2018 SCIENCELINE
Journal of Educational and Management Studies
J Educ Manage Stud, 8(3): 56-63, Sep 25, 2018
 ISSN: 2322-4770

Cooperative learning instructional approach for students' mathematics achievement and attitude towards mathematics: a case study on probability and statistics lesson at a governmental secondary school in Ethiopia

Dejene Girma Denbel

Assistant Professor, Dilla University, College of Natural and Computational Science, Department of Mathematics, Dilla, Ethiopia
Correspondence: dejene28@gmail.com

ABSTRACT

Introduction: The purpose of this study was to see the impact of cooperative learning on mathematics achievement and attitude towards mathematics at secondary school mathematics. The study significantly reflected the case study of grade eleven students in a secondary school, Ethiopia. **Approach:** quasi-experimental study done on two selected teams. Random assignment was done, one category (n = 51) was allotted to associate experimental group and therefore the other (n = 51) was allotted as a control group. The two teams were pre-tested previous the implementation of the intervention. Post-test given at the end of intervention; whereas daily quiz used as a tool for formative testing. Teaching and learning method administered for 2 weeks. Data were analysed using the paired t-test to determine performance by comparing the mean of the post-test for treatment and control groups at the significant level of $p < 0.05$. **Results:** The result has shown by strong evidence ($t = 2.285$, $p = 0.027$) that the teaching of mathematics through cooperative learning approach improves their achievement score. Moreover, it had been evidence ($t = 4.45$, $p = 0.0001$) that the teaching of mathematics through cooperative learning approach higher attitude towards mathematics. **Conclusion:** From the result, a cooperative learning approach facilitated the instruction for this explicit topic. Therefore, those mathematics teachers have to be required to incorporate in their teaching of mathematics at secondary school. In fact, it is needed further study to generalize this result to a bigger domain.

Original Article
PII: S232247701800008-8

Rec. 24 May 2018
Acc. 10 Jul. 2018
Pub. 25 Sep. 2018

Keywords
Cooperative learning approach,
Mathematics Achievement,
Attitude

INTRODUCTION

Abilities along with problem solving and critical thinking, creativity and innovation, and collaboration and verbal exchange are the centre in twenty first century instructional abilities (kay, 2010). Such capabilities now not performed via conventional strategies.

Development of problem solving competencies as an instance specifically often tackled thru collaborative procedures. Group work and brainstorming, collaborative and co-operative work, and inquiry-based and problem-based instruction are similar educational approaches to cooperative learning. All these attributed to end up "self-determined" and "quite self-sustaining" existence-long learners (Blaschke, 2012; Madhuri et al., 2012).

According to Osman et al. (2011) cooperative learning in mathematics offers possibility to students to work collectively, that students do together, to discover a method to a problem or to prepare a challenge, and can refer to a variety of techniques wherein students interact with each other.

In this study cooperative learning used in actual classroom setting. Nevertheless, implementing collaborative learning strategies in the classroom does not appear too necessarily either student engagement or achievement of learning objectives (Bruffee, 1984, 1993; Savery, 2006; Summers & Volet, 2010).

Problem statement

Many would agree with the axiom, "Two heads are better than one", cooperative learning approach based such principle. Leading experts in cooperative learning have studied and analysed numerous educational settings. Johnson and Johnson (1999) together, proclaim, "Working together to achieve a common goal produces higher achievement, greater productivity and problem solving than does working alone. This is so well confirmed by so much research that it stands as one of the strongest principles of social and organizational psychology" (Johnson & Johnson, 1999, p. 72).

For too long the educational arena has ignored the boundless research that proves students learn more when they work together. Educators would do well to embrace "one of the greatest success stories in the history of educational innovation", and begin successfully implement cooperative learning (Slavin, 1999, p. 74).

Cooperative learning is a powerful tool for learning. Research shows that students learn and understand more when they discuss and collaborate on mathematics. Yet how do educators make the risky transition from a traditional teacher-led classroom to a seemingly less-controllable team-based environment? The researcher believe that more teachers would be willing to incorporate the idea of cooperative learning groups into their classrooms if they better understood the benefits of teaming and knew what type of structure was needed for the prose to be successful.

