International Journal of
Advances in Scientific Research and Engineering (ijasre)

E-ISSN : 2454-8006

DOI: 10.31695/IJASRE.2020.33774

Volume 6, Issue 3
March - 2020

Investigating Various Grouping Strategies in Teaching and Learning of Mathematics

David Kibe Muchiri[1], Mary C. Wanjiku Njenga[2]

[1]African Institute for Mathematical Sciences, University of the Western Cape, South Africa. Email: davidkibe@aims.ac.za

[2]Department of Educational Communication and Technology, School of Education Kenyatta University, Kenya

---

ABSTRACT

Group work can become a powerful tool for teaching and learning of mathematics. Grouping strategy is one of the factors that determine the effectiveness of group work. In this paper, the researcher investigated the effectiveness of various strategies for grouping students in a maths class. Learners were placed in groups according to various strategies and given the same treatment under similar conditions. Afterward, a test was administered to gather the feedback of every grouping strategy and the results analyzed. Mixed-ability grouping based on academic achievement was observed to be the most effective grouping strategy.

Key words: Group work, Grouping strategy, Homogeneous, Mixed-ability, Treatment.

---

1. INTRODUCTION

In the recent years, mathematics educators are striving to improve teaching methods that are learner-centered, with the aim of improving student performance. Group work is one of such methods commonly used by teachers to encourage student participation and generation of ideas when solving a problem. Group work can be very effective if a good grouping strategy is implemented. A grouping-strategy is an art of arranging students for group work. There are various strategies that can be used to arrange students in groups. Each grouping strategy has its own merits and demerits. The most effective grouping strategy is crucial to teaching and learning of mathematics. However, little has been done to investigate the effectiveness of various grouping strategies. In this paper, we study, analyze and discus the effectiveness of various grouping strategies that can be used to promote academic achievement in mathematics education.

There exist a vast literature on various methods of instructions; both teacher centered and student centered approach, [1]. Teacher centered approaches include; lecture method, chalkboard illustrations and demonstrations. These methods are important especially when introducing a lesson, teaching a concept for the first time or when emphasizing a point. However, teacher centered methods have very little learner participation. On the other hand, learner centered methods include; group work, discussions, debates and discovery activities. These methods promote student participation which is key to learning of mathematics. Learner centered approaches have been observed to be more effective in maths education than teacher centered, [2], though they can be time consuming and less productive if not well planned. Every method requires proper planning and can be useful depending on the context. Dominance of one method however, can be boring to students. A competent teacher should be able to integrate a number of methods to make lessons interesting for learners.

Group work is a method of instruction that is widely used in many fields of academics. This method is vital not only in classroom but also in offices where employees and stakeholders meet in groups to deliberate on issues affecting them. [3] has outlined a number of importance of group work in a classroom. Apart from maximizing participation of every student, group work should promote equity, collaborative skills and interrelationship among learners. Working in groups help students validate their ideas and deepen the understanding of mathematics, [4, 5]. When a teacher implements an effective grouping strategy, group work becomes more productive. Students in a productive group are able to simplify the problem that looked

difficult on chalkboard. Students in groups can even persevere to tackle more complex problems through sharing of divergent ideas.

2. GROUPING STRATEGIES

An effective group work, among other factors, requires an effective grouping strategy that will maximize learner participation and promote academic achievement. In this paper, we investigate the effectiveness of four grouping strategies discussed below.

(i) Random grouping strategy.

Random grouping is a strategy of teaming students without any specific consideration. The teacher selects students at random and places them in groups. Learners have no idea whom they are going to be teamed up with. Teachers can use this strategy when they want to achieve impartiality. It promotes socialization and mobility of knowledge across the class. Nevertheless, some students may fail to participate fully and freely if grouped with less familiar students or those they don't get along with. In addition, since this grouping does not consider student ability as a factor, some groups might be less advantaged when given a task to pursue.

(ii) Student-choice grouping strategy.

In this grouping learners are allowed to choose their group partners. Learners organize themselves according to their own preference. Most students choose their friends to work with. Students get an opportunity to work with people they get along well with. Some may choose colleagues who are more gifted in the subject so as to benefit from them. However, a group of friends can run the risk of having a team of story tellers who end up goofing off instead of working.

(iii) Homogeneous grouping strategy.

