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Effect of Peer Mentoring Instructional Strategy on Students' Mathematics Achievement in HO Municipality, Ghana

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Abstract:- The impact of the peer mentoring instructional technique on students' mathematics achievement in senior high schools in the Ho municipality of Ghana was investigated in this study. To direct the investigation, two research aims and two hypotheses were developed. A quasi-experimental research approach was adopted for the investigation. One hundred fifty-nine (159) Senior High School two (2) mathematics students from two Senior High Schools in the Ho Municipality of the Volta Region of Ghana made up the study's sample. The Mathematics Students Achievement Test was the tool used to collect data (MSAT). The instrument underwent two rounds of expert validation, and a Pearson Product Moment Correlation reliability index of 0.85 was established. While employing Analysis of Covariance (ANCOVA) to test the null hypothesis, the acquired data were analyzed using adjusted mean and standard deviation to address the objectives. The results showed that students exposed to the peer mentoring instructional technique did much better than those exposed to the speak and chalk style of teaching, and their scores were higher. The interaction test revealed that there was no discernible interaction between gender and teaching strategy on the average student performance. The study came to the conclusion that the instructional style of peer mentorship is an effective way to teach mathematics. The study advised, among other things, that since the speak and chalk style of teaching was proven to be less effective and decreased students' achievement in mathematics, peer mentorship should be used as an educational strategy. However, math professors should accept it as one of their teaching methods while using it in the classroom.

Keywords:- *Peer Mentoring, Instructional Strategy, Mathematics Achievement.*

I. INTRODUCTION

The study of structure, order, and relationships is known as mathematics. It evolved from prehistoric activities like counting, measuring, and describing the shapes of objects. It uses reasoning and math to make calculations, and as it has developed, its subject matter has gotten more idealized and abstract (Whitehead, 2017). In daily life, mathematics is crucial. It is practically every discipline of science's tool and language. It aids in pattern recognition and increases our understanding of the environment. Because mathematics is an abstract subject, many students find it demanding and difficult in elementary school, high school, and even in college (Powell, Lembke, Ketterlin-Geller, Petscher, Hwang, Bos, Hopkins, 2021).

To help their students overcome this hurdle, math teachers work to establish a favorable environment for the subject. Giving pupils the chance to study and learn in groups by implementing the peer mentoring instructional technique is one way to accomplish this. Gu and Gu (2019) view mentoring as a long-term intervention in which the sharing of knowledge among peers is not just restricted to academic learning. Peer mentoring or support is a widely accepted practice in higher education around the world and can take many different forms. For example, peers may facilitate group study sessions, such as in peer-assisted study sessions, or they may provide one-on-one peer support in academic peer-learning situations or programs (Giles & Ody, 2015; Andreanoff, 2016).

Additionally, although some of these programs emphasize moral support, others place a greater emphasis on learning activities (Chilvers, 2016; Leidenfrost, Strassnig, Schtz, Carbon, & Schabmann, 2014). (Fayram, Boswood, Kan, Motzo, & Proudfoot, 2018). Students often gain from peer mentoring or assistance in terms of enhanced confidence and motivation, higher social and academic engagement, and a stronger sense of belonging. Benefits have been indicated for mentors in terms of the growth of more in-depth subject knowledge and improved employability skills. Some studies have indicated that groups can boost student retention (Giles & Ody, 2015; Olivier & Burton, 2020).

Peer mentorship, according to Wang (2018), is a teaching strategy in which faculty members (teachers, departments, and schools) create opportunities for students to share knowledge and learn from one another. By using this method or tactic, teachers and peer tutors can effectively tailor lessons for each student and control disruptive conduct in the classroom. Peer

mentoring simply means students teaching other students of the same or different age on one-on-one basis or one mentor working with two or three students (Cornelius & Sandmel, 2018). Cross, Lowcock, Fiave, Agyeniwah, and Kafui-Annan (2020) opined that Peer teaching (mentoring) is a system (method) of instruction where students collaborate with one another. Additionally, according to Bukari and Kuyini (2015), peer mentoring is a method of mutual learning in which students impart the required knowledge and abilities to one another while closely coordinating with their teacher in case there are any comments or inquiries. However, the teacher needs to be present at all times to resolve any issues that can emerge amongst pupils.

