Cooperative Learning Strategy and Students Performance in Mathematics in Junior High School in Hohoe Municipality, Ghana

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Abstract The study investigated the effect of cooperative learning strategy on student’s performance in mathematics at selected Junior High School in Volta Region of Ghana. The study adopted a quasi-experimental research design. The sample for the study consisted of two hundred and sixty-six (266) Junior High School 2 mathematics students selected from two Junior High Schools in Hohoe municipality of Volta Region in Ghana. The instrument for data collection was Mathematics Achievement Test (MAT). The instrument was validated by two experts and has reliability index of 0.87 obtained through the use of Pearson Product Moment Correlation. Two objectives and two hypotheses were formulated to guide the study. The data collected were analyzed using adjusted mean and standard deviation to answer the objectives while Analysis of Covariance (ANCOVA) was used to test the null hypothesis at alpha level of 0.05. The finding of the study confirmed that students performed better using cooperative learning strategy irrespective of their ability level than those students who were taught using the traditional method. The test of interaction showed that gender had no significant interaction with teaching strategy on students mean performance. The study concluded that cooperative learning strategy is a good teaching method for teaching mathematics. The study recommended that mathematics teachers should adopt the cooperative learning strategy in order to improve students’ performance, social interaction skills and foster meta-cognition in students. The study also recommended that workshops should be organized by educational bodies to emphasize and enlighten teachers and mathematics educators on the importance of using cooperative learning strategy in the learning and teaching in Junior High schools in Ghana.

Keywords: cooperative learning strategy, students performance, mathematics, traditional method

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1. Introduction

Mathematics is the science that deals with the logic of shape, quantity and arrangement. Mathematics is all around us, in everything we do. It is the building block for everything in our daily lives, including mobile devices, architecture (ancient and modern), art, money, engineering and even sport (Oxford languages, 2013). So when many students turn out to be very miserable and inattentive in a mathematics class after being taught a topic and discover they could not memorize or recall such a concept with ease. The reason for this difficulty may vary but this could sometimes be related to the teaching method being used to explain such topics Udeinya & Okabiah [1] blamed poor performance of students in mathematics on poor methods and approaches to teaching which has reduced the level of motivation. Harbor-Peters [2] asserted that the issue of poor performance in mathematics examinations was due to problem of teaching methods. There has also been an increasing awareness by those concerned with mathematics education that the conventional method of teaching mathematics has not been very successful. For effective teaching to take place, the skillful mathematics teacher needs to use many different methods and techniques at his disposal. A carefully designed teaching method can make teaching and learning effective [3]. One of the many teaching methods proposed by Johnson & Johnson 2019, Slavin 2018 that results in positive effect on students’ achievement is cooperative learning.

However, the review of students’ achievement in mathematics in junior high school Basic Education Certificate Examination (BECE) showed that students’ performance in mathematics was poor [4]. This persistent failure was blamed on constant usage of traditional method of mathematics educators. The limitation experienced with the traditional teacher centered methods led to the development of innovative strategies of teaching mathematics like cooperative learning strategy.
Cooperative learning can be defined as a teaching method that involves students in learning processes in order to understand and learn content of the subject [5]. Traditional class activities create a win–win situation, where one can only succeed if other loose, while cooperative learning is direct opposite to it, here conquest of all is success of all. Cooperative learning has edge over other teaching methods in terms of its effectiveness for improved cognition, social skills and motivation. Two major attributes that have distinguished cooperative learning from traditional learning include interdependence (positive) as well as accountability as each member of group is important for success [5]. Its competence in terms of augmenting academic achievement has been proved many research studies [6,7,8,9]. Cooperative learning also improves positive attitudes towards learning [7], improved social relations [10], in addition to high self-esteem and cohesiveness [5]. Cooperative learning can also be stated in terms of instructional strategy in which students work together to achieve learning target [11]. It is also presented by [12] that the cooperative learning method when used as a teaching activity, improves motivation, class participation and academic achievement of students.