In this strategy, learners of similar academic achievement levels are placed in one group. The teacher groups students in the order of their academic ability. Those of the same ability are placed together e.g. top performers are put in one group. In this grouping, students are able to work at the same pace. A group of gifted learners can progress at a faster pace as they challenge each other by showcasing their expertise and possibly be able to solve a more complex problem. This can be a plus to their performance. On the contrary, this grouping can disadvantage less-able learners if left to work on their own. They may get stuck in the middle of the task and feel helpless. This can lose their confidence and perhaps contribute negatively to their performance.

(iv) Mixed-ability grouping strategy.

In this grouping, learners of different abilities are placed together. For instance, every top achiever is grouped with a low performing student. This grouping gives learners an opportunity to assist each other. Advanced students get a chance to answer questions and help others understand a problem. On the other hand, less-able students get an opportunity to ask questions and validate their ideas. At the end of the day, every learner gets involved and benefit from each other. This strategy accelerates improvement and promotes equity. However, this might be time consuming and boring to gifted learners as they repeatedly make others understand a problem.

Mixed-ability grouping can be done in several ways. For example, if we had 30 students to make 6 groups of 5, we can arrange them in terms of academic performance from position 1 to position 30. We then divide them in 6 bunches of five students in the order of performance e.g. the first bunch to consist of students from position 1 to 6. We can now place them in mixed-ability groups according to the following ways;

- Integrate mixed-ability with random grouping. In this method, we randomly select a student from every bunch to form the first group. Similarly, we randomly select another student from each bunch to form the second group. The process continues until the last student gets a group.This promotes positive interrelationship among learners.

- Integrate mixed-ability with student-choice. In this method, we allow students of the second bunch to choose a group partner from the first bunch to pair with. Similarly, we allow students of the third bunch to choose a group to join. The process continues until everyone is grouped. Two people in one bunch should not join one group. This method maximizes collaboration.

DOI: 10.31695/IJASRE.2020.33774

- Mixed-ability grouping by pattern. Here, we team up students in a pattern of academic order of performance. Student in position 1 is paired with students in position 7, 13, 19 & 25. Student in position 2 is paired with students in position 8, 14, 20 & 26, and the pattern continues in that order. We can also arrange students in reverse pattern as follows; student in position 1 is paired with students in position 12, 18, 24 & 30. Student in position 2 is paired with students in position 11, 17, 23 & 29, and the pattern continues in that order. More patterns can be generated.
  In the subsequent sections, we assess each of the above strategies to determine the most effective in a classroom setup.

3. METHODOLOGY

This investigation was carried out in a classroom set-up of 30 students in a secondary school in Kenya. All students were female at the age of 16 years. All students belonged to one class. The academic ability of students was above average. The research was carried out within a term of 14 weeks. After every week of normal teaching in a maths class, students were given practice questions to work out within five days, after which a test was administered to assess their understanding. Practice questions were well prepared to cover topics already taught in class. Questions were arranged in a systematic order starting with direct questions to more complex ones. Students were made aware of a test after five days of practice questions. The test was made of questions similar and related to questions in the practice paper. The test was marked and performance categorized as follows;

Table 1: Grading system

Score	Grade
Below 40	Fail
40-59	Pass
60-79	Good pass
Above 80	Distinction

For the purpose of effective preparation on practice questions, students were arranged in groups of 5 according to various grouping strategies discussed in Section 2. Every strategy was implemented within two weeks. Under normal conditions, every group was subjected to the same treatment described below, after which an assessment was done and results analyzed and discussed.

3.1 Treatment

The treatment was composed of a set of practice questions that were made interesting and well crafted to start with simple to complex questions that would challenge all learners. These questions were sourced from topics that had already been covered by the teacher in classroom. These questions were for the purpose of maths mastery and revision. At any given time, every group was provided with a set of practice questions that were similar to all groups. Students were required to workout individually and discuss the solutions in groups within 5 days. Students were encouraged to work together as a team, share ideas and help each other to understand and solve the problems. Equal participation was encouraged and emphasized. After 5 days, a test of related questions was administered to every student to pursue it individually. The test was marked, results obtained and analysed. The best group was rewarded.