Benefits of cooperative learning

The research supporting cooperative learning is boundless. Researchers list numerous positive outcomes associated with this innovative style of teaching. The most researched and anticipated benefit of cooperative learning is higher academic achievement, problem solving and social skills development (Johnson & Johnson, 1999; Kagan, 1994; Leiken & Zaslavsky, 1997; Ma, 1996; Siegel, 2005; Slavin, 1999; Toumasis, 2004).

Cooperative learning also aids students in developing social skills. Teaching appropriate social behaviours to students is increasingly important due to the growing needs of children today. Cooperative situations help students learn these skills by working together. In a three-year study, Toumasis (2004) researched the effect cooperative learning had on 8th-10th graders' ability to read and understand mathematical textbooks. Toumasis (2004) determined that working cooperatively helped students "...form new friendships and learn to appreciate differences in ability, differences in personal characteristics and differences in opinion" (Toumasis, 2004; p. 669). In addition to learning social skills, cooperative learning has a positive impact on classroom climate, content communication, students' self-esteem, attendance, students' attitudes towards education, and students' psychological health. Cooperative learning shown to decrease special education placements, classroom/content anxiety, and disciplinary referrals (Johnson & Johnson, 1999; Kagan, 1994; Mueller & Fleming, 2001; Siegel, 2005; Slavin, 1999; Toumasis, 2004).

Educational research reveals that cooperative learning can benefit students' learning. No one needs to identify the details and structure of a successful cooperative learning classroom. Education as a whole seems to be on the verge of taking a giant step in the direction of cooperative learning if educators listen to the research and alter their teaching practices. The more information available, the more prepared we are as educators, and as a result the more our students will learn. To elaborate this fact more, the current study conducted.

This study guided by the following research questions:

1. Is there any difference in achievement in mathematics between students instructed using cooperative learning strategy and those instructed using the traditional classroom teaching method?
2. Is there any difference in attitude scores between students instructed using cooperative learning strategy and those instructed using traditional classroom teaching method towards mathematics?

Research hypotheses

Ho_1: *There is no significant difference in achievement in mathematics between students instructed with cooperative learning strategy and those taught using traditional classroom teaching method.*

Ho_2: *There is no significant difference in attitude scores between students instructed with cooperative learning strategy and those taught using traditional classroom teaching method towards mathematics.*

The null hypotheses (Ho) tested in the study, at 0.05 level of significance.

Objective of the study

The major objective of the study was being to examine the significant of cooperative learning approach for mathematics achievement and attitude towards mathematics. Specifically, the objectives of the study were to determine:

- Whether there are differences in achievement in mathematics between the experimental group (who thought using cooperative environment) and the control group (thought using the traditional approach)
- Whether there are differences in students' attitude towards mathematics between the experimental group (who thought using cooperative environment) and the control group (thought using the traditional approach)

Cooperative learning and academic achievement

For this study, several studies review compared test scores between students who worked in cooperative groups and those who worked in independent learning situations included.

- The first one, a quantitative study done by Zakaria et al. (2010), on the effects of cooperative

learning compared to methods that are more traditional with students from a school in Miri, Sarawak indicated that the cooperative learning approach resulted in higher achievement than the traditional teaching approaches.