According to Cropp (2017), peer mentorship or assistance enhances the overall learning experience and is crucial to the development of learning communities, which in turn affects student confidence and motivation and, ultimately, retention. In a similar vein, community development and involvement are both impacted by motivation and growing confidence (Deshler, Fuller, & Darrah, 2019).

Peer mentorship, according to Jalal (2021), is one of the most effective teaching and learning strategies because it addresses both the social and academic aspects of learning by fostering an inviting atmosphere for instruction and learning. Additionally, Asempapa, Morales, and Agili (2021) found that students who study in groups perform better on exams, particularly on questions requiring logic and critical thinking. In reality, peer mentoring is a form of collaborative learning that frequently occurs naturally among a group of students. In fact, peer mentoring is a proven method for assisting students in achieving their academic objectives, according to educators' research and experience.

Peer mentorship has nevertheless been identified as a useful strategy for raising mathematical achievement (Chong, Ching, Renganathan, Lim, Toh, Mason, Krishna, 2020). According to Orland-Barak and Wang (2021), peer mentoring benefits both slow and quick learners. It enables quick learners to understand the course's contents and articulate their ideas with assurance. Slow learners advance in performance and get a deeper comprehension of the concepts taught. Peer mentoring aids both quick and slow learners in cultivating crucial virtues like cooperation, self-worth, and self-discipline (Abdelkarim & Abuiyada, 2016).

In another study by Jibrin and Zayum (2012) peer mentoring significantly more successful than students who received traditional instruction. Nevertheless, peer mentoring allows for cooperative learning that enables students to learn from fellow students of the same or different level, and of the same age or different age, thus breaking certain barriers associated with learning directly from the teachers. Peer mentoring instructional strategy is also referred to as peer tutoring, peer leaders, cooperative learning pairs, child-to-child teaching, partner learning, peer education, peer assisted learning and mutual instruction (Zhang & Bayley, 2019; Fisher, Athamanah, Sung, & Josol, 2020).

Furthermore, effective teaching and learning depends heavily on teacher factor among other factors such as learner's interest and readiness, appropriateness of content and availability of instructional facilities. Teachers are seen as custodian of education system since no educational system can surpass the caliber of its professors (Rosemary, Ekechukwu, & Horsfall, 2015). Teachers as a factor to effective educating students, especially within mathematics, have been concerned making use of appropriate teaching strategies to improve the level of performance of their students.

According to Fuadiah and Suryadi (2019), Teaching and learning strategies must be changed so that both high-performing and low-performing students can benefit individually or positively from social and cognitive growth.

Vygotsky cited in Abdelkarim and Abuiyada (2016) argued that communication and interaction between people are necessary for learning to occur. As a teaching strategy, peer mentoring has been suggested to encourage student to student interaction. Consequently, the practice of mentoring is now being acknowledged and embraced by schools and universities, foundation, corporation. Peer contact can significantly affect both academic performance and motivation. (Abdelkarim & Abuiyada, 2016; Debbağ & Yıldız, 2021).

Meanwhile, the differential performance level of learners in a class, level or school can make peer mentoring suitable for adoption among students with mixed abilities, cross-age and those from varying family socio-economic status. Lam (2019), therefore, considered peer tutoring (mentoring) as communication between a top student who is succeeding in the class or who recently finished it successfully and another who is having trouble in it.

