



Model for Implementing Cooperative Learning in a Mathematics Classroom

Evans Atteh^{1*}, Augustine Boadi¹ and Emmanuel Appoh Andam²

¹*Department of Mathematics and ICT, Wiawso College of Education, Sefwi Wiawso, Ghana.*

²*Department of Mathematics, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.*

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJARR/2020/v11i430270

Editor(s):

(1) Dr. Fagbadebo Omololu Michael, Durban University of Technology, South Africa.

Reviewers:

(1) Pasupuleti Venkata Siva Kumar, Vallurupalli Nageswara Rao Vignana Jyothi Institute of Engineering & Technology, India.

(2) Diab Zouhair, Larbi Tébessi University, Algeria.

(3) Jelena Šuh, Serbia.

Complete Peer review History: <http://www.sdiarticle4.com/review-history/52160>

Original Research Article

Received 10 August 2019

Accepted 16 October 2019

Published 06 July 2020

ABSTRACT

This paper identifies 5-step model that can be adopted or implemented by every mathematics teacher and various training settings to effectively move teaching and learning towards an active cooperative learning environment. This model is built upon existing ideas proposed over the years by scholars in education and best practices concerning effective teaching and learning environment which tends to equip teachers with very useful skills and guidelines for classroom instructions concerning cooperative learning approach. Consequently, this model can assist instructors to move teaching and learning towards an active cooperative learning environment which has been proven as more effective and enjoyable for teachers and students for learning.

Keywords: *Cooperative learning; learning environment; cooperative learning model; mathematics classroom.*

1. INTRODUCTION

The development of the ability of students to solve problems has long been recognized as one of the major goals of mathematics education [1]. It is fundamental in our society that every individual is faced with making decisions and therefore they must have the ability to think creatively, laterally, divergently, rationally, objectively, and systematically. However, teaching mathematics means teaching students how to: define the problem to be solved, devise a plan, choose appropriate strategies, collect and analyze relevant information, evaluate relevant information and apply the appropriate strategies to solve a problem, evaluate the results and make decisions [2]. This suggests that students are expected to move beyond the usual rigorous calculation and use mathematics ideas in investigating real life situations. It is based on this philosophy that the mathematics curriculums across the world have been designed purposely to provide students with the mathematics knowledge and skills and develop thinking skills strategies to enable them to move higher in the educational ladder, solve problems and make decisions in everyday life. The attainment of these goals among others is based on a set of general objectives which should guide instruction in the mathematics classroom; including working cooperatively with other students and develop interest in mathematics, manipulate learning materials to enhance understanding of concepts and skills among others [3].

It is believed that educators' instructional decisions stem from complex foundational beliefs about teaching, learning, the nature of human interaction, and the fundamental purposes of schooling [4]. To overcome such barriers, a variety of teaching and learning methods have been suggested and advocated for use in our mathematics classroom, to help us move away from the teacher - centered approach to a more student - centered approach [5]. Understanding these beliefs is central to the implementation of educational innovations and instructional improvement efforts [6]. One such innovation is cooperative learning, which research consistently supports as an effective method of learning in raising student achievement and increasing motivation to learn [7]. In addition, Slavin [8], posited that cooperative learning produces greater student achievement than traditional methodologies.

Therefore, this paper turns to propose a 5-step model that can be implemented in all mathematics classrooms to help promote teaching through co-operative learning. This model provides mathematics educators with a very useful assistance which intends to move teaching and learning from the lecture-based learning environment towards an active co-operative learning environment.

2. THE NEED FOR CO-OPERATIVE LEARNING

A study by Springer, Stanne and Donovan [9] suggested that cooperative learning is a term that is used to describe an instructional arrangement for teaching academic and collaborative skills to small heterogeneous groups of students. They further explained that the term cooperative learning refers to students working in teams on an assignment or project under conditions in which certain criteria are satisfied, including team members being held individually accountable for the content of the completed assignment or project [9]. Therefore, it can be said that cooperative learning is the instructional use of small groups so that students work together to maximize their own and each other's learning. "Cooperative learning is grounded in the belief that learning is most effective when students are actively involved in sharing ideas and working cooperatively to complete academic tasks" [5].