- The second is quantitative study by Harskamp and Ding (2006), on high school physics students. Which asked whether collaborative learning helped student achievement more than individual learning. in both cases where students were given hints, and not given hints and found that students who worked in cooperative groups received higher scores on the post assessment than their peers who had worked independently.
- A quantitative study of 8th grade students in Israel, by Kramarski and Mevarich (2003) found that of four instructional methods, cooperative learning with metacognitive training produced the best results.
- The other is a quantitative and qualitative study by Leonard (2001) on the influence of group composition on student interactions in heterogeneous and homogeneous groups. Found that while no significant differences existed between student achievements in heterogeneous versus homogeneous groups, low and middle achieving students received significantly higher test scores after working in groups than they had previously.
- A quantitative study by Linchevski and Kutscher (1998) on the effects of learning mathematics in mixed ability settings on students' achievement studied 1730 grade seventh students in 12 Israeli junior high schools. Found that the effects of similar ability grouping were not uniform. Five schools had a positive grouping effect, meaning that students close to the cut-off point for one ability group gained more by being hypothetically part of a lower ability group than of the next higher one while seven schools had a negative grouping effect.
- A quantitative study by Madrid et al. (2007) examined the effects of competitive team peer tutoring compared to the effects of a cooperative team peer tutoring procedure in academically at-risk, Hispanic, bilingual children. Found that both peer tutoring methods lead to significantly higher post-test scores than the traditional teacher-led procedure, but that the cooperative method led to even higher scores than the competitive method.
- A quantitative study by Retnowati et al. (2010) on the effects of worked example and problem solving approaches in individual versus group settings studied 108 seventh graders in three math classes in on Indonesian junior high school and found that group setting did not appear to have any statistically significant impact on student achievement.
- A quantitative study by Sherman and Thomas (1986) on the effects of cooperative versus individual learning strategies with general mathematics classrooms taught by two different teachers in a rural, Midwestern, predominantly Caucasian, middle class high school found that the cooperative group obtained significantly higher achievement on the post-test than the individualistic group.
- Finally, in a quantitative study, Zakaria et al. (2010), asked "What are the effects of the Student Teams- Achievement Divisions (STAD) cooperative learning method versus more traditional methods (direct instruction with students working independently) on student achievement in mathematics?" The researchers studied 82 students from a Form 1 school in Miri, Sarawak. In this study, 38 were in a control class that taught using traditional teacher-centred instruction, while 44 students in an experimental class taught in small groups where given the opportunity to discuss potential solutions. The results indicated that the cooperative learning approach resulted in higher achievement than the traditional teaching approaches.

Cooperative learning and students' attitudes toward mathematics

One of the most pressing issues in mathematics education, beyond getting students to pass standardized tests, is the issue of students' attitudes toward mathematics. Four studies in this review examine the effects of cooperative learning on students' attitudes toward mathematics and toward their math classes.

- A quantitative, quasi-experimental study by Ifamuyiwa and Akinsola (2008) investigated the effects of self and cooperative instructional strategies on senior secondary students' attitudes toward mathematics. The study focused on Second year students in nineteen public Senior Secondary schools in Ijebu-North Local Government Area, Ogun State, Nigeria and found that overall, students in the study reported more positive attitudes about achievement in mathematics, though the self-instructional students reported a higher increase in attitude than did that cooperative group.
- A quantitative study by Ke and Grabowski (2007) examined the effects of combining computer games with cooperative learning in mathematics by studying 125 grade five students varying by gender, socioeconomic status and race. All with basic computer skills who elected to participate found that cooperative game playing resulted in greater attitudes about math than either competitive game playing or no game playing in economically disadvantaged students, but no statistically

significant differences in attitudes for economically normal students.

- A quantitative study by Bilican et.al. (2011) studied 7834 grade 8 students in 1999 (Trends in International Mathematics and Science Studies or TIMSS 1999 sample), and 4498 grade eight students in 2007 (TIMSS 2007 sample), from schools in Ankara Turkey and asked whether students' opinions about "teaching activities in math courses" changed from 1999 to 2007. The study showed a correlation between a large increase in the number of students who had experienced cooperative learning and an increase in the number of students who reported agreeing or partially agreeing with the statement "I enjoy learning math."
- Finally, one of the studies had ambiguous results regarding students' attitudes toward mathematics. Owens and Barnes (1982) asked about the relationships between cooperative, competitive, and individualized learning preferences of secondary school students and the perceptions of classroom atmospheres in two classes. They found that that senior high school student expressed a much greater preference both for more cooperative and more competitive social contact in learning than those do first year high school students, indicating that older students expressed a preference for cooperative learning, but showing little information about the impact of cooperative learning on students' attitudes.

Implementing cooperative learning models

Siegel (2005) indicated several cooperative learning methods. Student Team Learning, Learning Together, and Cooperative Learning, are leading models in the world of cooperation. Therefore, not only is it important for one to pick a single cooperative learning model to implement in the classroom problem solving, but the educator must also take ownership of the strategies described within the model to promote a cooperative learning environment. It is increasing teachers' ownership of cooperative learning models, which most efficiently done through professional development training than specific to the desired framework (Mueller & Fleming, 2001). This study also focused and utilized increased teachers' ownership of cooperative learning model. Flexibly used stated models in successive experimental periods during investigation.