4. RESULT AND DISCUSSION

In this section, we analyze and discuss the results of five maths tests done after implementation of various grouping strategies. Figure 1 below shows the trend of performance of students in various grouping strategies. Poor performance was recorded when no grouping was implemented, as seen in the first bar. Majority of students scored below 40 marks. When group work was introduced, the number of students below 40 marks decreased drastically. Different grouping strategies resulted to different outcomes. Mixed-ability grouping had the least number of students who scored below 40 while homogeneous grouping had the highest as shown below. This shows that mixed-ability grouping worked for many students, it helped majority to improve. On the other hand, homogeneous grouping had no positive impact on less-able learners. However, this grouping had the highest number of students who scored above 80 as seen in the figure. This implies that homogeneous grouping favored top performing students. They scored high marks. Thus, it is evidently clear that homogeneous grouping is an effective strategy for high achievers.

DOI: 10.31695/IJASRE.2020.33774

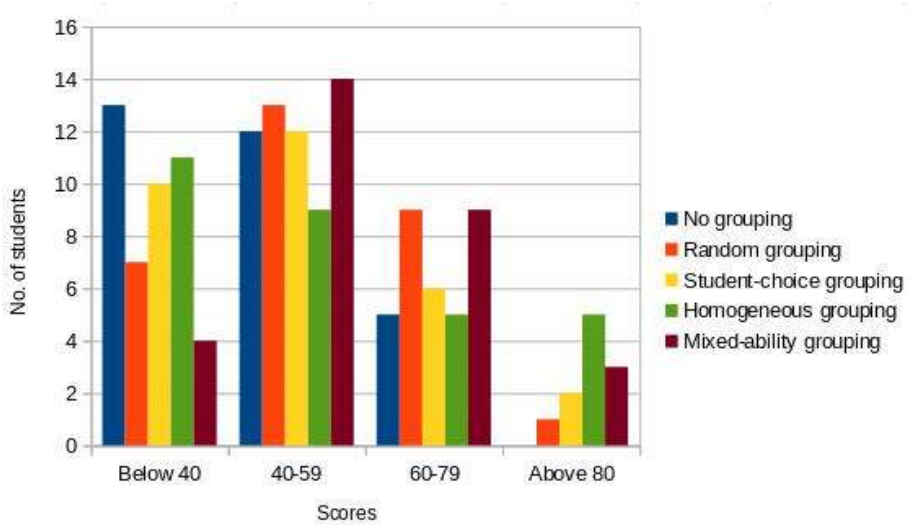

Figure 1: Performance of students in various grouping strategies. Mixed-ability grouping had the least frequency below 40 marks while homogeneous grouping had the highest frequency above 80 marks.

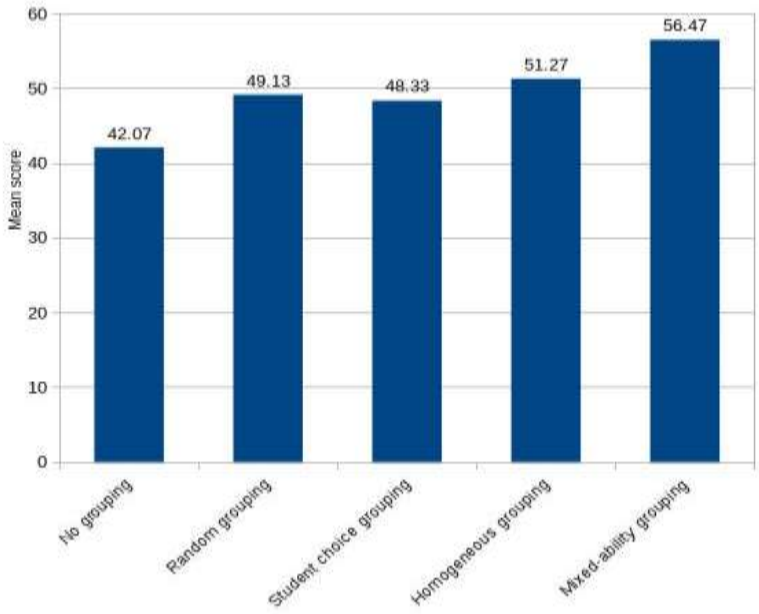

Figure 1: Mean scores of four grouping strategies. Mixed-ability grouping had the highest mean score.