By the nature of cooperative learning it can be termed as an active method of learning since students learn more by doing something active than by simply watching and listening. The effectiveness of cooperative learning in education in relation to students taught traditionally—i.e., with instructor-centered lectures, individual assignments, and competitive grading cannot be underestimated since cooperatively taught students tend to exhibit higher academic achievement, greater persistence through graduation, better high-level reasoning and critical thinking skills, deeper understanding of learned material, greater time on task and less disruptive behavior in class, lower levels of anxiety and stress, greater intrinsic motivation to learn and achieve, greater ability to view situations from others' perspectives, more positive and supportive relationships with peers, more positive attitudes toward subject areas, and higher self-esteem.

Naturally, students who are weak in mathematics when working individually are likely to give up when they get stuck but working cooperatively will keep them going until a solution is found. Additionally, the stronger students who are mostly faced with the task of explaining and clarifying material to weaker students often find gaps in their own understanding and fill them in as they progress. In furtherance, Cheong [10] elaborated that;

'Group-based learning creates an environment in which students can practice, gain, and improve soft skills such as leadership, communication, social and conflict resolution skills. However, simply placing students in groups and creating group-based assessment tasks will not necessarily result in students developing and practicing these skills. Instead, specific approaches, such as cooperative learning in this case, need to be followed to ensure students develop these skills.'

Another huge benefit of co-operative learning for instructors is that when assignments are done cooperatively, the number of papers to grade/mark decreases thereby decreasing the workload of teachers.

3. 5-STEP MODEL FOR PRACTICING CO-OPERATIVE LEARNING

Cooperative learning is an approach to group work that maximizes the learning and satisfaction that result from working on a high-performance team and minimizes the occurrence of those unpleasant situations such as class disruptions. The skills students develop while collaborating with others are different from the skills students develop while working independently. Cooperative learning is based on several basic principles that all must be considered during assessment. These are; positive interdependence, individual accountability, face-to-face promotes interaction, appropriate use of collaborative skills and group processing. Positive interdependence for example, occurs when the success of the individual and the success of the team are positively correlated. Therefore, using cooperative learning groups to accomplish academic tasks does not only provides opportunities for students to develop interpersonal skills but also gives them authentic experiences that will help them be successful in their future careers.

Step 1: Teach the Class in general

The teacher specifies the objectives for the lesson (one academic and one social skill). The teacher goes on to teach the academic concepts, principles, and strategies that the students are to master and apply, and explains the;

- a. Task to be completed,
- b. Criteria for success,
- c. Positive interdependence,
- d. Individual accountability, and
- e. Expected student behaviors.

The teacher introduces the actual area to be covered under the lesson. This involves the use of examples and non-examples to give detailed explanation about the topic under discussion. During this general class discussion, the appropriate hands-on materials are employed in the teaching process to aid students in acquiring the basic concept of the topic.

Step 2: Placed the students into groups

The teacher makes a series of decisions about how to structure the learning groups. This includes but not limited to;

- a. What is the size of the groups,
- b. How students are assigned to groups,
- c. What roles to assign to individual students,
- d. How to arrange materials, and
- e. How to arrange students' sitting to maximize effective learning.

Students are placed in groups based on their academic abilities. This heterogeneous grouping makes it possible for the academically weak students to learn a lot from those students who are academically strong. The frequent questions from the weak students and the explanations from the stronger students help to fill in the knowledge gap.

Step 3: Provide Exercises/Assignments for the groups to discuss/solve for solution

The teacher provides enough exercises or assignments for students to brainstorm and "jaw jaw" to test for understanding within the group. These exercises or assignments should be able to generate healthy arguments and counter discussion to ensure proper understanding of the concept under discussion. Therefore, teachers should avoid giving out problems that requires

