UNIVERSITY OF EDUCATION, WINNEBA

COMPARATIVE ANALYSIS OF THE PEER TUTORING AND TRADITIONAL METHODS IN TEACHING SELECTED TOPICS IN GENERAL BIOLOGY

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DECLARATION

STUDENT'S DECLARATION

I, **Esther Dorcas Nartey**, hereby declare that this thesis, with the exception of quotations and references contained in published works which have all been identified and duly acknowledged, is entirely my own original work, and that it has not been submitted, either in part or whole, for another degree elsewhere.

SIGNATURE: ……

DATE: ……

SUPERVISOR'S DECLARATION

I hereby declare that the preparation and the presentation were supervised in accordance with the guidelines for supervision of thesis as laid down by the University of Education, Winneba.

NAME OF SUPERVISOR: ……..

SIGNATURE: ……

DATE: ……

DEDICATION

This thesis is dedicated to my loving kids.

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ABSTRACT

The aim of this study was to compare the effects of peer tutoring and traditional methods on students' performance in some selected topics in General Biology in the Colleges of Education in the Ashanti Region. Mampong Technical College of Education was the experimental College while Wesley College of Education was the control College in this study. A pre-test – post-test non-equivalent quasi-experimental design was used for the study. The sample size was 92 students. The experimental group consisted of 52 students while the control group consisted of 40 students. The students in the experimental group were instructed with peer tutoring while the control group were instructed with the traditional method. Both groups were taught the same content which was on supporting system in animals and the excretory system. Three instruments were used for the data collection in this study. These were a general biology achievement test (GBAT), a questionnaire on students' perception towards peer tutoring (QCM) and a structured interview. Descriptive statistics, paired and unpaired t-test were used to analyse the data for answering the research questions. The results indicated that those instructed with peer tutoring did better than those instructed with the traditional method. It was also found that there was statistical significant difference or effect on the academic achievement with respect to knowledge, comprehension and application levels of cognitive domain of the students of the experimental group. It has been recommended that to enhance the academic achievement of students, it might be a useful practice if low achievers are allotted to students with high achievement rate so that they are provided with guidance and support in low-performing subjects.

CHAPTER ONE

INTRODUCTION

1.0 Overview

This chapter includes the background of the study, statement of the problem, the purpose of the study, objectives of the study, research questions, significance of the study, rationale of the study**,** limitation, delimitation and definition of terms.

1.1 Background to the Study

Biology is difficult to teach and to learn because it consists of unfamiliar concepts which involve complex relations (Adlaon, 2012). The highly conceptual nature of biology makes it particularly difficult for students. Meanwhile the present instructional strategies used in classrooms have not sufficiently eased the learning process. Although biology has become an integral part of almost all public and private examinations, the subject biology has become a rather unpleasant task for most students. Yet, in many respects it is a very crucial prerequisite to most higher sciences. Naturally, some people find it easy to understand concepts in biology, whereas others find it difficult. However, the fact still remains that biology demands careful thoughtfulness, a creative mind, and conscious thinking from learners, which has been difficult for some students (Letao & Bradley, 2015). For instance, the 2019 results of the general biology end of semester examinations indicated that students' general performance was not good (Institute of Education, 2019). Students showed poor performance in providing answers for questions. The Researcher has over the period observed through practice in teaching that most general biology students perform poorly in the subject. Researchers have identified some reasons to be the contributory factors in the underachievement of general biology students. Mashile (2001), pointed out that family aspects such as parenting style, socioeconomic status, parental involvement, and parental belief and

attitude are particularly related to students' general biology achievements and academic attitudes. Inadequate and poor practical sessions in the laboratory may be other contributing factors to students' poor performance in general biology (Anthony–Krueger, 2007). Mynt and Goh (2001), noticed in their study that the class sizes in biology classroom environments also influence the achievement of students. Considering students' performances, it is quite apparent that there are root causes to these poor performances which are encountered by the students. Some of these could be caused by the way and manner biology is taught. Most teachers use the traditional teacher centered method of teaching. When general biology is taught through the traditional method, students may not sufficiently participate in the lessons or understand the concept because it will be teacher centered; therefore, students will not have interest in the subject and hence perform poorly. Some students also have the notion that general biology involves a lot of reading, and so it is difficult for them to read a lot of text and comprehend adequately (Mucherah, 2008).

However, when Biology is taught in such a manner that peers can support each other to understand concepts, interests could be aroused (Colvin, 2007). Peer tutoring is believed to help students have higher academic achievements, improved relationships with peers, improved personal and social development, and increased motivation. The teacher then has more opportunity for individualized instruction and increased facilitation of inclusion and opportunities to reduce anti-social behaviors (Topping, 2008). Teachers can develop and implement their own peer tutoring procedures in their classrooms and adapt it to incorporate a wide variety of materials. Good peer tutoring is reciprocal. In other words, students have turns playing the role of a teacher and learner during the same tutoring session. The advantage is that it prevents negative feelings of always having to be the learner and feelings of superiority of always being

the teacher. Peer tutoring creates an opportunity for the students to utilize their knowledge and experience in a meaningful way. In this process the tutors reinforce their own learning through reviewing and reformulating their knowledge. This could hopefully help students learn how to learn meaningfully, thereby improving their academic performance, not only in general biology but in other courses as well. Peer tutoring has been found to promote the understanding of science concepts; hence many studies have been, and are still being conducted in the use of peer tutoring to enhance students' conceptual understanding. The extent to which peer tutoring could influence students' achievement in general biology is consequently worth exploring.

1.2 Statement of the Problem

The problem with some general biology students in Colleges of Education is that these candidates have not been performing well. Through classroom interactions, it is apparent that most students have problems with their understanding of biological concepts. Some students lack the prerequisite skills necessary for successful biology studies as they did not offer elective biology in the senior high school. Most tutors in the Colleges of Education are still using the traditional techniques of teaching (Wood, 2007). The traditional technique of teaching is mainly taught in abstract; besides it has a lot of terminologies which may be difficult to pronounce. Peer tutoring as a method of instruction is not used in Colleges of Education. Hence, Colleges of Education students may not be benefiting from the advantages of peer tutoring. This study therefore, was designed to explore the comparative benefits of peer tutoring as against the traditional method in a College of Education and to find out how it would enhance students' understanding of general biology.

1.3 Purpose of the Study

The main purpose of this study was to compare the effectiveness of the peer tutoring method with the traditional method for teaching and learning some selected topics in general biology at two Colleges of Education in Ghana. This study focused on finding out whether the peer tutoring could positively affect students' achievement in the study of general biology, and enable them to learn meaningfully or otherwise.

1.4 Objectives

The study was to:

1. Find out the students' perceptions towards peer tutoring.
2. Examine the effect (statistical differences) of peer tutoring with respect to knowledge gain, comprehension and application levels of cognitive domain of the Bloom taxonomy.
3. Find the difference in achievement between students taught through peer tutoring and those taught with the traditional method.

1.5 Research Questions

1. What are the students' perceptions towards peer tutoring?
2. What are the effects (statistical differences) of peer tutoring with respect to knowledge, comprehension and application levels of cognitive domain of the Bloom?
3. What is the significant difference in achievement between students taught with peer tutoring and those taught with the traditional technique method?

