn. When any of the members need help and guidance, others are willing to help. They also learn to express their opinions about matters discussed and to listen to others' opinions and analyze them, to be flexible in response to contrary opinions and to avoid prejudice. It is in this climate that students feel valued and consider themselves as part of the educational process [13,14]. The research related to cooperative learning and its positive effects has developed around various aspects of the development of individual social skills. Studies by Yang and by Onwuebuozie have shown that students educated via the

cooperative learning approach display more educational improvement than students whose learning was based on an individual approach [15,16]. This may be attributable to the role that more active cooperation has in creating stronger motivation among college students [3,17]. In their study, Tolmie et al. noted that teachers, who had more tools for communication made more cognitive questions in the course of their interactional way of teaching and peer to peer learning, further motivating pupils to work together [18]. These researchers saw many significant improvements in social relations, in their own research, which was titled "The social effects of cooperative learning in the elementary schools". In explaining the effects of cooperative learning on the social and psychological attributes of undergraduate taking a basic course in mathematics, Kocak [19] noted that cooperative learning was effective in reducing levels of loneliness and social anxiety while increasing levels of happiness among participants. Other studies, for example that by Lavasani et al. [20], have found that cooperative learning in the course of group work enabled distribution of tasks within the problem solving group [20]. They found that friends, having the opportunity to talk and negotiate, used the time effectively in their interactions with classmates. The manner in which cooperative learning affects students' achievement and problem-solving skills has also been investigated by Erdem [21]. This study of interacting groups examined students' mathematics achievement and problem solving skills. The experimental group was instructed using cooperative learning methods, while the control section was instructed using the traditional lecture format. Mathematics achievement and problem solving skills were better in the experimental than in the traditional group. In addition, a study by Olumi Yadzi [22] of the impact of cooperative learning on the social skills of female students in grade one explored these teaching methods in Iranian schools. The results of the study show that Iranian children and adolescents misunderstood social cooperation inside family and school. Ghodrati et al. [23] also found that cooperative learning increased memory recall comprehension and understanding and the analysis of scientific information in the empirical sciences [23]. Malaysian scholars, drawing on findings from their own studies of cooperative learning, have emphasized the use of cooperative learning as a pedagogy that is effective in improving students' mathematics achievement and communication skills [24]. Aziz and Hossain [24-25] also found

that peer-tutoring methods were more successful than traditional methods, as reflected in the average performance scores of students. Other researchers have shown that cooperative learning enhances social skills and social behavior and as well as helpfulness and reduces anxiety in male and female students [20,26]. Other studies carried out on the influence of this method on the educational performance and progress of male and female students have found striking differences between the scores arising from mutual methods and those from traditional methods. Moreover, the mutual learning groups/peer tutorials had more effect on educational development [27,28].

As reviewed above, extensive research has been carried out on the application and effectiveness of various cooperative procedures. In these studies it has been shown that the cooperative learning approach makes achievements of social relevance and promotion of cooperative tasks enhances educational progress, and even decreases the extent of students' anxiety. However, it seems that a detailed research is still lacking on the analysis of the different aspects of this approach, or on the relevance of different influences. Cooperative learning has evolved into structured cooperative group work as exemplified in the Learning Together model, Student Team-Achievement Division (STAD), Team-Games-Tournament (TGT), Team Accelerated Instruction (TAI), Cooperative Integrated Reading and Composition (CIRC), Jigsaw and Group Investigation (JGI) [29]. In the current study, we used the cooperative learning approach embodied in Student-Teams-Achievement Division (STAD) in which students are placed in small groups (or teams). The class in its entirety is presented with a lesson and the students are subsequently tested. Individuals are graded on the team's performance. Although the tests are taken individually, students are encouraged to work together to improve the overall performance of the group [28]. To conclude, there is evidence that cooperative learning improves mathematical knowledge. However, most studies have been carried out in western countries. Research on this topic in non-western countries, such as the Islamic Republic of Iran (henceforth Iran), is scarce. For this reason, one aim of the present study was to address this gap in the literature.