In this case, the high ability students in the classroom who understand the lesson serve as mentors (tutors) to others referred to as mentee (tutee). Mathematical instruction and learning must be made natural and interactive so that students can learn and develop pertinent skills from their mates. Drawing, according to Vygotsky theory of social constructivism means how students learn from one another, and can develop and exchange simple mnemorlic, acronyms or rhythm, to solving mathematical problem. Peer mentoring can be enriching based on Albert bandura's social learning theory where students (mentees) directly copy the other student (mentor) and can replicate the mentor's behaviour. The utilitarian value of mathematics as a daily practice in students can be attained and learnt when peers are involving in such activities as making and giving change in buying and selling transactions. Peer mentoring can therefore allow students to learn they interact with one other and collaborate on a daily basis. (abdellcarim & Abuiyadu, 2016).

It is important for mathematics teachers to harness the avenue created by student age differences and mathematic abilities in senior secondary schools to facilitate, motivate and improve students' performance in the subject. Adopting peer mentoring instructional strategy is capable of aiding students academically and socially. Effective peer mentoring is also able to motivate learning and performance in subject-based assessment and as well socially help the mentor or mentee to recognize and validate good practices. Shi (2019) noted that for mathematics, there is considerable variability in the level of skills that the students have and researches have blamed this on class size and basic mathematics knowledge.

No doubt, the learning population of students seeking and attending senior high schools in Ghana is quite outrageous. They attend schools with differences in various forms of student characteristics, such as interest, readiness, capabilities and abilities, age, home socio-economics statuses which constitute constraints to teaching and learning. Besides class sizes are more than the acceptable standard, making the teaching and learning of mathematics, a general subject ineffective. Students perform poorly in mathematics in both internal and external exams. Due to the enormous class size, using the talk and chalk teaching approach has only produced minor or negligible results. Thus, there is need to ask one pertinent question: which other instructional strategy can be adopted aside the talk and chalk method by mathematics teachers to mitigate the effect of these constraining factors?

The need for adopting more result oriented instructional strategy which is student centered is therefore, pertinent in this era of free education to allow flexibility in learning procedure and teaching approach in order to enrich students' achievement.

However, studies on peer mentoring or most forms of support in higher education are centered on in-person learning environments. (Lee, McGee, Pfund, & Branchaw, 2015; Haran & Jeyaraj, 2019; (Bradley-Levine, 2016). The impact of the peer mentoring instructional technique on senior high school students' motivation and confidence in the setting of learning mathematics has not received much research. This study aims at putting the peer mentoring instructional strategy to practice in mathematics class and determining if it can be used to support the traditional method prevalent in most senior high schools in Ghana.

➢ *Purpose of the study*

The purpose of the study is to determine whether the instructional technique of peer mentorship can have a positive impact on students' academic achievement in mathematics in senior high schools in Ghana.

➢ *Objectives of the Study*

- To determine whether there is a difference in the mean performance score between students taught using the speak and chalk method and those taught using the peer mentoring instructional strategy at senior high schools in Ghana.
- To determine whether there is a difference in the mean performance score of male and female students taught in Ghanaian senior high schools utilizing the peer mentoring instructional technique.

➢ *Research Hypotheses*

The following null hypothesis was tested at a 5% level of significance in order to meet the study's goal.

Ho_1: The mean performance score of students taught using the peer mentoring instructional strategy and those taught using the talk and chalk method do not differ statistically significantly from one another.

Ho_2: The mean performance scores of male and female students who were taught using the peer mentoring instructional technique did not differ statistically significantly.

II. METHODS

The non-equivalent control group design is a part of the study's quasi-experimental group design. Because it establishes a causal connection between the independent and dependent variables, the design is regarded as suitable. Because it was possible to completely randomize the patients, this design was chosen. Since it is impossible to interrupt a class that is already in session in a school, intact classes were employed as the experimental and control groups.