1.6 Research Hypothesis

1. There are no effects (statistical differences) of peer tutoring with respect to knowledge gain, comprehension and application levels of cognitive domain of the Bloom taxonomy.
2. There is no significant difference in achievement between students taught with peer tutoring and those taught with the traditional method.

1.7 Significance of the Study

The outcome of this study could inform general biology tutors in the two Colleges of Education about the effectiveness of peer tutoring, in order to help them improve upon their skills in their delivery of general biology lessons. It could serve as a reference for further studies or research. The study could give useful information to the Ministry of Education and other educational authorities to undertake interventions to promote the use of peer tutoring in general biology. Furthermore, the findings of this study could serve as a useful material for the organization of workshops, seminars and in-service training for general biology tutors.

1.8 Rationale of the Study

A study conducted by Ullah, Tabassum, and Kaleem (2018), concluded that peer tutoring enhanced the academic achievement of students in the experimental group significantly as compared to the control group; hence, it was an effective method of instruction for teaching. Peer tutoring increased academic achievement and motivation in tutors and students being tutored (Robinson, Schofield, & Steers-Wentzell, 2005).

In this study the researcher used peer tutoring to assist learners improve academic achievement in general biology and motivation for learning and classroom participation. This study was important because the college environment is known to have a code of conduct, believing that students learn better when they are seated in quiet

rows, receiving teacher-directed instruction, rather than working with one another. Students can share their ideas with the class as a whole; however, sharing and learning with partners are strongly discouraged. Understanding these policies and strict guidelines, the researcher still wanted to pursue research in regards to students learning from one another, not just the traditional way of learning from the teacher. As a tutor, the researcher needed to understand and provide multiple ways of teaching so students may have success and achieve great results in general biology. The researcher does not want to limit the classroom to just teacher-directed instruction. For this reason, conducted research on peer tutoring and the impact that it may have on student achievement in general biology.

1.9 Delimitation of the Study

Only general biology students in the Colleges of Education were considered for the study since the topics selected were opened to only general biology students.

Also, only two general biology topics (supporting system in animals and excretory system) were discussed in this study.

1.10 Limitation of the Study

The nature of the research involved investigation into pedagogical issues for first-hand information. The research involved observation, discussions and interaction with learners in order to get reliable data. One limitation was that only Mampong Technical College of Education and Wesley college of Education in Ashanti Region were selected out of the several Colleges of Education in Ghana for the study, since the study was time bound. Since, only two Colleges of Education were selected out of the Colleges in Ghana for the study, there is a constraint on the scope to which the findings can be generalized to other Colleges both inside and outside Ashanti Region. Generalisation of the outcome of this study therefore should be done with circumspection.

1.11 Definition of Term

Traditional method (or abstract) teaching method: In this study, this is the teacher-centred method of teaching. The teacher explains concepts, demonstrates, occasionally asks questions and answers students' questions without the students' active participation or involvement in practical work.

Peer tutoring: In this study this is the instructional strategy where students are taught by their peers, who have been trained and supervised by the classroom teacher.

1.12 General Layout of the Study

Chapter One dealt with the introduction of the study. It highlighted on the background to the study, statement of the problem, purpose of the study, research question, significance of the study, limitation, delimitation, definition of terms and organisation of the rest of the study.

Chapter Two is a review of literature relevant to the study. The review focused on the types of peer tutoring, benefits of peer tutoring, effects of peer tutoring on students' achievement in general biology, theoretical framework of peer tutoring, traditional method of teaching, and summary of review of related literature.

Chapter Three described the methodology used in the study. This chapter would highlight on the research design, population, sample and sampling techniques, instruments, data collection procedures and data analysis.

Chapter Four presents and describes the results in reference to the purpose of the study and findings of other researchers as reviewed in chapter two.

Chapter Five presents the overview of the research problem and methodology, summary of the key findings, draws conclusions and offers recommendations as well as suggestions.

CHAPTER TWO

LITERATURE REVIEW

2.0 Overview

This chapter deals with the review of related literature relevant to the study. It covers the types of peer tutoring, benefits of peer tutoring, effects of peer tutoring on students' achievement, theoretical framework of peer tutoring, traditional method of teaching, and summary of reviewed related literature.

2.1 Peer Tutoring and its Benefits

Peer tutoring is a flexible, peer-mediated strategy that involves students serving as academic tutors and tutees (Ullah, Tabassum, & Kaleem, 2018). Typically, a higher performing student is paired with a lower performing student to review critical academic or behavioral concepts. The term peer tutoring is used for various tutoring activities but mostly it is referred to the students who usually study or learn in pairs in order to help each other. Peer tutoring usually leads to better understanding of the academic concepts but it is more fruitful when the students having different ability levels work with each other (Kunsch, Jitendra, & Sood, 2007). In peer tutoring, the learner or tutee gets one on one attention. Peer tutoring enables both tutor and tutee to gain self-confidence, the tutor by observing self-competence in his or her capability to help someone and the tutee by gaining positive reinforcement from the peers. Therefore, peer tutoring has a very positive impact on the process of learning. One other benefit is that it improves reading achievement for students of all levels.

Some established positive outcomes of peer tutoring in reading classes include improvements in key reading skills as well as gains in self-concept and competency in reading (Miller, Topping, & Thurston, 2010). Results from a study of peer tutoring

reading programs in middle schools indicated that students' oral reading rate increased following peer tutoring programs.

Peer tutoring also accommodates diverse students within a classroom.

Inclusive learning, which is the practice of teaching disabled students alongside non-disabled peers in regular classroom settings, can be facilitated through an emphasis on differentiated learning, where students of varying academic levels receive instruction appropriate for their individual learning styles and speeds (Scruggs, Mastropieri, & Marshak, 2012). Differentiated learning, which emphasizes providing students with varied opportunities to acquire knowledge and master skills, can be difficult to implement in a traditional classroom setting (Scruggs, Mastropieri, & Marshak, 2012). Peer tutoring can be an effective strategy for educators to facilitate differentiated learning without stigmatizing and alienating students. When peer tutoring is implemented in a class-wide setting, students are able to approach the curriculum at their individual learning level, using strategies tailored to individual mentees. In addition, peer tutoring promotes higher-order thinking.

By explaining concepts in detail, high-level questioning, and the use of supportive communication skills, peer tutors can help low-performing students master material previously introduced in a traditional classroom setting and build on their knowledge using higher-ordering thinking skills (King, 1997).

Furthermore, peer tutoring results in positive effects on social, self-concept, and behavioral outcomes.

Social, self-concept, and behavioral outcomes were affected positively with the use of peer assisted learning strategies, including peer tutoring. Additionally, researchers found a significant positive relationship between social and self-concept outcomes and

academic achievement. Decreases in disruptive behavior (Leasher, Canas, & Canas, 2007), and improvement in social interactions among culturally and developmentally diverse peers are also noted outcomes of peer tutoring programs (Ginsburg-Block, Rohrbeck, & Fantuzzo, 2006).

Finally, peer tutoring increases students' sense of control and responsibility for their academic achievement.