Regarding grouping in a cooperative learning setting, the majority of research suggests cooperative groups be heterogeneous, including high, middle, and low achievers, boys and girls, and an ethnic and linguistically diverse representation of the class. The distribution of ability levels in a group specified as including a high-ability, medium-high ability, medium-low ability, and low ability student (Johnson & Johnson, 1999; Kagan, 1994; Mueller & Fleming, 2001; Toumasis, 2004). In the current study, however heterogeneous grouping used.

METHODOLOGY

Quasi-Experimental research design used in this study as a quantitative research .The study followed a pre-test, post-test control group design. This design consisted of two instructional groups' cooperative group (experimental group) and traditional classroom teaching group (control) and repeated testing (pre-test and post- test).

The main independent variables was be exposure to cooperative learning strategy, and problem solving skill while the dependent variables were be achievement in problem solving test and attitude towards mathematics. In the study in two groups 51 in experimental and 51 in control group a total of 102 students participated. Experimental group thought by cooperative learning approach and the control group thought by usual method for two weeks.

Achievement test

In this study, the achievement test used to measure the students' mastery of the topic of statistics and probability. The pre and post-test contained 30 objectives (multiple-choice items) questions. The time allocated was 90 min. one mark allocated to each item. All items used are based on form 11 mathematics syllabus which cover selected topic concepts of mathematics particularly statistics and probability. Validity is an important feature for an instrument (Healy & Perry, 2000). An instrument said to have high validity if the degree of its ability to measure what should it measured is high. All the items reviewed by the mathematics expert teachers for validation.

Attitude towards mathematics

A set of attitude questionnaire items arranged and designed by the researchers. The instrument given to experts in mathematics education for validation. Some items in a section on disposition in an instrument, higher order thinking and problem-solving checklist constructed (Borich, 2004).

Since the items were not scored dichotomously, the reliability coefficient of the test was estimated using Cronbach's coefficient alpha (α) as provided by Gregory (2004). The reliability coefficient for the attitude score test found to be 0.81. Attitude questionnaire contains 15 items. In this questionnaire, all respondents were required to choose the answer that reflects their own views and stance on the statements that administered in

accordance with the Likert scale of five points, strongly disagree-1 to strongly agree-5 points.

Paired sample t-test is a statistical technique that used to compare two population means in the case of two samples correlated. Paired sample t-test used in before and after intervention.it is help full when the samples are the matched pairs, or when it is a case-control study. In this particular research the mean achievement test score on problem solving as achievement test task of those instructed using cooperative learning group (called experimental group) were compared with those instructed using traditional method (called control group) at the level of significant 0.05 (5 %). Moreover, before and after treatment both groups' attitudinal score compared. For the study, post achievement test scores and post-attitudinal scores evaluated to see the effect of the treatment.

RESULTS AND DISCUSSION

Pre-test achievement means scores

Before taking the intervention, the pre-achievement test given for both groups. The means scores of the achievement test mean result for the experimental and the control group presented in the table 1.

Pre- attitude mean scores of the experimental and the control group

Similarly before taking the intervention students attitude towards mathematics in general and cooperative learning in particular was assesses. The analysis of the mean result score analysed using paired t-test. Table 2 below shows the result in this regards.

Post-test achievement means scores

After two weeks of intervention, both groups given a post-test and their mean score were analysed using Paired t-test. Table 3 shows the summery of their result in this regards.

The relevant results for the paired t-test are in p-value column. From this row observe the t statistic, t = 2.285, and p = 0.027; significant probability of this result occurring is not by chance, under the null hypothesis of no difference. The null hypothesis is rejected, since p < 0.05 (in fact p = 0.027). There is strong evidence (t = 2.285, p = 0.027) that the teaching of mathematics through cooperative learning improves students achievement score and problem solving in mathematics.

Post- attitude mean scores of the experimental and the control group

Table 4 describes the paired t-test analysis of post-attitude scores of the experimental and control group. The mean score result in this regard compared at the level of 0.05 level of precision.

Table 4 results for the paired t-test are in p-value column. From this row observe the t statistic, t = 4.450, and p = 0.000; significant probability of this result occurring is not by chance, under the null hypothesis of no difference. The null hypothesis is rejected, since p < 0.05 (in fact p = 0.000). There is strong evidence (t = 4.45, p = 0.000) that the teaching of mathematics through cooperative learning improves students attitude towards mathematics.