All 4696 pupils in senior high school level two (SHS 2) mathematics in the Ho municipality of the Volta Region make up the study's population. The sample for the study consisted of 159 mathematics senior High school two (SHS 2) students from three schools, 98 of whom were male and 71 of whom were female. The courses used in the study were chosen by the researchers using the purposive sampling technique. Since everyone is included in the sampling process using this method, the validity of the information can be quickly proven. Data were gathered using a mathematics performance test that included 25 multiple-choice, option-rich questions (A-D). Two specialists in the mathematics department of St Francis College of Education in Ghana verified the instrument. The study's dependability coefficient was 0.85 utilizing Pearson Product Moment Correlation. Before the post-test, the therapy exercises lasted for seven weeks. The research objectives were answered using mean and standard deviation, and the null hypotheses were tested using analysis of covariance (ANCOVA) at the 5% level of significance.

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III. RESULTS

Objective 1: To find out if there is difference between the mean performance score of students taught with peer mentoring instructional strategy and those taught using talk and chalk method?

Table 1: Mean and standard deviation of pre-test and post-test scores of students taught with Peer mentoring instructional strategy and those with talk and chalk method.

Group	N	Pre-test		Post-test	
		Mean	SD	Mean	SD
Peer mentoring strategy	90	23 45	8.42	67 54	13.67
Talk and Chalk method	69	22.12	4.32	38.34	6.23

According to Table 1, a group taught mathematics using the talk and chalk approach had a pre-test mean of 22.12 and a standard deviation of 4.32, whereas a group taught mathematics using the peer mentoring instructional strategy had a pre-test mean of 23.45 and a standard deviation of 8.42. A group taught mathematics using the talk and chalk approach had a post-test mean of 38.34 and a standard deviation of 6.23, while a group taught using the peer mentorship instructional strategy had a post-test mean of 67.54 and a standard deviation of 13.67. A group taught utilizing the peer mentoring instructional strategy experienced a mean difference between the pre- and post-tests of 44.09, compared to 16.22 for a group taught using the talk and chalk method. With the exception of the group that was taught utilizing the peer mentoring instructional technique, all of the groups' post-test means were higher than their pre-test means. This finding showed that the talk and chalk method had less of an impact on kids' math achievement than the peer mentoring instructional strategy.

Objective 2: To find out if there is difference between the mean performance score of male and female students taught mathematics using peer mentoring instructional strategy

Table 2: Mean and standard deviation of pre-test and post-test scores of male and female Students taught using peer mentoring instructional strategy.

Group	N	Pre-test		Post-test	
		Mean	SD	Mean	SD
Male	57	18.32	8.17	67.74	15.97
Female	33	19.10	9.42	68.56	15.23

The findings, which are shown in Table 2, showed that the male students who were taught mathematics utilizing the peer mentoring instructional technique had pre-test means of 18.32 and 8.17 and post-test means of 67.74 and 15.97. For the male group, the difference between the pre-test and post-test averages was 49.42. The pre-test mean and standard deviation for the female students who were taught mathematics using the peer mentoring instructional technique were 19.10 and 9.42, respectively, and the post-test mean and standard deviation were 68.56 and 15.23, respectively. For the female group, the difference between the pre-test and post-test averages was 49.46.

Ho_1: There is no statistically significant difference between the mean performance score of students taught with peer mentoring instructional strategy and those taught using talk-chalk method

Table 3: Analysis of covariance (ANCOVA) of the significant difference in the mean performance scores of students taught mathematics using peer mentoring instructional strategy and those taught using talk-chalk method.

Source	Type III sum of square	df	Mean Square	F	P
Corrected Model	473.744	2	236.872	11.505	.000
Intercept	2027.976	1	2027.976	98.496	.000
Pretest	121.386	1	121.386	5.896	.016
Group	336.939	1	336.939	16. 365	.000
Error	3170.781	154	20.589		
Total	81625.250	159			
Corrected Total	4118.267	158			

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The results in Table 3 demonstrated a substantial difference between students who received mathematics teaching using the peer mentoring instructional strategy and those who received mathematics instruction using the talk and chalk method. The calculated F-ratio was 16.365, and the related probability value was 0.000. The null hypothesis (Ho 1) was rejected in favor of the alternate hypothesis since the associated probability value of 0.000 was less than the threshold value of 0.05 established for level of significance. This suggests that there was a substantial difference between students taught using the talk and chalk approach and those taught using the peer mentoring instructional strategy, favoring the peer mentoring instructional strategy.