Peer tutoring programs have also been shown to improve student's ability to accept constructive feedback from adults (Mitchem, 2001). Training students in peer tutoring strategies can help students take responsibility for their learning, and their ability to recognize and accept responsibility for academic failures.

2.2 Types of Peer Tutoring

There are different types of peer tutoring these include: Classwide Peer Tutoring, Cross-age Peer Tutoring, Same-age Peer Tutoring, Reciprocal Peer Tutoring and so on (Goulburn, 2017).

2.2.1 Reciprocal peer tutoring (RPT)

In this type of peer tutoring the peers learn from each other by changing their status from tutor to student. Both peers take turns at being the tutor while the other one acts as the student or learner. This strategy provides a very good opportunity to every student to act as a tutor which enhances his confidence level (Ali, Anwer, & Jaffar, 2015).

2.2.2 Class-wide peer tutoring (CWPT)

Class-wide peer tutoring breaks the whole class into smaller groups. It is one of the important types of peer tutoring in which all the students of the classroom very actively learn from each other for an extended time period. They act as tutors as well as students or learners. So, every student of the class involves himself in the assigned activities and

learns in a very good way (Greenwood, Carta & Hall 1988 as cited in Maheady & Gard, 2010).

2.2.3 Cross-age peer tutoring (CAPT)

In this type of tutoring the elder student act as tutor and they teach the young students. The tutors have a higher academic background as compared to their students or learners. This approach is valuable for the students because they get effective individual instructions and feedback from their tutors. On the other hand, the tutor gets valuable teaching experience. Cross-age tutoring has been successfully applied to students with varying disabilities (Ali, Anwer, & Jaffar, 2015).

2.2.4 Same-age peer tutoring (SAPT)

Peers who are within one or two years of age are paired to review key concepts. Students may have similar ability levels or a more advanced student can be paired with a less advanced student. Students who have similar abilities should have an equal understanding of the content material and concepts. When pairing students with differing levels, the roles of tutor and tutee may be alternated, allowing the lower performing student to quiz the higher performing student. Answers should be provided to the student who is lower achieving when acting as a tutor in order to assist with any deficits in content knowledge. Same-age peer tutoring, like classwide peer tutoring, can be completed within the students' classroom or tutoring can be completed across differing classes (Hott & Walker, 2012). Procedures are more flexible than traditional class wide peer tutoring configurations.

2.2.5 Peer assisted learning strategies (PALS)

This is a version of the CWPT model, involves a teacher pairing students who need additional instruction or help with a peer who can assist (Fuchs, Fuchs, & Burish, 2000). Groups are flexible and change often across a variety of subject areas or skills. Cue cards, small pieces of cardstock upon which are printed a list of tutoring steps, may be provided to help students remember PALS steps (Spencer, Scruggs, & Mastropieri, 2003). All students have the opportunity to function as a tutor or tutee at differing times. Students are typically paired with other students who are at the same skill level, without a large discrepancy between abilities.

2.3 Selecting Tutors and Tutees

One common method for determining dyads, or groups, involves ranking students from the highest performing to the lowest performing student for the particular activity or subject. Pairs can be formed by cutting the list in half and then matching the top performing student with the first lowest performing student, the second highest performing student with the second lowest performing student, and so forth (Hott & Walker, 2012). If heterogeneous groups are desired, the number of students in each team should be determined. The list of students can then be numbered from one to the desired number of persons in a group and then repeated until the entire class is included (Harper & Maheady, 2007).

When selecting tutors, teachers should be cognizant of which students can be most helpful in the process. Teachers should be mindful of differing student personalities, needs, and preferences. Dyads or groups should be established accordingly.

2.4 Selecting Peer Tutoring Models

Peer tutoring models are flexible and can be altered to meet individual student or class learning needs. The academic task should dictate the appropriate model based on content and learning goals. While there is some upfront planning and instruction, once students develop an understanding of procedures, groups or dyads can be altered dependent upon the setting, activity, or desired learning outcomes.

2.5 Needed Instruction Use Peer Tutoring

Depending on the subject area and model selected, one to four, 30- to 45-minute sessions can be devoted to teaching and modeling (Spencer, 2006; Mastropieri & Scruggs, 2007; Polloway, Patton, & Serna, 2008). Students should master each step of the model selected before learning additional skills. A teacher will need to closely monitor student progress to ensure that established procedures are followed, students utilize interpersonal skills, and content is covered.

2.5.1 Training peer tutors

- Establish rules for confidentiality of student progress.
- Define and develop procedures for social skills students may need throughout peer tutoring (i.e., sharing, taking turns, using respectful language, and accepting criticism or feedback).
- Define and develop procedures for moving into peer tutoring groups quickly and quietly.
- Explain and model peer tutoring and allow students to practice prior to the first peer tutoring session. Consider using a prepared script for practicing interactions (Fulk & King, 2001).
- Train students how to provide feedback for correct and incorrect peer responses, including praise.

- Teach students how to carefully monitor their own and their partner's progress.

2.6 Effects of Peer Tutoring on Students' Achievement

Rivera, Al-Otaiba and Koorland (2006), created a review of literature on reading instruction and students with emotional behavior disorders (EBD). The researchers' focus was on the primary grades. One review, which focused on researching reading interventions by (Rivera, Al-Otaiba & Koorland, 2006), concluded that traditional method or teacher-led direct instruction and tutoring were effective instructional strategies for teaching reading to students with EBD. Although this review of literature focused on reading intervention, teacher-led instruction was proven to have significant gains in learners. Teachers concluded thattraditional methodof instruction worked well when teaching small groups of students with EBD,

Their findings supported the efficacy of traditional methodor teacher-led direct instruction and tutoring. Because of the small number of studies found, Coleman and Vaughn also conducted a focus group with experienced teachers of students with EBD to discern which approaches teachers considered most successful (Rivera, Al-Otaiba & Koorland, 2006). The findings in the review of literature supported the effectiveness of both teacher-led instruction and direct tutoring.

In contrast to research supporting positive outcomes in peer-to-peer learning through evaluative measures, Cairo and Craig (2005), conducted a study to determine whether or not student-to-student tutoring had greater learning gains than non-tutored students. Based on this research, Cairo and Craig (2005), found that tutors and students being tutored had no statistical evidence of increased learning gains in comparison to those of regular classroom instruction. This study only compared tutors versus non-tutors in learning retention. These results contrasted findings from Topping, Campbell, Douglas,

and Smith (2003), where teachers and researchers noticed longer retention of mathematical reasoning and concepts in tutors and students being tutored.