Figure 2 shows mean scores of students' performance in various grouping strategies. When no group work was implemented a mean score of 42.07 was recorded. This was the lowest score. This shows that giving students practice questions to prepare for a test on their own was not very effective. When students were organized in groups to prepare for the same, a significant change of result was recorded. The mean score rose by a margin of 6.26. This clearly depicts that group work is vital in the teaching and learning of mathematics.

Random grouping and student choice grouping had a small mean score margin of about 0.8, as seen in Figure 2. Generally, the two groupings are commonly used in classroom but they are not as effective as mixed grouping. Homogeneous grouping had a mean score of about 51.27. This high score was due to the fact that many of the top achievers scored very high marks which raised the mean grade, though majority of low performing students did not score high.

Mixed-ability grouping strategy recorded the highest mean score of about 56.47. Majority of students performed above average. This is due to the fact that competition was replaced by collaboration. Top achievers felt the satisfaction of helping

DOI: 10.31695/IJASRE.2020.33774

low performing students in their group. On the other hand, less-able learners depended on advanced students to improve their grade. Consequently, the top achievers did not score very high marks as observed in homogeneous grouping. This might be due to less competition within the group. However, this remained to be the most effective grouping strategy.

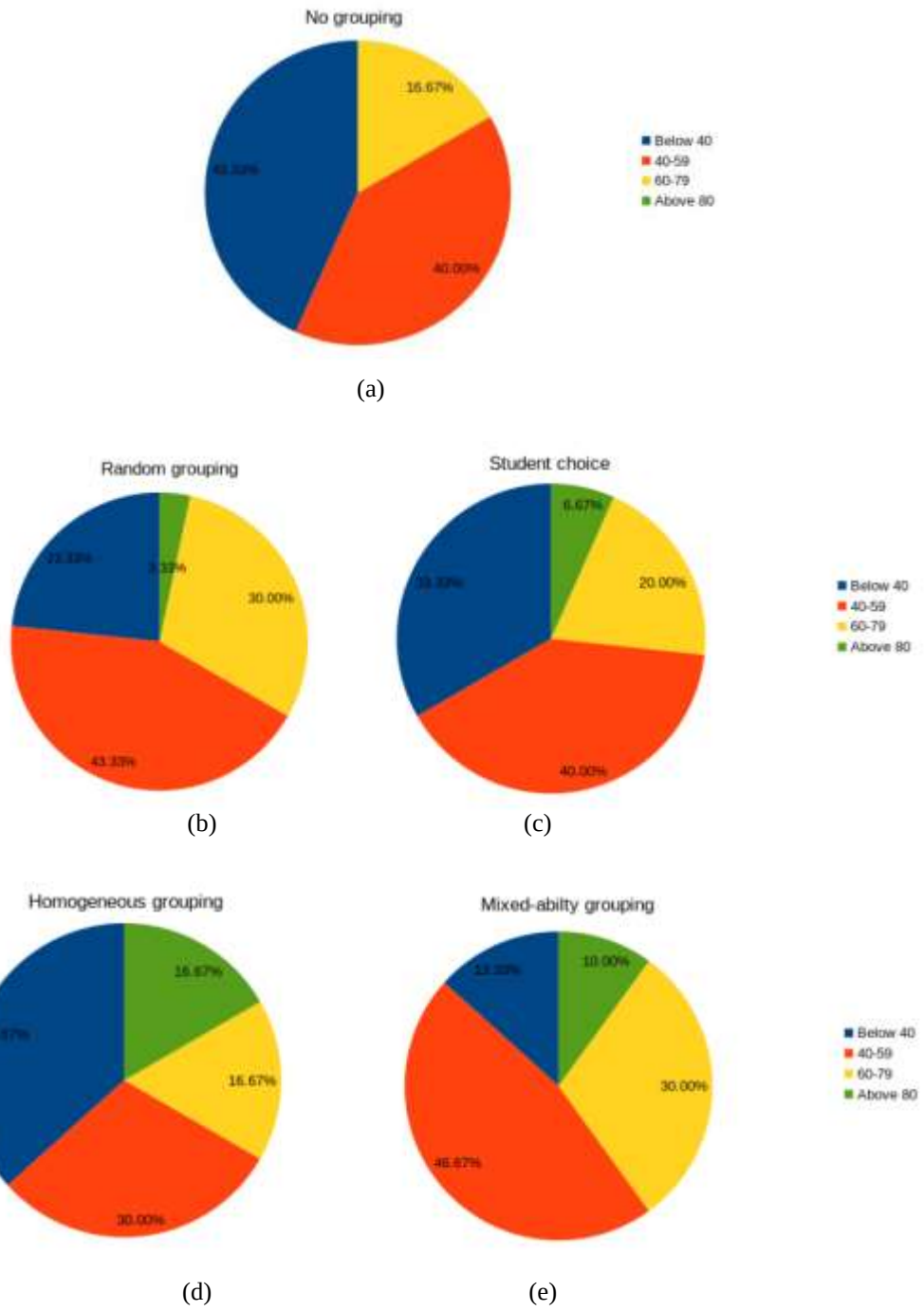

Figure 2: Students performance in various groupings.

DOI: 10.31695/IJASRE.2020.33774

Figure 3 shows performance of students in various grouping strategies. In agreement with the above discussion, majority of students in Figure 3a scored below 60 marks which corresponded to 83.33% of the total number of students. No student scored above 80 marks. This might be caused by lack of competition and collaboration which are key elements to learning of mathematics. Students who scored below 60 marks in random grouping and student-choice grouping are 66.66% and 73.33%, as seen in Figure 3b and 3c respectively. Random grouping might not be very effective since the strength of groups in terms of abilities may get biased. Student choice grouping can also fail when students goof off with their friends instead of working as a team. Homogeneous grouping has the highest number of students who scored above 80 marks, about 16.67% of the students, see Figure 3d. This is due to the fact that advanced student in one group can challenge each other as they share their expertise. They can tackle a complex problem easily as they share ideas and strategies of solving it. Less-able achievers in one group are not motivated hence poor results. Figure 3e shows that more than 86% of students scored above 40 marks. This is a clear indication that mixed-ability grouping is the most powerful strategy to use in a maths class. Learners in this grouping are able to work without unnecessary competition and superiority complex. It gives students an opportunity to embrace, discuss and listen to other's heterogeneous ideas.