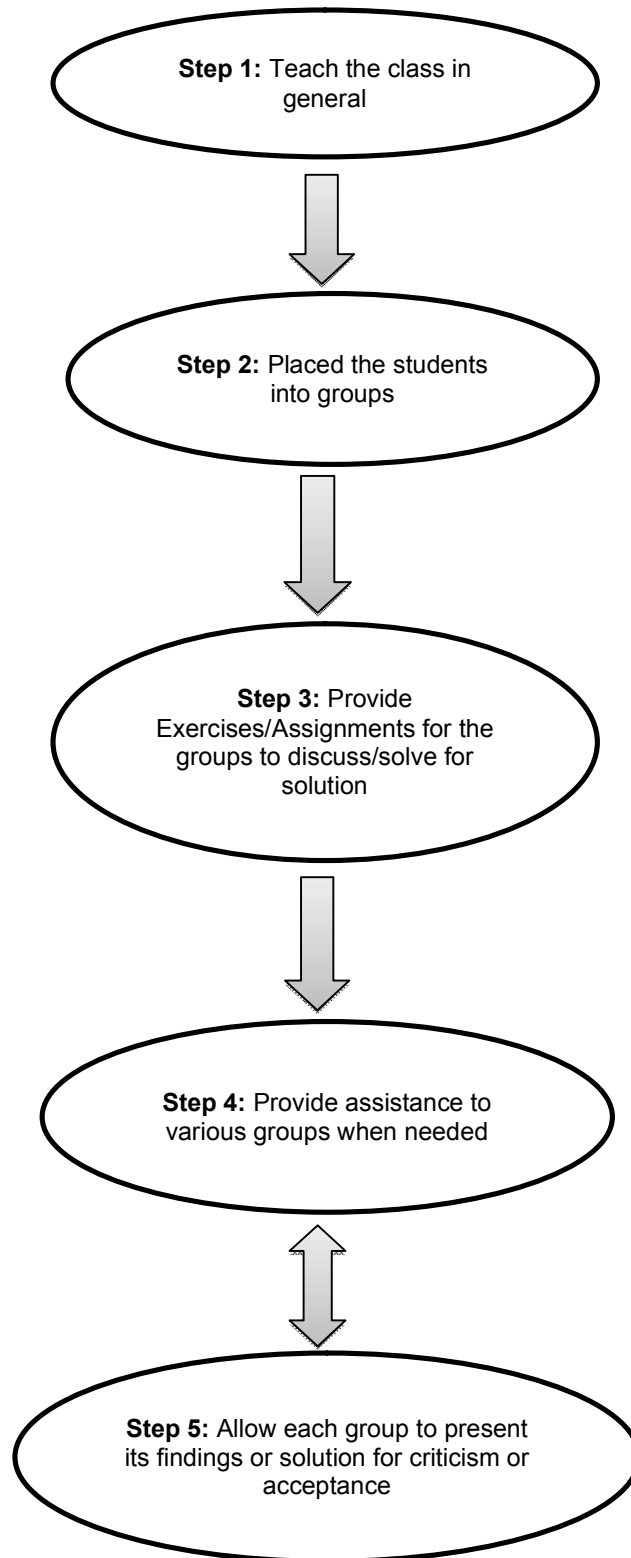


Fig. 1. 5-step model structure to help instructors to implement co-operative learning in schools

straight forward answers since it does not support healthy discussions.

Step 4: Provide assistance to various groups when needed

The teachers should monitor the functioning of the learning groups and intervenes to;

- a. Teach collaborative skills and
- b. Provide assistance in academic learning when it is needed.

This is where instructors should allow the groups run while the instructor circulates through the room to collect observation data, see whether the students understand the assignment, give immediate feedback and praise for working together. It follows that, if a group is having difficulties, the instructor can intervene to help them get on the right track.

Step 5: Allow each group to present its findings or solution for criticism or acceptance

The presentation allows the teacher to evaluate students' performance against the preset criteria for excellence, and ensures that groups process how effectively members worked together. This suggests that, once the group finishes their exercises or assignments, work should be assessed by both the instructor and the groups. The presentation process involves asking the groups to rate their own performance and set goals for themselves to improve their cooperative work when there are shortfalls in their findings or solutions. In a situation where the solutions or findings presented by a group is wrong, the group is encouraged and assisted to go over the steps again until the required solution is found.

4. CHALLENGES IN PRACTICING CO-OPERATIVE LEARNING

Although cooperative learning can be highly effective, there are some possible challenges in this approach of teaching. One of the major criticisms of cooperative learning is that it tends to hold back the learning potential of students who are naturally gifted. In most cases, students who are prone to social anxiety and prefer to work alone may suffer a negative effect of cooperative learning. Therefore, instructors must understand that cooperative learning is not for everyone and must compliment or supplement some material to students who thrive in a less socially active environment. It is believed that

most students have been trained to see learning as an uncompromisingly individual process in which independence is demanded and rewarded [11]. Therefore, introducing cooperative learning into a classroom where individuality is highly regarded will create confusion.

When cooperative learning is not properly planned and executed, especially when students lack clearly defined goals, some group members may do most of the work while others passively observe or minimally participate. This diffusion of responsibility is detrimental to the achievement outcomes of cooperative learning because it may promote ignoring and off-task behaviors among the members of the group. This is why vocal opponents of cooperative learning take issue with the concept of group rewards in which each member of a learning team receives the same grade although the contributions to the task may be disparate.