Based on the research reviewed here, the following hypotheses were formulated. In a comparison of cooperative and traditional learning methods in the teaching of mathematics

in the fourth and fifth grades we anticipated superior acquisition of mathematic knowledge in the intervention (cooperative learning using STAD) than in the control condition (individual learning). More specifically:

- Ho1: In the fourth grade there will be significant differences in learning mathematics between students taught using a cooperative method and those taught using traditional or individual methods.
- Ho2: In the fourth grade there will be significant differences in learning mathematics between male students taught using a cooperative method and those taught using traditional or individual methods.
- Ho3: In the fourth grade there will be significant differences in learning mathematics between female students taught using a cooperative method and those taught using traditional or individual methods.
- Ho4: In the fifth grade there will be significant differences in learning mathematics between students taught using a cooperative method and those taught using traditional or individual methods.
- Ho5: In the fifth grade there will be significant differences in learning mathematics between male students taught using a cooperative method and those taught using traditional or individual methods.
- Ho6: In the fifth grade there will be significant differences in learning mathematics between female students taught using a cooperative method and those taught using traditional or individual methods.

## 2. MATERIALS AND METHODS

### 2.1 Study Population

The study involved an intervention pretest-posttest design with sampling from all male and female pupils in 4<sup>th</sup> and 5<sup>th</sup> grades of elementary schools in Holaelan city, Ilam. We compared the effectiveness of a cooperative learning method with traditional learning methods in the area of mathematics. Ninety-four pupils (47 in the intervention group and 47 in the control group) were selected by stratified random sampling. Participants were from lower middle class backgrounds, the mean age of the final sample being  $M_{age}=12.01$  years ( $SD=0.43$ ). All participants and their parents were fully informed about the aims and scope of the study and gave their written informed consent. The entire study

was approved by the ethics committee of the Educating and training Organization of Ilam. A planned cooperative learning technique (STAD) was provided to the intervention group for six weeks, while the control group was taught using traditional learning methods over the same period. After completion of the intervention, the effectiveness of the two methods was compared.

### 2.2 Study Tools and Measurements

The research tools included tests written by the researcher and the pretest and posttest were carried out in the same manner for both groups. In this study, because the measurement tools (tests) were written to cover the particular material taught, the justification for the measurements was necessarily contextual. Because the analysis of the context was mostly deductive, in evaluating the contextual justifiability of the measurements, the researcher were dependent on the judgment of university professors and the expertise of educational specialists, teachers and trainers experienced in evaluating contextualized measurements. In order to determine the validity of test results the test was repeated three weeks after the posttest. Cronbach's Alpha coefficient for the measure was 0.92.

### 2.3 Assessing Mathematics Knowledge

All the 4<sup>th</sup> grade participants had to learn seven sections of a mathematics text, one which was not part of their regular curriculum. The sections of the text were covered in 18 sessions. Topics included: Division (4 sessions), Note fractions (1 session), Equal fractions (2 sessions), Simplifying fractions (2 sessions), Comparing fractions (3 sessions), Adding fractions (3 sessions) and Subtracting fractions (3 sessions). The 5<sup>th</sup> grade participants had to learn eight sections of a mathematics text which was also not part of their regular curriculum. The sections chosen were covered in 18 sessions. Topics included: Decimal numbers (3 sessions), Note fractions (1 session), Dividing fractions (4 sessions), Multiplying fractions (4 sessions), Capacity (2 sessions), Circular area (1 session), Circular environment (1 session) and Angle bisector (2 sessions). Both groups met twice a week for 45 minutes over a period of 6 weeks. Pupils' knowledge of each topic was assessed via a written test with a combination of multiple choice open response formats and a maximum score of 20.

## 2.4 Study Methodology

After selecting participants for the two groups we trained one of the teachers in the mutual teaching method (STAD) to be used in this study. Initially, we created groups each of either three or four pupils. The incongruent groups, those, whose members had different capabilities and information, were more efficient. Then, the teacher talked for around 15 minutes about the objectives of the lesson, things that they would be expected to learn from the lesson and the important parts of the lesson, which needed to be discussed. Pupils then had the opportunity to work on the activities and subjects given to them in their groups for a certain time. Time adjustment at this step was very important. The teacher walked among the groups and, while evaluating them, provided them help and guidance if necessary. Group leaders were then asked to give a short presentation of their results following which the teacher and other groups could put questions to the group leader and other group members. In the final step, evaluation, the teacher evaluated each group's work. The teacher was able to use a checklist to evaluate knowledge, skills and attitudes. It was also possible to get the groups themselves to be responsible for evaluation (self-evaluation). In the traditional (usual) method pupils were not assigned to groups. Teaching was mostly via lecturing. The pupils competed with each other, and the more competent ones could not help the weak ones. The teacher was the key to this method. The goal and basis of this method was provision of information to pupils by the teacher. Evaluation was based on the pupils' individual scores.