Another research study supporting teacher-directed instruction was conducted by Mathes, Torgesen, Clancy-Menchetti, Santi, Nicholas, Robinson, and Grek, (2003). These researchers conducted a study that compared the results of direct-teacher instruction with peer tutoring. They also used several components of peer-assisted learning strategies (PALS). Mathes et al. (2003), utilized 89 first-grade participants that were either paired with a peer or given direct-teaching in the form of small groups, from the classroom teacher. Each tutoring group worked on a variety of reading concepts such as oral reading fluency, word recognition and phonics, and reading comprehension. Mathes et al. (2003), noted that both groups of students, peer tutored and direct instructed, made gains in reading comprehension. Nonetheless, students that were led in teacher-directed instruction made higher learning gains than those who participated in peer tutoring. These researchers also concluded that regardless of peer tutoring or direct-teaching, more effective instruction is led in small groups rather than whole class instruction. They claimed that students work at different paces, and if not careful, students can be left behind, discouraged, and distracted. Coleman and Vaughn (as cited in Rivera, Otaiba & Koorland, 2006), noted that teacher-directed instruction is a positive means in gaining results in student learning. However, Mathes et al. (2002), found that students also made significant learning gains by assisting one another with learning, especially when teachers were pre-occupied with other students during small group instruction. Although, Robinson, Schofield, and Steers-Wentzell (2005), found that peer-to-peer learning created positive academic success as previously stated; they cautioned teachers and other researchers to not solely depend upon peer and cross-age tutoring. These types of social learning heavily focused on the imminent topic being

studied with little regard to other subject matter. Summers (2006), also suggested that teachers participating in collaborative learning practice become aware of the pressures that students face. Students at sixth grade level may compare themselves to their peers, withdraw from their group members, and resist participation to avoid being humiliated in front of their peers, especially during a time in their lives when fitting in is most important.

2.7 Benefits of Peer Tutoring

Literature on the effects of peer tutoring at both the elementary and secondary levels, as well as the limited amounts on postsecondary levels, shows that it provides a variety of benefits for many students. Some of these benefits include improved academic achievement, desirable behaviors (e.g., increased time on task and improved classroom behavior), improved attitudes towards schools and the subjects being studied, increased self-esteem and self-confidence, and increased positive social and emotional skills (Topping, 1996; Robinson, Schofield, & Steers-Wentzell, 2005; Miller, Topping, & Thurston, 2010; Okilwa & Shelby, 2010).

2.7.1 Academic benefits of tutoring

The most noted improvements shown in the literature on peer tutoring are the academic improvements. Extensive research has shown that PALs and its other forms have successfully enhanced comprehension, accuracy, and knowledge in subjects such as mathematics, social studies, science, and reading across all different groups of students (Miller, Topping, & Thurston, 2010). Although most of these discoveries have been found in the elementary setting, many studies have shown effectiveness in secondary classrooms. Robinson, Schofield, and Steers-Wentzell (2005), also discussed a study in which students who participated in peer tutoring in 10th grade mathematics classes

received higher scores on the Texas Assessment of Academic Skills (TAAS) mathematics exam than did those who had no tutoring.

Despite a number of studies supporting positive academic effects of peer tutoring, some question remains as to whether it produces similar positive results when the content is more advanced. Allsopp (as cited in Miller, Topping, & Thurston, 2010), studied the use of tutoring in subjects that require the use of higher order thinking skills (like algebra). He found no difference in achievement scores between the tutoring groups and the control group, which used traditional independent student practice instead of tutoring. In other words, the study showed that tutoring was similar in its effects to simple individual work in the algebra classes. Nevertheless, Allsopp claimed that the peer tutoring showed potential of being more effective than the traditional practice. This particular study is important because most peer tutoring studies, especially in mathematics, are done on basic skills in a subject, like basic computation and problem solving (Miller, Topping, & Thurston, 2010).

Topping (as cited by Robinson, Schofield, & Steers-Wentzell, 2005), examined 75 studies of Keller's Personalized System of Instruction (PSI), a program that bases tutoring strategies on the needs of the individual student, in higher education institutions. In 48 out of 61 studies, research showed a more positive effect in students who used PSI. Eleven of these studies analyzed student feedback, and ten reported that PSI received more favorable ratings. Although there are some studies done on tutoring at post-secondary levels, the number is still small in comparison to the overall studies on peer tutoring. The scarcity of research in this particular field still leaves open the question of whether or not tutoring is effective.

Overall, research on peer tutoring and the use of peer tutoring supports the conclusion that it holds academic benefits for those students who are being tutored. Many of these

studies varied on their subject, participant group/age level, setting, and procedure, but they all produced similar results that supported the use of peer tutoring.

Peer tutoring also holds some academic benefits for the tutoring students as well. A meta-\analysis reported that, in 33 out of 38 of the studies that focused on academic achievement of tutors, students who served as tutors performed better than did control students on examinations in the subject being taught. Out of those studies, 10 had results that were statistically significant (Comfort, & McMahon, 2014). Robinson, Schofield, and Steers-Wentzell (2005), also reported on more recent studies that showed academic benefits for tutors. In that study, students who served as tutors received a greater increase in score on their mathematics assessments "than did a control group of students with a similar initial achievement-level" (p. 334).

2.7.2 Non-academic benefits of peer tutoring

Peer tutoring also improves more than just academic achievement in both tutors and tutees. These additional improvements include behaviors like increased time on task, general classroom behavior, increased attendance and retention rates, and more positive attitudes about school (Robinson, Schofield, & Steers-Wentzell 2005). Okilwa and Shelby's (2010), synthesis of literature revealed that a large number of the studies that they examined found increased on-task behavior in the students. Another meta-analysis of peer tutoring programs found 8 studies that demonstrated increased positive attitudes towards school and the subjects being learned following peer tutoring (Robinson, Schofield, & Steers-Wentzell, 2005). While these behaviors are not the central focus in the present study of peer tutoring, it is important to discuss them because of the relationship between these behaviors and student achievement.

Peer tutoring can also benefit students socially and emotionally. The effects of peer tutoring on students' social and emotional behaviors are second only to academic

achievement as the focus of many studies on peer tutoring. One observed benefit is "improved social interactions or relationships such as making friends" (Okilwa & Shelby, 2010, p. 452). Some specific social and emotional outcomes that peer tutoring seems to target include a sense of belonging and social acceptance, self-concept, and attitude towards subject matter (Robinson, Schofield, & Steers-Wentzell, 2005), as well as self-esteem and self-worth (Miller, Topping, & Thurston, 2010).

Robinson, Schofield, and Steers-Wentzell (2005), found studies indicating that "peer tutoring (boosted) academic self-concept, which is the degree to which students feel positively toward themselves as students" and that these did not result from "pre-existing differences in academic competence" (p. 339). Miller, Topping, and Thurston, (2010), also cited a meta-analysis that reported several studies that found gains in students' self-concept with small to moderate effect sizes.

Peer tutoring has also shown gains in sense of belonging and social acceptance among peers in both tutors and tutees (Robinson, Schofield, & Steers-Wentzell, 2010). Students make connections with classmates that would never have been made outside the tutoring groups. Also, not understanding class material makes many students feel alienated. Tutoring helps with their understanding and reduces the feeling of alienation. A study analyzed by Cohen, Manion, and Morrison (2010), found that feelings of social acceptance were greater in students that participated in Reciprocal Peer Tutoring than in students that were randomly assigned to classes without tutoring. Another study reviewed by Robinson, Schofield, and Steers-Wentzell (2005), revealed that students who had received peer tutoring rated themselves as having a higher level of social skills than their peers. While the socio-emotional outcomes are not directly linked to the student achievement that results from peer tutoring, these outcomes are an important factor in students' perceptions on the effectiveness of tutoring.