Ho_2: There is no statistically significant difference between the mean performance scores of male and female students taught using peer mentoring instructional strategy.

Table 4: Analysis of covariance (ANCOVA) of the significant difference in the mean performance scores of male and female students taught mathematics using peer mentoring instructional strategy.

Source	Type III sum of square	df	Mean Square	F	P
Corrected Model	2769.460	2	1384.730	17.764	.568
Intercept	3227.987	1	3227.987	41.410	.665
Pretest	1228.627	1	1228.627	15.761	.369
Gender	1296.839	1	1296.838	16. 638	.381
Error	6623.704	85	77.952		
Total	617325	90			
Corrected Total	14973.995	89			

The result in Table 4 show the mean performance score of male and female students taught mathematics using peer mentoring instructional strategy. An F- ratio of 16.638 was obtained with associated probability value of 0.381. Since the associated probability value of 0.381 is greater than 0.05 set as level of significance, the null hypothesis (H_2) was accepted. This indicates that gender does not determine students' performance when taught mathematics using peer mentoring instructional strategy.

IV. DISCUSSION

Result in Table 1 indicates higher achievement mean scores of students taught mathematics with peer mentoring instructional strategies compared with their counterpart in talk and chalk method. The result in Table 3 also indicates a significant difference in the mean performance scores of students taught mathematics using peer mentoring instructional strategies and those taught using talk and chalk method. This finding is in line with study by Chong, et al., (2020) and Wang (2018) that, peer mentoring significantly achieved better than those exposed to conventional teaching. Additionally, peer mentorship has been found to be a useful method for raising mathematics achievement, according to Abdellcarim and Abuiyada (2016). According to Asempapa, Morales, and Agili (2021), peer mentorship benefits both slow and quick learners. The study's findings support this claim. It enables quick learners to understand the course's contents and articulate their ideas with assurance. Slow learners advance in performance and get a deeper comprehension of the concepts taught. Both quick and slow learners benefit from peer mentoring when learning important qualities like cooperation, self-worth, and self-discipline.

Table 2 revealed which the achievement average test results for both male and female pupils taught mathematics with peer mentoring instructional strategies were the same. Also the result in Table 4 upheld the hypothesis that there is no significant difference in the performance of students exposed to peer mentoring in mathematics in Ghana on the basis of gender. Peer mentoring had no gender bias with respect to improving students' academic performance in mathematics that is peer mentoring did not favour male over female or vice versa. The improvement on the performance of students exposed to peer mentoring cannot be traced to gender as both male and female students got a better grade. This is in line with similar studies by Jibrin and Zayum (2012), Fayram, Boswood, Kan, Motzo, and Proudfoot (2018) and (Lam (2019) who reported that there was no significant difference in the academic achievement in mathematics and science of both male and female students exposed to peer mentoring instructional strategies.

V. CONCLUSION

Based on the findings of the study, the researchers conclude that peer mentoring instructional strategy is more superior to talk and chalk method of teaching as it enhanced students' academic performance in mathematics. The result of the study also indicated that the peer mentorship educational technique benefited both male and female students equally.

RECOMMENDATIONS

Considering the study's findings the researchers recommend that mathematics teachers adopt the peer mentoring instructional strategies in their teaching and learning process in order to improve students' performance since peer mentoring instructional strategy was found to be more effective in Ghana's senior high schools' mathematics instruction and learning.

Moreover, Government and interested parties of Ghana's educational system should intensify efforts in providing adequate and enabling environment that will enhance and foster the use of peer mentoring instructional strategies.

Conferences, Seminars and workshop should be organized and sponsored by government for teachers on how to use peer mentoring instructional strategy effectively.

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