Cooperative learning has been used many researcher as instruction strategy with positive and improved results. A few studies have been carried out in local context also, for example Iqbal [13] conducted a study the examine the effect of cooperative learning on academic achievement on secondary school students in the subject of mathematics, he reports that there was a significant difference between the achievement scores of the students taught by the cooperative and traditional method. The students who were taught by the cooperative method shown high scores. Similarly, Bibi [14] and Siddiqui [15] has carried out their research by using cooperative learning for improving performance of ESL learners, the results were positive. Similarly, study carried out by Arbab [16] for two weeks on general science students also proved that students taught with cooperative learning method has improved results than control group.

Cooperative learning is a teaching strategy that organizes students in small groups so that they can work together to maximize the learning of others. In particular, the cooperative learning approach to education is the place where students are organized in pairs or in small groups to help each other in learning the assigned material [17,18]. Akinbobola [19] also defined cooperative learning as a way of learning in which students of different ability levels work together in small groups to achieve a goal. It involves the use of a variety of learning activities to improve the understanding of a topic. Students in a group interact with each other, share ideas and information, seek for additional information and make decisions about their discoveries for the whole class. There are four basic elements in the cooperative learning strategy. These basic elements include: (1) small groups must be structured for positive independence; (2) there must be face-to-face interactions, (3) individual responsibility and (4) use of interpersonal skills and small groups. It is known that cooperative learning actively involves students in the learning process and seeks to improve the critical thinking, reasoning and problem solving skills of the learner [20].

Jacobson and Baribor [21] reiterated that group work arouse students’ learning interest, cultivate their exploring ability and creative thinking and improve their team spirit and social communication skills. Group work can help students become more active in their learning. When working with peers in a group, students are encouraged to articulate their ideas and question the ideas of others. According to Simek, Bylilar and Kucuk [22], cooperative learning is a process aimed at facilitating the achievement of a specific end product or objective through people working together in groups. Similarly, Ruel and Bastianns [23] see cooperative learning as a method of instruction that allows students the independence of the use of mental processes to contribute to knowledge. Naseem and Bano [24] believe that when students of different cognitive, intellectual and physical levels are exposed to solving a given task, they have the opportunity to interact and work as a team. They say it improves learning attitudes, interpersonal skills and the concept of self. Teacher dependency also decreases. Therefore, the teacher’s role changes from providing information to facilitating student learning. Therefore, the teacher remains in the background and becomes a guide, a facilitator, an illuminator or a “torch bearer”. The tasks of cooperative learning are usually intellectually demanding, creative, open and involve higher-order thinking tasks. Cooperative learning can therefore give weak students the opportunity to learn and achieve the maximum [25]. Furthermore, cooperative learning involves group work among students, resulting in positive interdependence. Typically, in cooperative learning, academic assignments are structured or divided so that everyone can participate fairly and all students are responsible [26].

A review of the studies on the effects of cooperative learning on student’s performance indicated that all researchers made similar findings. Ajaja [25], Crosby and Owens [27], Steven and Slavin [28], Megnin [29], Webb, Trolper and Fall [30] found that the cooperative learning is not limited to a particular ability level or sex, but to all who engage in it. Similarly, Glassman [31] and Johnson, Johnson and Stanne [32] found that cooperative learning emphasizes status and respect for all members, regardless of gender. More importantly, the study by Crosby and Owens [27] found that different cooperative learning strategies can be employed to help low ability students to improve achievement, who had difficulties making success in the traditional classroom. Ajaja and Eravwoke [18] also reported a non-significant difference in achievement test scores between the male and female students in cooperative learning group. This mean that male and female were having equivalent performance in mathematics after being taught through cooperative learning methods.

1.1. Statement of the Problem

The difficulty in understanding mathematics is evident in the low achievement level of student in the low achievement level of students in both internal and external examination and the phobia expressed in learning the subject. This abysmal performance was attributed to wrong use of teaching approaches in mathematics such as traditional method. However, the present study intends to
find out whether or not cooperative learning strategy has varying effect on student’s performance in Mathematics of Junior High School level.

1.2. Aim and Objectives of the Study

The purpose of the study was to investigate the effect of the cooperative learning strategy on the academic performance of students in mathematics at Junior High School level. Specifically, the study sought to:

1. find out if there is difference between the mean performance score of students taught with cooperative learning strategy and those taught using traditional method at Junior High School in Ghana.
2. find out if there is difference between the mean performance score of male and female students taught using cooperative learning strategies at Junior High School in Ghana.