Peer tutoring helps to develop the skills of students to manage and plan learning experiences, work in association, give and receive responses about their activities and finally evaluate their own learning. At present, the significance of peer tutoring is increasing, and it has become an important part of many courses and disciplines in different countries (Ali, Anwer, & Jaffar, 2015). Similarly, other characteristics of both tutors and tutees, such as discussion abilities, confidence and motivation, also develop through peer tutoring (Galaviz, 2009).

According to Rizve (2012), students experiencing peer tutoring did better in their zone of proximal development than students experiencing traditional methods of teaching in the learning of English. Several studies carried out on the impact of peer tutoring reveal that it has a positive role in the instructional process. For example, during an evaluation study by Brost (2011), in Chippewa Valley Technical College in Eau Claire, Wisconsin, USA researchers explored some facts about peer tutoring. The primary purpose of the research was to evaluate the effectiveness, shortcomings, and practicability of the peer tutoring program that already existed in Chippewa Valley Technical College. The findings of the research showed that the peer tutoring program at Chippewa Valley Technical College was effective but needed some improvement. The process of peer tutoring should be restructured based on prior planning and scheduled so that it improves the level of understanding. The achievement rate of the tutoring program was good but needed further efforts to increase. The door is open for other researchers from all over the world to contribute by devising more tutoring models. In another experimental study conducted by Campit, Cayabyab and Galas (2015), peer tutoring was found to have significant positive effects on the performance of students. Similarly, Rizve (2012), measured the effect of peer tutoring on students' academic achievements at secondary level in the subject of English in light of Vygotsky's theory in her

doctorate dissertation. She believed that effective learning takes place in the zone of proximal development of a child if help is provided by peers or by some elders. Vygotsky recommended that social interactions, communication and guidance are prerequisites for learning. Therefore, scaffolding was recommended for those students, who are in the zone of proximal development. The researcher provided scaffolding in the form of peer tutoring to the students of the experimental group of 9th grade by the students of 10th grade of the same school in the subject of English. The control group was given instruction through the traditional method. The findings of the study pointed out that the experimental group had performed well as compared to the control group. Likewise, a study performed by Ezenwosu and Nworgu (2013), explored the effectiveness of peer tutoring and gender on the achievements of students in the subject of biology. The finding of the study revealed that students who were instructed through peer tutoring had performed significantly better than students of the control group. The results also supported the claims of studies such as Ezenwosu and Nworgu (2013), Comfort and McMahon (2014), that peer tutoring has significant effects on academic performance in the subject of biology. One of the reasons for improvement in academic performance may be learning from peers, which further supports Skinner's idea of learning.

2.8 Summary of Peer Tutoring and its Effects on Students

Research on peer tutoring and effects on students in biology has proven to be a beneficial way of achieving academic success (Nesselrodt & Alger, 2005; Robinson, Schofield, & Steers-Wentzell, 2005; McMaster, Fuchs, & Fuchs, 2006; Spencer, 2006). Research has also proven peer tutoring to have significant gains in student learning in reading, which is commonly intertwined into the biology classroom on a daily basis (Fuchs & Fuchs, 2005). Whether same-age, cross-age or reciprocal peer tutoring,

research has shown significant gains in learners of all backgrounds and on various levels (Cairo & Craig, 2005). However, regardless of the teaching technique (peer tutoring or traditional method), research has shown that learning gains and academic achievement can be made in small groups especially when the learners' difficulties are addressed first (Mathes et al., 2003).

2.9 Theoretical Framework

Vygotsky (as cited in Ullah, Tabassum, & Kaleem, 2018) said that academic performance of slow learners could be improved if they were engaged in collaborative work or in peer tutoring. Vygotsky was the strongest supporter of peer tutoring. Vygotsky classified learners into three categories based on their cognitive development: (1) The zone of actual development, in which the students are independent in their learning, meaning that the individual does not need any help in the learning of a specific topic at this stage; (2) the zone of proximal development, in which the students depends on one other for learning and need a little help (Vygotsky recommended peer tutoring for the students in this stage); (3) the zone of no development, in which students cannot perform or learn something even in the presence of external help. Here, even peer tutoring is also useless Vygotsky (as cited in Ullah, Tabassum, & Kaleem, 2018). According to Rizve (2012) (p. 171), students experiencing peer tutoring did better in their zone of proximal development than students experiencing traditional methods of teaching in the learning of English.

According to Vygotsky's theory, the cognitive development of every child is enhanced through social interaction with other people, especially people with more skills (Ullah, Tabassum, & Kaleem, 2018). Vygotsky's sociocultural theory of cognitive development clearly states that, social learning comes before cognitive development; and that makes children construct knowledge actively. In his theory, he emphasized

children learn through social interaction that include collaborative and cooperative dialogue with individuals who are more skilled in tasks they are trying to acquire (Psychology notes headquarters, 2019). Vygotsky referred to people who are higher skilled as the More Knowledgeable Other (MKO). They could be teachers, parents, tutors and even peers.

2.10 Traditional Method of Teaching

This method of teaching is also referred to as the conventional or expository method of teaching. It is also referred to as the lecture method of teaching. It is mostly described as teacher-centred, teacher dominated, or teacher activity method (Tamakloe, Amedahe, & Atta 2005). The role of the student is less active and more passive in the teaching and learning interaction. Teachers occasionally may demonstrate a process for students to observe, engage students in brief discussion and questioning, and often use illustration from diagrams, and charts. The teacher mostly does the talking. Wood (2007), observed that biology teachers in the secondary schools introduce lessons followed by explanations and demonstrations. Meanwhile according to Maryellen (2013), students often prefer to participate in a lesson rather than to be passive learners in a lecture or teacher dominated lesson. During activities, students work alone, and collaboration is discouraged. Teachers must recognize that students can learn from each other and that the deepest learning happens when students have the opportunity to practice and obtain feedback (Maryellen, 2013). Wood (2007), noticed that most schools had inadequate charts and diagrams hence sometimes illustrations were missing from teaching. He observed that few questions are allowed from students of which teachers answered. After each explanation, the teacher dictated copious notes for students to write. He reported that during his research, he inspected the notebooks of the students and found out that all of them had the same notes, indicating that they had

their notes solely from their general biology tutors. He further reported that teaching was direct from teacher to learner.

According to Tamakloe, Amedahe, and Atta (2005), for students to benefit fully from such a method which is teacher centered, the teacher must prepare adequately, reading from many sources to get quality information. This will help the teacher get mastery over the method. Larbi (2005), conducted a study in the eastern region of Ghana comparing the indigenous method approach to the traditional method of teaching. He found out that students taught with indigenous method of teaching science achieved significantly higher marks than those taught with the traditional method. Likewise, Wood (2007), reported that students who were exposed to thecollaborative approach achieved significantly higher marks than their counterparts exposed to the traditional method. Research shows that those exposed to peer tutoring achieved significantly higher scores than those exposed to the traditional method (Bunting, Coll, & Campbell, 2006; Asan, 2007; Akpinar & Ergin, 2008).

2.10.1 Effect of traditional method on students' achievement

Knight and Wood (2005), carried out an experiment to determine whether students learn best through the use of the traditional method or interactive teaching style in biology lesson. In two successive semesters, they presented the same course syllabus using the two different teaching styles. They used performance on pre-tests and post-tests, and on homework problems to estimate and compare student learning gains between the two semesters. Their results indicated significantly higher learning gains and better conceptual understanding in the more interactive course than the traditional method course.