Table 1. *Pre-test achievement means scores for the experimental and control group*

Group	N	Mean	SD	T-Value	df	P-Value
Experimental	51	53.31	10.179	.408	50	.685
Control	51	52.39	12.814			

Sig. level <0.05 (P-Value <0.05)

Table 2. *Pre -Attitudes mean score for the experimental and control groups*

Group	N	Mean	SD	T-Value	df	P-Value
Experimental	51	3.8169	.39883	-1.755	50	.085
Control	51	3.8494	.42067			

Sig. level <0.05 (P-Value <0.05)

Table 3. *Post-test achievement means scores of the experimental and control group*

Group	N	Mean	SD	T-Value	df	P-Value
Experimental	51	62.57	11.626	2.285	50	.027
Control	51	56.92	11.182			

Sig. level <0.05 (P-Value <0.05)

Table 4. *Post-attitude mean scores of the experimental and control group*

Group	N	Mean	SD	T-Value	df	P-Value
Experimental	51	3.9494	.42067	4.450	50	.000
Control	51	3.8669	.39883			

Sig. level <0.05 (P-Value <0.05)

DISCUSSION

Achievement in mathematics and problem solving skill

From the research questions raised, the first hypothesis stated as:

Ho_1: *There is no significant difference in achievement in mathematics between students instructed with cooperative learning strategy and those taught using traditional classroom teaching method.*

The achievement level of students thought in cooperative learning approach and thought in the traditional approach was compared by considering the mean result achievement provided after intervention were made .therefore, the paired t- test result have shown that t statistic, t = 2.285, and p = 0.027. Which indicated that there is strong evidence (t = 2.285, p = 0.027) that the teaching of mathematics through cooperative learning improves students achievement score and problem solving in mathematics. Since, p value is < 0.05 (p = 0.027) the null hypothesis stated above ($Ho_{1)}$ is rejected. This is quite evident that, those thought in cooperative learning approach better in the mathematics achievement test in this particular topic "statistics and probability".

This result coincides with similar research conducted in the literature review. In a quantitative study done by Zakaria et.al. (2010), Harskamp and Ding (2006), Kramarski and Mevarich (2003), Madrid et.al. (2007), Retnowati, Ayers, and Sweller (2010), and Sherman and Thomas (1986) got similar result.

Therefore, the study shown that cooperative learning approaches promote learners achievement than providing the lesson by teacher-dominated approach. The results of this study indicate that the cooperative learning approach resulted a higher achievement than the traditional teaching approaches. The reason for the increase in students' achievement may cause by the students' involvement in explaining and receiving explanation in which the concepts easily understood. Cooperative learning gives more space and opportunities for students to discuss, solve problems, create solutions, provide ideas and help each other. Traditional teaching methods are teacher based, therefore, given less opportunity to students for discussion, problem solving, creating solutions and working with peers.

Attitude towards mathematics

From the research, questions raised gain, the second hypothesis stated under used in line with attitude towards mathematics.

Ho_2: *There is no significant difference in attitude scores between students instructed with cooperative learning strategy and those taught using traditional classroom teaching method towards mathematics.*

Before the intervention, the attitude towards mathematics for both group recorded and no difference noticed. After intervention, this was changed. Results for the paired t-test are in p-value column. From this row observe the t statistic, t = 4.450, and p = 0.000 are indicators for the significant difference between experimental and control groups .The null hypothesis stated above is rejected, since p < 0.05 (in fact p = 0.000).There is strong evidence (t = 4.45, p = 0.000) that the teaching of mathematics through cooperative learning improves students attitude towards mathematics.

The results of this study indicate that the cooperative learning approach increase attitude towards mathematics. This is probably because when students work in-group they feel that they can depend on others for help and therefore increase their confidence in solving mathematics problem. This may indirectly change their attitudes towards mathematics. Cooperative learning also emphasizes social interaction and relationships among groups of students in particular and among classmates in general. Cooperative learning actively involves students in the learning process. These findings are consistent with the findings of some previous researchers. A quantitative study by Bilican, Demirtasli and Kilmen (2011), Ifamuyiwa and Akinsola (2008), Owens and Barnes (1982).