1.3. Research Hypothesis

To achieve the objectives of the study, the following null hypothesis was tested at a 0.05 level of significance.

\( \text{Ho}_1 \): There is no statistically significant difference between the mean achievement score of students taught mathematics using cooperative learning strategy and those taught using traditional method.

\( \text{Ho}_2 \): There is no statistically significant difference between the mean performance scores of male and female students taught using cooperative learning strategies.

2. Methodology

The design of the study is quasi-experimental group design. Specifically, the non-equivalent control group design. The design is considered appropriate because it establishes a cause effect relationship between the independent variable and the dependent variable. This design was adopted because it was possible to have a complete randomization of the subjects. Thus, intact classes were used as experimental and control groups, since it is not possible to disrupt existing classes in a school. The population of the study consists of all the 6234 Junior High School Two (JHS 2) in the Hohoe municipality in the Volta Region of Ghana. A total of 266 Junior High School Two (JHS 2) mathematics students consisting of 142 males and 124 females’ student constituted the sample for the study, through purposive sampling techniques. Data was collected through mathematics Achievement test which consist of 10 items with 4-option multi choice test questions. The instrument was validated by two experts in mathematics department of St. Francis College of Education, Hohoe. A reliability coefficient of 0.87 was obtained for the study using Pearson Product Movement Correlation. The treatment exercise lasted for five weeks before the post-test. Mean and standard deviation were used to answer the research questions while the null hypothesis was tested with analysis of covariance (ANCOVA) at 0.05 level of significance.

3. Results

3.1. Objective One

To find out if there is difference between the mean performance scores of students taught mathematics with cooperative learning strategy and those taught using traditional method at Junior High School in Ghana.

Table 1. Mean and standard deviation of pretest scores of students’ taught using cooperative learning strategy and those taught with traditional method

| Group               | N   | Pre-test Mean | Pre-test SD | Post-test Mean | Post-test SD |
|---------------------|-----|---------------|-------------|----------------|--------------|
| Cooperative learning| 135 | 8.26          | 3.29        | 18.73          | 7.46         |
| Traditional         | 131 | 7.56          | 3.29        | 10.54          | 2.63         |

Table 1 show that the group taught mathematics using cooperative learning strategy has a protest mean of 8.26 with a standard deviation of 3.29 while a group taught mathematics using traditional method had a pre-test means of 7.56 with a standard deviation of 3.29. Also the table also shows the group taught mathematics using cooperative learning strategy had a post-test mean of 18.73 with a standard deviation of 7.46 while a group taught using traditional method had a post-test mean of 10.54 with a standard deviation of 2.63. The difference between the pre-test and post-test mean of a group taught using cooperative learning strategy was 10.47 while that of a group taught using traditional method was 2.98. However, for each of the groups, the post-test means were greater than the pretest means with the group taught using cooperative learning strategy having a highest mean gain. This shows that cooperative learning strategy has more effect on student’ achievement in mathematics than the traditional method.

3.2. Objective Two

To find out if there is difference between the mean performance score of male and female students taught using cooperative learning strategies at Junior High School in Ghana.

Table 2. Mean and standard deviation of pretest and post-test scores of male and female students’ cooperative learning strategy

| Gender | N  | Pretest Mean | Pretest SD | Post-test Mean | Post-test SD |
|--------|----|--------------|------------|----------------|--------------|
| Male   | 71 | 5.35         | 2.13       | 16.40          | 2.89         |
| Female | 64 | 5.85         | 1.69       | 16.90          | 1.81         |

The result in Table 2 showed that the male students taught mathematics using cooperative learning strategy has pretest mean of 5.35 with standard deviation of 2.13 and a post-test mean of 16.40 with a standard deviation of 2.89. The difference between the pre-test and post-test means for the male group was 11.05. The female students taught mathematics using cooperative learning strategy has a pre-test mean of 5.85 with a standard deviation of 1.69 and a post-test mean of 16.90 with standard deviation of 1.81. The difference between the pre-test and post-test means for female group was 11.05.
4. Discussion of Findings