5. CONCLUSION

Group work is vital to the teaching and learning of mathematics. A good grouping strategy can make a group more effective. In this paper, we investigated the effectiveness of various grouping strategies. Students were arranged in groups according to each strategy and subjected to the same treatment under normal environment. When no grouping was used, students recorded the least mean score. On introduction of group work, the performance improved drastically. This was a clear indication that group work adds value to student performance. Every strategy was investigated and it was observed that, homogeneous grouping recorded the highest number of students with very high marks and others with very low marks compared to other grouping strategies. This shows that this grouping favored top achievers and disadvantaged low achievers. This is due to the fact that advanced students in one group can challenge each other as they share their expertise, hence are able to tackle more complex tasks within a sensible amount of time. On the other hand, not unless the teacher work with low achievers, they can feel discouraged and probably lose confidence to go on with the task. This grouping can be reliable when dealing with advanced students of the same academic level. Most importantly, mixed-ability grouping recorded the highest mean score. Majority of students scored above average. This is due to the fact that mixed-ability grouping gives all learners with their diverse background, an opportunity to embrace others, share ideas and show their expertise in a collaborative manner. This grouping promotes respect, equity, positive interrelationship and maximum participation among learners. This is thus, the most effective grouping strategy to implement in a whole class of mathematics. Conclusively, it shows that depending on your desired outcome, every grouping strategy will always have a positive impact on mathematics education.

REFERENCES

[1] Gary D Borich. *Effective teaching methods*. Pearson Education India, 1988.

[2] Jeffrey Cornelius-White. Learner-centered teacher-student relationships are effective: A meta-analysis. *Review of educational research*, 77(1):113 143, 2007.

[3] Zeynep Fidan Kocak, Radiye Bozan, and Ozlem Isık. The importance of group work in mathematics. *Procedia-Social and Behavioral Sciences*, 1(1):2363 2365, 2009.

[4] Lorraine M Guitierrez and Robert Ortega. Developing methods to empower Latinos: The importance of groups. *Social Work with Groups*, 14(2):23 43, 1991.

[5] Anastasia Sofronion and Konstantinos Poutos. Investigating the effectiveness of group work in mathematics. *Education Sciences*, 6(3):30, 2016.

DOI: 10.31695/IJASRE.2020.33774