Charlton (2006), on the other hand thinks the traditional method is probably the best teaching method in many circumstances and for many students; especially for communicating conceptual knowledge, and where there is a significant knowledge gap between teacher and students. It is effective because they exploit the spontaneous human aptitude for spoken (rather than written) communications.

2.10.2 Merits of traditional method

Tamakloe, Amedahe, and Atta (2005), (p.43) enumerated the following as merits of the traditional method.

1. The traditional method provides great opportunity for students to learn to take down notes.
2. The teachers have greater control over what is being taught in class.
3. The traditional method enables a great amount of course content to be covered in the face of a heavy loaded syllabus or programme of instruction.
4. The traditional method makes for economy since a large number of students can be taught at a time in one classroom. It is a straight forward way to impart knowledge into students.
5. It is more helpful for teaching specific facts, concept or laws.

Ormrod (2015), (p. 13) outlined the following as pros of traditional method of teaching

1. When education is teacher-centered, the classroom remains orderly. Students are quiet, and the teacher retains full control of the classroom and its activities.
2. Since students learn on their own, they learn to be independent and make their own decisions.
3. The teacher directs all classroom activities; they don't have to worry that students will miss an important topic.

2.10.3 Demerits of traditional method of teaching

Tamakloe, Amedahe, and Atta (2005), (p. 48) pointed out the following disadvantages of the traditional method. Generally, the traditional method is not suitable for students who are low on the academic ladder. They find it difficult to listen and take notes at the same time. It does not take into consideration individual differences.

1. The traditional method in most cases encourages rote learning.
2. It does not give the students enough chance to develop their oral skills.
3. Teacher activity overshadows that of students making them play comparatively passive role in the teaching and learning process.
4. On the spot feedback is usually very scanty and unreliable.
5. There is little scope for student activity; hence the traditional method goes against the principle of learning by doing.
6. In the traditional method, the teacher to a large extent spoon feeds the students and does not allow them to develop their powers of reasoning.

Ormrod, (2015), (p. 56) outlined the following as cons of traditional method of teaching

1. When students work alone, they do not learn to collaborate with other students, and communication skills may suffer.
2. Teacher-centered or traditional instruction can get boring for students. Their minds may wander, and they may miss important facts.
3. Teacher-centered or traditional instruction doesn't allow students to express themselves, ask questions and direct their own learning.

Since science mainly involves activities to help students explore facts about the world in which they live, the traditional method is therefore not the best for solely teaching science. As already stated, the traditional method rather promotes rote learning. Wood (2007), indicated that general biology teachers resort to the traditional method because

of the work load. He reported that the enrolment in most science classes is about 50 to 70 students, making it difficult for teachers to resort to the use of more competitive methods. Biology teachers can enrich traditional methods of teaching by using more teaching and learning materials, slides and overhead projectors if not peer tutors.

2.11 Summary of Review of Related Literature

Based on the aforementioned studies, peer tutoring is very effective in assisting teachers to increase time for teaching learning activities. Similarly, during peer tutoring session, when both tutor and tutee are interacting and exchanging their views, the process of accommodation is taking place and the process of learning is proceeding further. Other characteristics of both tutors and tutees, such as discussion abilities, confidence and motivation, also develop through peer tutoring. According to researchers such as Austin (2008) and Eisenkopf (2010), peer tutoring has positive impacts on student learning, motivation and socialization. Peer tutoring was found effective in the development of creativity and problem-solving skills of both tutors and tutees. Due to its interactive nature, peer tutoring helps the tutor in understanding the mental level of the tutees and concept about the topic. More over results are very successful if the tutor and tutees are engaged in collaborative work and meaningful activities under planned and structured program.

CHAPTER THREE

METHODOLOGY

3.0 Overview

This chapter covers the research design, population, sample and sampling procedure, instrument, data collection procedure, description of treatment/ interventions and data analysis.

3.1 Research Design

A pre-test - post-test non-equivalent quasi-experimental design was used for the study since the subjects were not assigned randomly to the experimental and control groups (Cohen, Manion, & Morrison, 2018). In a typical school situation, classes cannot be disrupted or reorganized for the researcher to conduct a study; therefore, in such a case, it is better to use groups that are already organized or intact (Ary, Jacobs, & Razavieh, 2002). Even though this design suits this study, it has some weaknesses. The major weakness lies in its inferiority to randomized experiments in terms of internal validity (Trochim, 2000). Hence some extraneous factors such as age, ability, maturation and previous learning experiences were not controlled in this study. Both qualitative and quantitative data were used for the study. Scores of students' achievement tests for pre-test and post-test constituted the quantitative data while the observation, interview and questionnaire on students' perceptions towards peer tutoring constituted the qualitative data. The achievement tests which were Pre-test- Post-test were administered to both the control and experimental groups. The experimental group received treatment using the peer tutoring method while the control group received treatment using the traditional method. Both groups however covered the same content in general biology. In this study, the achievement of the students was the dependent variable while the

teaching approaches (peer tutoring and the traditional method) were the independent variables.

3.2 Population

The target population for the study were all Colleges of Education students offering general biology in Ghana. It is estimated that about 400 students offered general biology in the country. However, the accessible population were second year general biology students in two colleges of the Ashanti Region of Ghana whose population is 92.

3.3 Sample and Sampling Procedure

For the purpose of this study, the Researcher selected all second-year general biology students in Mampong Technical College of Education as the experimental group, through a purposive sampling technique. Besides the proximity, the college was selected because of the willingness of the college to accommodate the study and the availability of a reasonable number of general biology students in the college. The Researcher administered the pre-intervention general biology test, post-intervention general biology examination and questionnaire to all the selected second year students. The experimental group were observed by the Researcher. Ten students were selected randomly for the interview. Some of the second-year general biology students of Wesley College of Education were purposely selected as the control group. The experimental group was made of 52 students with all being males and, while the students in the control group were 40 in number all were males. Therefore, the sample size for the study was 92 general biology students. The two colleges selected were about 20km apart so; this reduced interaction between the control and experimental groups.

3.4 Instruments

Four instruments were used for the data collection in this study. These were general biology achievement test (GBAT), questionnaire on students' perception towards peer tutoring (QPT), observation and a structured interview.