Leading researchers on cooperative learning are with the believe that the challenges of cooperative learning are surmountable when it is understood and implemented fully by teachers [12,13].

5. CONCLUSION

It is deemed necessary that teachers give thoughtful consideration to various instructional methods and to the personal beliefs that motivate them prior to contemplating that particular method or approach to teaching. Implementing cooperative learning through this model requires a commitment to active and student-centered learning which may be uncomfortable and unfamiliar in the initial stage. But with creativity and proper planning the potential hindrances in the application of this model can be overcome. The encouragement of active group learning can be achieved in any content area by modification of teaching strategies and the incorporation of simple cooperative learning techniques.

Research by scholars in decades ago has established that collaborative work among students in classroom settings have enormous benefits both in the cognitive and social realms. It is important to note that teachers at all levels of education who have used cooperative learning have acknowledged that its impact stretches beyond classrooms. This practice has positive effects on the classroom and school climate as it minimizes students' disruptive behavior, consequently reducing the needed discipline the

teacher has to spend time on. When using cooperative learning students are involved in dialog, healthy debate, and problem solving as well as higher order thinking such as analysis, synthesis and evaluation.

The use of the 5-step model to assist students learn through cooperative learning approach will require a fundamental change in instructional technique from the old lecture method of teaching to a learner-centered approach of learning. The benefits include positive students' relationships and psychological health in social life.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Atteh E, Andam EA, Obeng-Denteh W, Okpoti CA, Amoako J. The problem solving strategy of solving mathematical problems: The case study of Esaase Bontefufuo Senior High Technical School, Amansie West District of Ghana. *International Journal of Applied Science and Mathematics*. 2014;1(2):40-45.
2. Atteh E, Andam EA, Obeng-Denteh W. Problem solving framework for mathematics discipline. *Asian Research Journal of Mathematics*. 2017;4(4):1-11.
3. Ministry of Education Youth & Sports, Ghana. Teaching Syllabus for Mathematics (Junior High School). Accra, Ghana: Ministry of Education, Youth and Sports; 2007.
4. Fang Z. A review of research on teacher beliefs and practices. *Educational Research*. 1996;38(1):47-65.
5. Andam EA, Atteh E, Obeng-Denteh W. The cooperative learning approach of solving word problems involving algebraic linear equations at institute for educational development and extension (IEDE), university of education, Winneba, Ghana. *Journal of Mathematical Acumen and Research*. 2016;1(1):1-11.
6. Abrami P, Poulsen C, Chambers B. Teacher motivation to implement an educational innovation: Factors differentiating users and non-users of cooperative learning. *Educational Psychology*. 2004;24(2):201-216.
7. Johnson DW, Johnson RT. Essential components of peace education. *Theory into Practice*. Boston: Allyn and Bacon. 2005;44(4):280-292.
8. Slavin RE. Comprehensive approaches to cooperative learning. *Theory into Practice*. Academic Search Premier. 1999;38(2).
9. Springer L, Stanne ME, Donovan S. Effects of small-group learning on undergraduates in science, mathematics, engineering, and technology: A meta-analysis. National Institute for Science Education: Madison, WI; 1997. Available:<http://www.wcer.wisc.edu/nise/CLI/CL/resource/R2.html> (Accessed October 5, 2006)
10. Cheong C. Fromoup-based learning to cooperative learning: A metacognitive approach to project-based group supervision. *International Journal of an Emerging Transdiscipline*. 2010;13:73-86.
11. Gergits J, Schramer J. The Collaborative Classroom as a Site of Difference; 1994. Available:<http://jac.gsu.eduU/jac/14.l/Articles/10.htm> *Group-Think: How Harmful is it Really!* (n.d.), <http://www.geocities.com/Athens/Atlantis/4124/group.html>
12. Walters LS. Putting cooperative learning to the test. *Harvard Education Letter*; 2000. Available:<http://www.edletter.org/past/issues/2000-mj/cooperative.shtml>
13. Rottier J, Ogan B. Cooperative learning in middle level schools. Washington DC: National Education Association; 1991.

© 2020 Atteh et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:

The peer review history for this paper can be accessed here:
<http://www.sdiarticle4.com/review-history/52160>