## 2.5 Statistical Analysis

In this study, both descriptive and deductive statistics were used for data analysis (data were obtained from the results of pre-test and post-test and the scores of pupils). We used descriptive statistics, average, standard deviation, average error, deductive statistics and t-test. In the deductive statistics, to control for the influence of pre-test performance levels, we used the analysis of the difference among scores by subtracting the pre-test score for a student from the post-test score and then measuring the average for both groups and finally comparing the obtained averages using independent t-tests. The changes in effectiveness following

interventions were compared using paired t-tests. P values of 0.05 or less were considered statistically significant. All the statistical analyses were performed using SPSS version 16.0 (SPSS Inc., Chicago, IL, USA) and SAS version 9.1 for Windows (SAS Institute Inc., Cary, NC, USA).

## 3. RESULTS

This study, focusing on the educational development of 4<sup>th</sup> and 5<sup>th</sup> graders in mathematics, sought to evaluate the influence of a mutual teaching method on this development. The results of the study and the information set out in Table 1 show that at the pretest were no significant differences between the two groups. However, the posttest (following the educational program) showed a significant improvement in the scores of the intervention group, but not those of the control group.

To control for the influence of previous knowledge (pretest), firstly we calculated the difference between pretest and posttest scores, then measuring the average for both groups and finally comparing the obtained averages using independent t-tests.

Table 1 indicates that there was a significant difference between the average scores of 4<sup>th</sup> graders in the two conditions, with the scores of students in interventional group showing improvement, compared with the pretest (18.07). In contrast, change in average score in control group was 11.94. The difference between the two conditions was significant ( $P < 0.05$ ), indicating the superiority of the mutual teaching method. Also of note, Table 1 indicates a substantial difference between the average scores of the 4<sup>th</sup> graders in the control and intervention conditions respectively.

Table 1 further indicates a large difference in the progress of 5<sup>th</sup> grade pupils in the two conditions, with those in the intervention condition having an average of 13.74 increase compared to the control group with just 7.78. Thus, there was a significant effect ( $P < 0.05$ ) of mutual teaching on learning mathematics at this level. Table 1 also indicates, however, that the significant advantage of mutual teaching was restricted to the grade 5 boys; no significant advantage was apparent among the girls at this grade level.

**Table 1. Comparison of the development (difference pre- and post-test) between groups and gender of 4<sup>th</sup> and 5<sup>th</sup> graders**

Grade	Group						Statistics		
	Intervention group			Control group			Total t (df)	Male t (df)	Female t (df)
	Total n	Malen	Female n	Total n	Male n	Female n			
4th	25	16	9	25	14	11	6.24*** (48)	4.97*** (28)	3.64** (18)
5th	22	9	13	22	10	12	4.18*** (42)	4.02 ** (17)	1.97 (23)

Note. \* =  $p < .05$ ; \*\* =  $p < .01$ , \*\*\* =  $p < .001$

#### 4. DISCUSSION

Teaching via the mutual method is a new approach in education the main objectives of which are: Engaging pupils in the learning process; removing the unilateral atmosphere in classrooms; encouraging an interest among pupils in active learning. Also this method allows pupils to learn skills such as consulting, organizing, and taking a leadership role. In the mutual method, the teacher does not teach, but plays the role of guide and problem solver. Teaching and learning become the responsibility of the students. Another of the benefits of this method is learning teamwork that leads to attentive, responsible, critical and creative citizens. In other words, it helps to achieve the effective socialization of students, which should be one of the goals of education. Though the mutual teaching method was introduced some decades ago, it has only been recently that it has been studied in more detail, with new elements being introduced. In particular, it is now appreciated that the term "cooperative learning" cannot be applied to any group activity. The mutual method, by creating educational groups, meets the need for students to be together and also helps those who have problems in learning since in this method the groups are responsible for the learning of all their members. Completing a task successfully leads to enthusiasm and passion for additional work. In this regard, in the present study, teaching was successfully applied among 4<sup>th</sup> and 5<sup>th</sup> graders. Most importantly, the present pattern of results was observed in a non-western country, but it was in accord with previous results [20-27].