3.4.1 General biology achievement tests (GBAT)

The General Biology achievement test was categorized into GBAT1 (Appendix C) and GBAT2 (Appendix D). The GBAT1 (per-test) which comprised twenty objective questions and two essay test items was used as the pre-test for both the control and experimental groups. The GBAT1 had a total duration of one hour. The pre-test was used to ascertain the amount of knowledge the students had on general biology and to determine the homogeneity or the heterogeneity of the control and experimental groups. Students have had lessons on osmosis and diffusion in their first year in the college of education. The GBAT2 (post-test) was administered after the treatment had been given. The achievement of the post-tests between the experimental and the control groups were compared. GBAT2 also comprised twenty objective questions and two essay test items. All the essay questions were subdivided into three parts. The 'a', 'b' and 'c' questions were based on knowledge, comprehension and application levels of cognitive domain of the Bloom taxonomy respectively. The GBAT2 exercise lasted for a duration of one hour. The test items were developed based on two topics (supporting system in animals and excretory system) from the second semester courses for general biology, and some modified past questions. To ensure content and face validity of the instrument, the test items were subjected to expert judgment by a general biology tutor with eleven years of experience for corrections and suggestions to improve upon the instruments. Scoring rubrics were developed for both GBAT1 and GBAT2 to facilitate the scoring. For the objective questions, each correct answer or response was assigned

one mark while a wrong response was assigned a zero mark. The total mark was 100. Thus, the objective questions were scored over 20 marks and the essay 80 marks. Out of the 80 marks, all 'a' questions (knowledge level) were scored 20 marks. All 'b' and 'c' questions (comprehension and application levels respectfully) were awarded 30 marks each. In order to ensure internal consistencies of the achievement tests, the assistance of examiners was sought, one for GBAT1 and another for GBAT2. The examiners had between 8 to 12 years of teaching experience as biology tutors and serve as assistant examiners for the West African Examination Council and Institute of Education, University of Cape Coast. The examiners and the Researcher discussed the scheme and agreed on the marks to be awarded. Five photocopies of the students' script were marked and the scores compared so that the differences in scoring could be discussed for agreement to be reached before the live scripts were scored. One week was spent in marking the scripts.

3.4.2 Questionnaire on perception of students towards peer tutoring (QCM)

The questionnaire was developed to find out the perceptions of students in the experimental group towards peer tutoring (Appendix A). Since the introduction of peer tutoring was a novel method in the selected school, it was important to find out from students who were exposed to this treatment what their perceptions towards this new method were. The QCM consisted of two sections; the first was to get background information about the students while a second section consisted of 13 items based on a five-point Likert scale with 'strongly agree', 'agree', 'undecided', 'disagree' and 'strongly disagree'. Scores of 1, 2, 3, 4, and 5 were assigned, respectively to negative worded items. Scores of 5, 4 ,3 ,2, and 1 were assigned, respectively to positive worded items. For each item, students were requested to indicate their responses by ticking the appropriate column. Likert-type scale appears easy to construct, produces more

homogeneous scales, permits spread of variance and allows subjects to indicate their degree of feeling or opinion; this makes it one of the most popular methods of perception and attitudinal scale constructions (Lehmann & Mehrens, 1991). Additionally, likert scales are often found to provide data with relatively high reliability (Fraenke & Wallen, 2000.). Cronbach's coefficient alpha was deemed suitable for measuring the reliability of QCM because it is used when measures have multiple-scored items such as perception and attitudinal scales (Payne & Payne, 2005).

3.4.3 Observation

Observation employs vision as it main means of data collection. The Researcher used this technique to know and collect information on the degree of students' interest and participation in peer tutoring.

3.4.4. Structured interview

A structured interview was further used to find out students' opinions on the peer tutoring approach (Appendix B). Three areas were covered; interest in peer tutoring, performance in class, and class participation. Only ten students were randomly selected for the interview. Although the findings might not have been transferable, it impacted positively on the credibility and dependability.

3.5 Validity and Reliability

The content validity of the instruments was determined by subjecting them to expert judgment (Rye & Rubba, 2002). The instruments (GBAT, QCM and structured interview) were subjected to inspection by experts including the supervisor of this project, who is a lecturer at the University of Education, Winneba, and two science tutors who had 7 to10 years of teaching experience, for their judgments on the content and the level of language. To ensure validity of the interview, the transcribed responses

were read back to the students who were interviewed to ascertain from them whether the responses were exactly what they said. The reliabilities (internal consistencies) of the two tests were determined and the reliability co-efficient (Cronbach's alpha) were calculated using SPSS Version 16.0. The interrater reliability of the GBAT1 (pre-test) was 0.88 and 0.89 for the GBAT2 (post-test).

3.6 Pilot Testing

A pilot test was conducted in Kibi College of Education, in the Eastern Region, in order to check for the appropriateness of the instrument for data collection. The students of the college took a pre-test before a treatment was administered, and then wrote a post-test after a lapse period of one week. The students who received instruction through peer tutoring approach were given questionnaires to respond to on their perceptions towards peer tutoring after they had taken the post-test. The interrater reliability of the pre-test and post-test were 0.88 and 0.89 respectively. Cronbach alpha coefficient of reliability for QCM was 0.80.

3.7 Data Collection Procedure

As a way of familiarization, osmosis and diffusion in living tissues were discussed with students for a day. This topic was chosen because it's a treated topic in first year and so would serve as revision for them. At the end of the familiarisation, a pre-test on the general biology achievement test (GBAT) was administered to both the control and experimental groups. The pre-test was to ascertain the homogeneity of the experimental and control groups, and also to know the level of knowledge each group has. After the pre-test, the treatment followed. Students in both the control and the experimental groups were taught for two weeks. The Researcher taught the experimental college while another tutor taught the control college. Two weeks was for teaching the topics and the one week was for administration of the achievement post-tests, questionnaires

and the interview. Students were observed during teaching. Both the control and the experimental group were taught the same content, had the same instructional objectives, same lesson duration and class assignment.

3.8 Description of Treatments/Interventions

The Researcher adopted the Class Wide Peer Tutoring (CWPT) style for the experimental group. Class wide peer tutoring involves dividing the entire class into groups of two to five students with differing ability levels. Students then act as tutors, tutees, or both tutors and tutees. The student tutors were trained and supervised by the Researcher. The entire class participated in structured peer tutoring activities two or more times per week for approximately 40 minutes. Students were observed during the learning activity. While the procedures and routines remain the same, student groups were changed weekly. The control group were taught the same content and in the same sequence as the experimental group. However, they were taught using the traditional method. The traditional method involves teaching topics in a regular general biology class where teaching and learning activities were mainly teacher-centered. After the treatment to the experimental group, both the experimental and the control groups were given another general biology achievement test as the post-test.

3.9 Data Analysis

The data received were entered separately into Microsoft excel for data output. The scores from the pre-test and post-test were subjected to descriptive and inferential statistics. Descriptive statistics which were used included mean and standard deviation frequencies and percentages. Depending on the result of the normality test, the statistical tools, t – test (Unpaired), which allow for the testing of the statistical significance at 0.05 alpha levels were employed for the analysis of data. When the P values from the results of these statistical tools are above 0.05, then there is no

significant difference, but if the P values are less than 0.05, then there is significant difference. Unpaired t - test were used to compare the pre-test scores in achievement for the experimental and control groups to ascertain the entry behaviour of the students. Also unpaired t-test were used to compare the post-tests scores in GBAT between the experimental and control groups in order to answer research question 3. The group on which the teaching methods are used on is the independent variable because it would have effect on the dependent variables. Observations made were summarized. Paired t - test was used to compare the pre-test and post-test scores in achievement for the experimental group to ascertain the differencewith respect to knowledge, comprehension and application levels of cognitive domain of the Bloom. Each level was analyzed separately. This was done in order to answer research question 2. Thematic content analysis was used to analyse student responses to the questionnaire and the structured interview to answer the first and second research questions. By this, the major area of the questionnaires and the interview were put into themes to determine the perception of students about the peer tutoring approach to teaching and learning. Also, to determine some of the challenges students encounter in studying general biology.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 Overview

In this chapter the results from the study were presented, analysed and discussed in relation to the three stated research questions and hypotheses.