Results in Table 1 indicates higher achievement mean scores of students taught mathematics with cooperative learning strategy compared with their counterparts in traditional method. The result in Table 3 also indicates a significant difference in the mean performance scores of students taught mathematics using cooperative learning strategy and those taught using traditional method. This finding is in consonance with Jacobson and Baribor [21] who indicate group work arouses students’ learning interest, cultivate their exploring ability and creative thinking and improve their team spirit and social communication skills. Ajaja [25] noted that cooperative learning can give weak students the opportunity to learn and achieve maximally. Similarly, the study by Crosby and Owens [27] found that difference cooperative learning strategies can be employed to help low ability students to improve achievement, who has difficulties making success in the traditional classroom. Simsek, Byilir and Kucuk [22] also defined cooperative learning as a process meant to facilitate the accomplishment of a specific end goal through people working together in groups. Ruel and Bastians [23] also observed that cooperative teaching strategy allow the students the independence to use his/her mental process to contribute to knowledge. Stevens and Slavin [28] stressing the importance of cooperative learning noted that cooperative learning increase in students’ academic performance of all ability levels.

Table 2 revealed that the achievement means scores of the male and female students taught mathematics with cooperative learning strategy were the same. Also, the result in Table 4 revealed that gender is not a significant factor in determining students’ performance in mathematics using cooperative learning strategy. This finding harmonizes with Ajaja [25], Crosby and Owens [27], Steven and Slavin [28], Megnin [29], Webb, Tropper and Fall [30] who found that the cooperative learning is not limited to a particular ability level or sex, but to all who engage in it. Ajaja and Eravvoke [18] reaffirmed the ability to cooperative learning when used as an instructional strategy to bring about achievement in school subject and a non-significance in achievement scores between male and female students in the cooperative learning group.

5. Conclusion

The results of the study showed that students performed better using cooperative learning instructional strategy irrespective of their ability level than those students using traditional method. The result of the study also indicated that both the male and female students benefitted equally from the cooperative learning strategy.

6. Recommendation

Since cooperative learning was found to be more effective in the teaching and learning of mathematics in our schools, mathematics teachers are advised to adopt the cooperative learning strategy in order to improve
students’ performance, social interaction skills and foster meta-cognition in students.

Workshops should be organized by educational bodies to emphasize and enlighten teachers and mathematics educators on the importance of the cooperative learning approach.

Additional research should be conducted on large sample to increase the generalizability of the finding to the subject of education and also future research should focus on comparisons between different models of cooperative learning.