Regarding the mathematics taught in most Iranian schools, the textbook treatment is rather abstract and when the material is delivered exclusively by teachers, pupils are not motivated to understand the material and are unable to improve their own cognitive functioning. So, it is

better that teachers and students work together to exchange information, as this requires interaction and coordination between all participants, even parents. It remains true, however, that successful realization of the mutual method depends on the teacher's awareness of the definition, nature and learning processes involved in cooperation. It was appreciated at the beginning of the study that the lack of one or more aspects or elements of cooperation should not cause teachers to lose heart and prevent them from completing the program. Teachers and their own managers, with the willing collaboration of students and their parents, can make the process work and even introduce innovations to improve it.

The results of the present study have shown that despite the brevity of the intervention, the commitment of teachers and students to traditional methods, the lack time available for working in groups, the lack of enthusiasm of some teachers for this approach and the obstacles to small group work posed by high student numbers, it is nonetheless possible for teachers to run cooperative groups in some classes. We note that differences in teachers' motivation, commitment, and willingness do reflect classroom reality. Accordingly, these issues have to be faced. Despite these issues, the present pattern of results is in accord with those studies showing a favorable impact of cooperative learning compared to traditional learning [20-27]. Important to this is the collaboration between teachers and managers and the careful introduction of the program to teacher and parents. The study also showed that despite the difficulties, this learning method was able to achieve clear effects in Iranian schools [cf. 20-27]. At the outset of the study the average level of competence in mathematics was similar in both the intervention and control conditions, but by the end of the study, the level in the intervention condition had increased markedly

while the average for control group was almost unchanged. More specifically, we can conclude that the mutual method based on the STAD pattern was influential in the educational development of 4<sup>th</sup> and 5<sup>th</sup> grade males and 4<sup>th</sup> grade females. Keramati [25] argues that learning by the cooperative method leads to improvement in social skills as well as in mathematics in 5<sup>th</sup> graders. Ahmadpanah et al. [27] also explored the impacts of the cooperative teaching method on 5<sup>th</sup> graders' achievement in sciences. Their results show that the cooperative groups, because of improvements in social skills, show more educational progress than students taught by traditional methods. Both Hancock [2] and Peterson and Miller [17] have argued that the positive effects of the cooperative method are due to improvements in student comprehension and motivation, which in turn lead to greater cognitive growth; this educational progress is consistent with the results of the present study. Also the results of this study are consistent with research in other countries [15,16,18,20,22,24-27]. On the other hand, there was no significant difference between the scores of 5<sup>th</sup> grade females in the intervention group and those in the control group, which shows that the mutual method is not invariably successful. These results are not consistent with most other studies, indicating a need for further study of the impact of this method on girls at all grade levels.

Finally, based on our results, we would recommend that the authors of school texts covering basic empirical principles and theories organize the contents in such away as to allow educational objectives to be achieved. Additionally, teachers should receive assistance in learning about cooperative methods via workshops, pamphlets and educational software.

Several limitations also argue against an over generalization of the study results. First, the result might reflect other, unassessed variables. For example, being included in the study could itself have had an effect on the results (Hawthorne effect). Second only children who were willing to participate and whose parents gave their consent were included in the study.

## 5. CONCLUSION

Our results clearly indicate that cooperative learning improves mathematics knowledge acquisition relative to traditional teaching approaches. In particular, the (SDAT) method was confirmed as a valuable, efficient and

successful cooperative learning technique at elementary school level in a non-Western country. Nevertheless, cooperative learning does not work automatically and requires adequate implementation and further development.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. Johnson DW, Johnson RT. A meta analysis of cooperative, competitive and Individualistic goal structure. Hillsdale, NJ: Lawrence Erlbaum; 1987.
2. Hancock D. Cooperative learning and peer orientation effects on motivation and achievement. *The Journal of Educational Research*. 2004;97:159-167.
3. Gillies RM, Khan A. The effects of teacher discourse on students' discourse, problem-solving and reasoning during cooperative learning. *International Journal of Educational Research*. 2008;30: 1-18.
4. Gokal A. Cooperative learning. *Collaborative Learning Education*. 1995;7:1.
5. Slavin RE. *Cooperative Learning*. New Jersey: Prentice-Hall; 1990.
6. Kagan S. The structural approach to cooperative learning. *Educational Leadership*. 1990;47(4):12-15.
7. Chiu MM. Group problem solving processes: Social interactions and individual actions. *Journal for the Theory of Social Behavior*. 2000;30(1):27-50;600-631.
8. Chiu MM. Flowing toward correct contributions during groups' mathematics problem solving: A statistical discourse analysis. *Journal of the Learning Sciences*. 2008;17(3):415-463.
9. Chiu MM. Adapting teacher interventions to student needs during cooperative learning. *American Educational Research Journal*. 2004;41:365-399.
10. Cohen EG. *Designing group work*. New York: Teacher's College; 1994.