Therefore, one can said much about this study is in line with several studies done worldwide. Local studies were not considered ,since the researcher have got no access to get local research done exactly in mathematics but in science in general the use of cooperative learning promote learners attitude towards the subjects .

CONCLUSION

Based on the result and discussion in chapter four, cooperative learning approaches as student-centred approaches improve mathematics achievement and attitudes towards mathematics among students. Therefore, teachers in secondary schools, especially teachers who teach mathematics need to be aware of the benefits and importance of cooperative learning and thus changing the practice of teacher-centred teaching methods to student-centred teaching methods. There are positive changes taking place when teachers change their teaching methods towards a more student-centred approach. Teachers need to master the mathematical content they delivered and plan how to implement cooperative learning better. Cooperative learning should be employed especially small group cooperative learning, so that students can be help each other in small groups. Therefore, teachers are encouraged to practice these methods regularly and effectively. The results showed that cooperative learning could have a positive effect on the formation of a more positive attitude towards mathematics among students. However, attitude is something very abstract and subjective in detecting changes in the short term. This study only lasted for two weeks. This means students exposed to learning in a very short period. Therefore, research should take a

longer time span so that the results of this study validated.

The literature shows that students who have learned in cooperative groups have had higher test-scores than their peers who have worked independently. Therefore, even if our main concern in education is how students perform on tests, cooperative learning produces better results than whole-class instruction. The literature also shows that cooperative learning has had a generally positive effect on the behaviour of students in the classroom, and potentially on the students' attitudes toward mathematics and school. Students who worked in cooperative groups learned improved interpersonal skills, as well as how to ask questions that could help them further their own learning, and engaged in more higher-order thinking than students who worked on their own. Additionally, students who had worked in cooperative groups reported increased levels of comfort and confidence with mathematics than their peers, and more students who worked in cooperative groups reported liking math.

Recommendation

Based on the result the following recommendation given:

- Students in the experimental group have shown better achievement in mathematics ,for similar students applied it will be help full,
- The study also have indicated that students thought with cooperative learning approach have shown better attitude towards mathematics than those in traditional approach , so it will be use full particularly applied for students having negative attitude towards the subject.

I noticed that benefits from cooperative learning shown by students of varying abilities and personalities; this was, and continues to be, a desire of math teachers. This advantage reinforced the idea that cooperative learning was beneficial in the classroom.

Therefore, teachers of secondary school can improve their students' attitude and achievement in mathematics .particularly it is important for students in Ethiopia, that it is evident that the achievement and attitude of students is minimal in most cases.

DECLARATIONS

Acknowledgements

I acknowledge secondary school students of Dilla, Ethiopia for their voluntarily participation in this study. In addition to this, I extend my appreciation for Dilla University, for providing materials and other resources.

Authors' contributions

The author worked fully engaged starting from proposal to end work alone.

Funding

This work funded partly by Dilla University, Ethiopia.

Availability of data and materials

The data made available as additional file, to make some statistical data results available, which is not fully included in the research report.

Competing interests

The author declares that he has no competing interests.

REFERENCES

Bilican, S., Demirtasli, R.N., & Kilmen S. (2011). The attitudes and opinions of the students toward mathematics course: The comparison of TIMSS 1999 and TIMSS 2007. *Educational Sciences: Theory and Practice*, 11(3), 1277-1283.

Blaschke, L.M. (2012). Heutagogy and lifelong learning: A review of heutagogical practice and self-determined learning. *International Review of Research in Open and Distance Learning*, 13(1), 56-71.

Bruffee, K.A. (1993). Collaborative learning: Higher education, interdependence, and the authority of knowledge. Baltimore, MD: Johns Hopkins University Press.

Bruffee, K.A. (1984). Collaborative learning and the "conversation of mankind." *College English*, 46(7), 535-552. doi.org/10.2307/376924

Harskamp, E., & Ding, N. (2006). Structured collaborative versus individual learning in solving physics problems. *International Journal of Science Education*, 28(14), 1669-1688. doi.org/10.1080/87567550009595813

Healy, M. & Perry, C. (2000). Comprehensive criteria to judge validity and reliability of qualitative research within the realism paradigm. *Qualitative Market Research*, 3(3): 118-126.