References

[1] Udeinya, C.S., & Okabiah, O.S (1991). Special methods of Teaching Science Subjects Enugu: ABIC.
[2] Harbor Peters, V.F.A. (2018). Unmasking Some Aversive Aspect of School Mathematics and Strategies for averting them. Inaugural Lecture: 5th July, 2018.
[3] Chianson, M.M. (2008). Cooperative learning: in Kurumeh, M.S &Opala M.F (eds) Innovative Teaching Approaches of Mathematics Education in the 21st Century. Vol. 1, pp. 27-40.
[4] Mills, E. D., & Mereku, D. K. (2016). Students’ Performance on the Ghanaian Junior High School Mathematics National Minimum Standard in the Effini Municipality, Ghana. African Journal of Education Studies in Mathematics and Science. Volume 12.
[5] Slavin, R.E. (2011). Instruction Based on Cooperative Learning. In R.E. Mayer & P.A. Alexander (Eds). The Nature of Learning: Using Research to Inspire Practice. OECD Publishing.
[6] McMaster, K., & Fuchs, D. (2020). Effects of Cooperative Learning on Academic Achievement of Students with Learning Disabilities: An Update of Tateyama-Sniezek’s Review. Learning Disabilities Res Pract, 17(2), 107-117.
[7] Johnson D.W., & Johnson, R.T. (2019). Social interdependence theory and cooperative learning: The teacher’s role. In R.M. Gillies, A. Ashman &Terwel (Ed), Teacher’s Role in Implementing Cooperative Learning in the Classroom (pp. 9-37). Springer.
[8] Nichols, J. (2015). The effects of cooperative learning on student’s achievement and motivation in a High School Geometry Class. Contemporary Educational Psychology, 21(4), 467-476.
[9] Winston, V. (2010). Effects of Cooperative Learning on Achievement and Attitude among Students of color. Journal of Educational Research, 9(5), 220-229.
[10] Johnson, D., & Johnson, R. (2005). New Development in Social Interdependence Theory. Genetic Social, and General Psychology Monographs, 131(4), 285-358.
[11] Abrami, P., Poulsen, C., & Chambers, B. (2004). Teacher motivation an educational innovation: Factor differentiating users and non-users of cooperative learning. Educational Psychology, 24(2), 201-216.
[12] Polloway, E., & Patton, J. (2001). Strategies for teaching learners with special needs. Merrill press.
[13] Iqbal, M. (2004). Effective of cooperative learning on academic achievement of secondary school students in Mathematics. (Doctoral dissertation). https://eprints.hec.gov.pk/cgi/search/advanced.
[14] Bibi, A. (2002). The comparative effectiveness of teaching English Grammar with the help of textbook and by using group work activities. (Doctoral dissertation). http://eprints.hec.gov.pk/cgi/search/advanced.
[15] Siddiqui, S. (2003). Collaborative approach to language learning. Karachi.
[16] Arbab, S. (2003). Effects of Cooperative Learning on General Science Achievement of 19th Class Students. Unpublished Master Dissertation, Rawalpindi: PAF College of Education for Women.
[17] Towbridge, L.W., Bybee, R.W., & Powell, J.C. (2000). Teaching Secondary school science. Upper Saddle Rivers, Merrill/Prentice Hall.
[18] Ajaja, O.P. & Eravwoke, O.U. (2010). Effects of SE learning cycle on students’ achievement in biology and chemistry. Cypriot Journal of Educational Sciences, 7(3), 244-262.
[19] Akinbobola, A. O. (2015). Effects of cooperative learning strategy on academic performance of students in Physics, Journal of Research in Education, 3(1), 1-5.
[20] Borich, G. D. (2015). Effective teaching methods, fifth edition. Merrill, Prentice Hall.
[21] Jacobson, B.N., & Baribor, V. (2012). The effect of teaching techniques on achievement in integrated science: the cooperative learning dimension. Journal of Education & training technology, 3 (1), 57-64.
[22] Simek, U. Byilar, Y., & Kucek, V. (2013). Effects of cooperative learning methods on students’ academic performances in social psychology lessons. International Journal on New Trends in Education and their implications 4(3), 1309-6249.
[23] Ruel, G., & Bastians, N. (2003). Free riding and team performance in project education, International Journal of Management Education 3(1), 26-37.
[24] Naseem, S., & Bano, R. (2013). Cooperative learning an instructional strategy technology. An International Journal of Educational Technology. 1(1), 2231-4105.
[25] Ajaja, R. (2018). Concept Mapping and cooperative learning strategies on students’ performance in Social Studies in Ika South Local Government Area of Delta State. An Unpublished PhD Thesis, University of Port Harcourt, Rivers State.
[26] Candler, L. (2014, March 18). Cooperative learning more than just group work. https://www.corkboardconnections.blogspot.com/.
[27] Crosby, M. S., & Owens, E.S. (2018). The disadvantages of tracking and ability grouping: A look at cooperative learning as an alternative. In National Dropout Prevention Center Bulletin: Solution and Strategies, (5), 1-8.
[28] Steven, R., & Slavin, R. (2018). The cooperative elementary school: Effects on student’s achievement, attitudes and social relations. American Educational Research Journal 32(2), 321-351.
[29] Megnin, J. (2020). Combining memory and creativity in teaching mathematics. Teaching Prek 25(6), 48-49.
[30] Webb, N., Troppr, J., & Fall, R. (1995). Constructive activity and learning in collaborative small groups. Journal of Educational Psychology, 89(34), 406-423.
[31] Glassman, P. (2015). A study of cooperative learning in mathematics, writing and reading in intermediate grades: A focus upon achievement, attitudes and self-esteem by gender, race and ability group. Dissertation Hofstra University, New York.
[32] Johnson, D., Johnson, R., & Stanne, M. (2013). Cooperative Learning methods: A meta-analysis. Minnesota: University of Minneapolis.