11. Ross J, Smythe E. Differentiating cooperative learning to meet the needs of gifted learners: A case for transformational leadership. *Journal for the Education of the Gifted*. 1995;19:63-82.
12. Buchs C, Butera F. Complementarity of information and quality of relationship in cooperative Learning. *Social Psychology of Education*. 2001;4:335-357.
13. Bargh JA, Schul Y. On the cognitive benefits of teaching. *Journal of Educational Psychology*. 1980;72:593-604.
14. Webb NM. Peer interaction and learning in cooperative small groups. *Journal of Educational Psychology*. 1982;74:642-655.
15. Yang ND. Exploring a new role for teachers: Promoting learner autonomy. *System*. 1980;26:127-135.
16. Onwuegbuzie AJ. Relationship between peer orientation and research achievement cooperative learning-based research methodology courses. *Journal of Educational Psychology*. 2002;94(3):164-170.
17. Peterson SE, Miller JA. Comparing the quality of students' experiences during cooperative learning and large-group instruction. *The Journal of Educational Research*. 2004;97:123-134.
18. Tolmie AK, Topping KJ, Christie D, Donaldson C, Howe C, Jessiman E, et al. Social effects of collaborative learning in primary schools. *Learning and Instruction*. 2009;20(3):177-191.
19. Kocak R. The effect of cooperative learning on psychological and social traits among undergraduate students. *Social Behavior and personality*. 2008;36(6):771-782.
20. Lavasani MG, Afzali L, Borhazadeh S, Afzali F, Davoodi M. The effect of cooperative learning on the social skills of first grade elementary school girls. *Procedia-Social and Behavioral Sciences*. 2011;15:1802-1805.
21. Erdem A. Preservice teachers' attitudes towards cooperative learning in mathematics course. *Procedia-Social and Behavioral Sciences*. 2009;1(1):1668-1672.
22. Olumi Yazdi M. The methods of teaching cooperation inside families and schools in Iran: The collection of papers for the first national conference on cooperation employment and development. Yazd University Publications. Persian. 2005;171-181.
23. Ghodrati M. The cooperative learning and individual learning according to memorization comprehension, analyse and inquiry of scientific information of practical science. *Education psychology*. Ghom University. Thesis for receiving «M. A» degree on psychologist, Persian; 2002.
24. Hossain MA, Tarmizi RA, Mohd Ayub AF. Collaborative and cooperative learning in Malaysian mathematics education. *Journal on Mathematics Education (JME)*. 2012;3(2):103-114.
25. Aziz Z, Hossain A. A comparison of cooperative learning and conventional teaching on students' achievement in secondary mathematics. *Procedia-Social and Behavioral Sciences*. 2010;9:53-62.
26. Keramati MR. The effect of cooperative learning on social skills and educational achievement of male students in fifth-grade science classes. *Journal of Psychology & Education*. Persian. 2007;37(1).
27. Keramati MR. The effect of cooperative learning on improvement of student at specific curriculum in physics. *Journal of Psychology & Education*. Persian. 2009;39(2).
28. Ahmadpanah M, Soheili S, Jahangard L, Bajoghli H, Haghighi M, Holsboer-Trachsler E, Conrad D, Brand S, Keikhavandi S. Cooperative learning improves social skills and knowledge of science topics in pre-adolescent children in Iran. *British Journal of Education, Sociality and Behavioural Science*. 2014;4(8).
29. Seifert K, Sutton R. *Educational psychology*. 2<sup>nd</sup> Edition. Chapter 9: Facilitating Complex Thinking. 2009;204.

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