Ifamuyiwa, S.A., & Akinsola, M.K. (2008). Improving senior secondary school students' attitudes toward mathematics through self and cooperative instructional strategies. *International Journal of Mathematics Education*, 39(5), 569-585.

Johnson, D. W. & Johnson, R. T. (1999). Making cooperative learning work. *Theory into Practice*, 38 (2), 67-73.

Kagan, S. (1994). Cooperative Learning. San Clement, CA: Resources for Teachers, Inc.

Kay, K. (2010). Foreword: 21st century skills: Why they matter, what they are, and how we get there. In J. Bellanca & R. Brandt (Eds.), *21st Century skills: Rethinking how students learn* (pp. 13-31). Bloomington, IN: Learning Tree.

Ke, F., & Grabowski, B. (2007). Gameplaying for maths learning: Cooperative or not? *British Journal of Educational Technology*, *38*(2), 249-259.

Kramarski, B., & Mevarech, Z.R. (2003). Enhancing mathematical reasoning in the classroom: The effects of cooperative learning and metacognitive training. *American Educational Research Journal*, *40*(1), 281-310.

Leiken, R. & Zaslavsky, O. (1997). Facilitating student interactions in mathematics in a cooperative learning setting. *Journal for Research in Mathematics Education*, 28 (3), 331-354.

Leonard, J. (2001). How group composition influenced the achievement of sixth- *grade* mathematics students. *Mathematical Thinking and Learning*, *3*(2&3), 175-200.

Linchevski, L., & Kutscher, B. (1998). Tell me with whom you are learning and I will tell you how much I have learned: Mixed-ability versus same-ability grouping in mathematics. *Journal for Research in Mathematics Education*, *29*(5), 533-554.

Ma, X. (1996). The effects of cooperative homework on mathematics achievement of Chinese high school students. *Educational Studies of Mathematics*, 31 (4), 379-387.

Madhuri, G.V., Kantamreddi, V.S.S.N., & Prakash Goteti, L. N. S. (2012). Promoting higher order thinking skills using inquiry-based learning. *European Journal of Engineering Education,* 37(2), 117-123. Accessed from http://dx.doi.org/10.1080/03043797.2012.661701

Madrid, L.D., Canas, M., & Ortega-Medina, M. (2007). Effects of team competition versus team cooperation in class wide peer tutoring. *The Journal of Educational Research, 100*(7), 155-160.

Mueller, A. & Fleming, T. (2001). Cooperative learning: Listening to how children work at school. *The Journal of Educational Research*, 94 (5), 259-265.

Owens, L., & Barnes J. (1982). The relationships between cooperative, competitive and individualized learning preferences and students' perceptions of classroom learning atmosphere. *American Educational Research Journal*, *19*(2), 182-200.

Retnowati, E., Ayers, P., & Sweller, J., (2010). Worked example effects in individual and group settings. *Educational Psychology*, *30*(3), 349-367.

Savery, J. R. (2006). Overview of problem-based learning: Definitions and distinctions. *Interdisciplinary Journal of Problem-based Learning*, 1(1). Accessed on http://dx.doi.org/10.7771/1541-5015.1002, 2/5/2016

Sherman, L.W., &Thomas, M. (1986). Mathematics achievement in cooperative versus individualistic goal-structured high school classroom. *Journal of Educational Research, 79*, 169-172.

Siegel, C. (2005). Implementing a research-based model of cooperative learning. *The Journal of Educational Research*, 98 (6), 339-349.

Slavin, R. E. (1999). Comprehensive approaches to cooperative learning. *Theory into Practice*, 38 (2), 74-79.

Summers, M., & Volet, S. (2010). Group work does not necessarily equal collaborative learning: Evidence from observations and self-reports. *European Journal of Psychology of Education*, 25(4), 473-492. http://dx.doi.org/10.1007/s10212-010-0026-5

Toumasis, C. (2004). Cooperative study teams in mathematics classrooms. *International Journal of Mathematical Education in Science and Technology*, 35 (5), 669-679.

Vaughan, W. (2002). Effects of cooperative learning on achievement and attitude among students of color. *Journal of Educational Research, 95*, 359-364.

Zakaria, E., Lu Chung, C., & Daud, M. (2010). The effects of cooperative learning on students' mathematics achievement and attitudes toward mathematics. *Journal of Social Sciences*, *6*(2), 272-275.