4.1 Findings Related to the Research Questions

4.1.1 Research question one

What are the perceptions of students towards peer tutoring?

Responses from the questionnaire on students' perception towards peer tutoring were used to see if there was consensus of opinion. A 5-point Likert scale with 'strongly agree', 'agree', 'undecided', 'disagree' and 'strongly disagree' with scores of 1, 2, 3, 4, and 5 were assigned, respectively to negative worded items. Also, scores of 5, 4, 3, 2, and 1 were assigned, respectively to positive worded items. The scores were used on the questionnaire to determine the degree of agreement with statement about peer tutoring. Mostly, strongly agree and agree were considered to be positive perceptions, undecided was considered neutral while disagree and strongly disagree were considered negative perceptions.

Table 1 shows the responses of students' perceptions towards peer tutoring

Table 1: The Responses of Students' Perceptions towards Peer Tutoring

Statement	SA n(%)	A n(%)	N n(%)	D n(%)	SD n(%)
5. I was more enthusiastic and motivated during peer tutoring.	35(67.31)	12(23.08)	2(3.85)	2(3.85)	1(1.92)
6. Peer tutoring as instructional technique is an effective strategy for students of all abilities.	39(75.00)	7(13.46)	4(7.69)	1(1.92)	1(1.92)
7. Peer tutoring stimulates me to learn general biology.	40(76.92)	9(17.31)	1(1.92)	1(1.92)	1(1.92)
8. Peer tutoring as instruction would promote the student understanding of concepts and do away with rote learning or memorization of facts.	30(57.69)	18(34.62)	2(3.85)	2(3.85)	0(0.00)
9. Peer tutoring hinder students' ability on learning tasks.	1(1.92)	2(3.85)	1(1.92)	10(19.23)	38(73.08)
10. I feel the use of peer tutoring for instruction would affect my learning during my private time in a positive way	32(61.54)	18(34.62)	0(0.00)	2(3.85)	0(0.00)
11. The use of peer tutoring for learning almost and always reduces the personal undue forgetfulness and recitation of mnemonics as well as acronyms during examinations.	30(57.69)	16(30.77)	0(0.00)	5(9.62)	0(0.00)
12. The use of peer tutoring would help me to accommodates diverse students within a classroom.	37(71.15)	14(26.92)	1(1.92)	0(0.00)	0(0.00)
13. Peer tutoring promotes higher-order thinking.	32(61.54)	11(21.15)	4(7.69)	3(5.77)	2(3.85)

Acronyms

SA = Strongly agree, A =Agree, N= Neutral, D = Disagree, SD = Strongly disagree

Table 1 indicates the ratings of the experimental group's perceptions about the effectiveness of peer tutoring as an instructional strategy in general biology lessons. The responses of students have been illustrated using graphs and charts.

Majority of the participants (67.31 %,) strongly agreed with item 5, which indicated that: Students were more enthused and motivated during peer tutoring lessons and this is graphically shown in Figure 1.

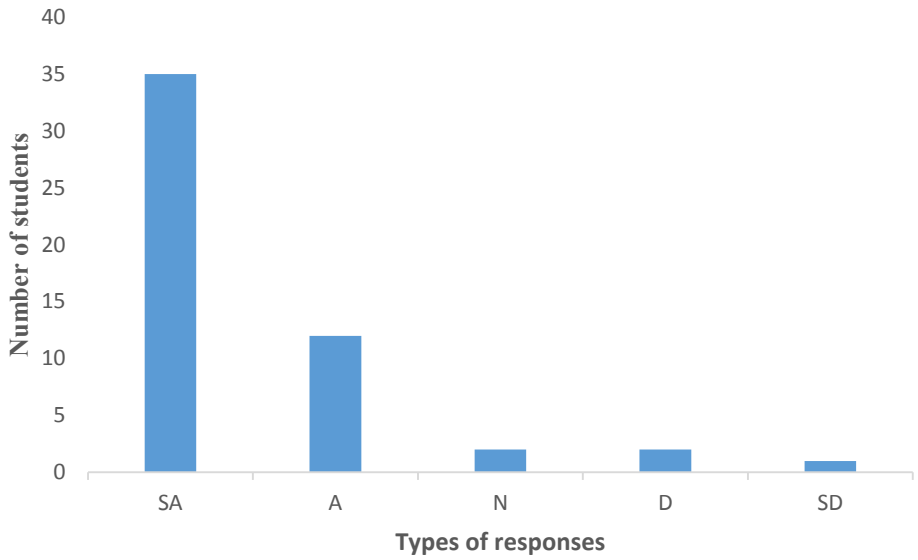

Figure 1: Peer tutoring makes students more enthused and motivated

As seen from Figure 1, students who strongly agreed that peer tutoring lessons make them more enthusiastic and motivated had the highest peak of 35.

Majority of the participants (75.00 %,) strongly agreed with item 6, which indicated that: 'Peer tutoring as instructional technique is an effective strategy for students of all abilities' and this is graphically shown in Figure 2.

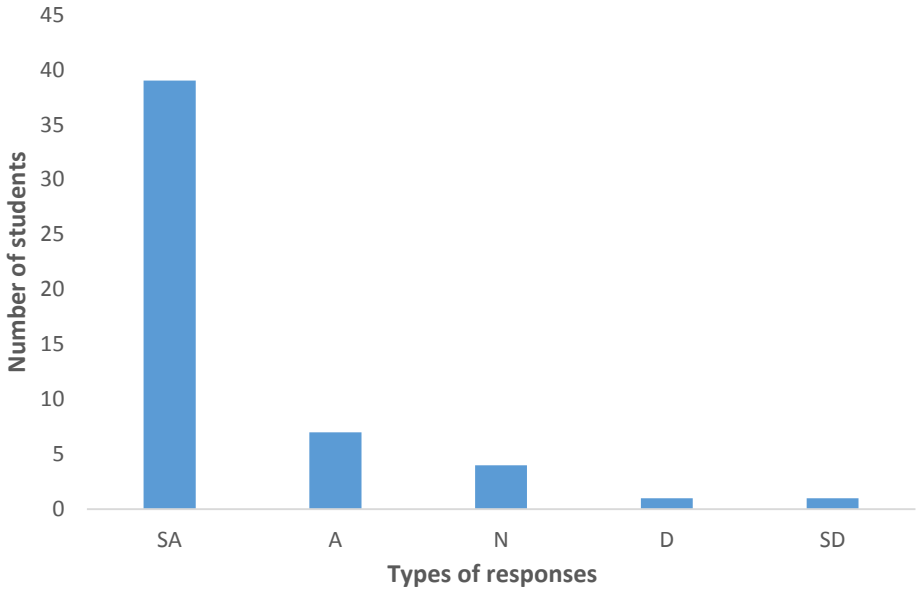

Figure 2: Peer tutoring is effective for students of all abilities

As seen from Figure 2, students who strongly agreed that peer tutoring is an effective strategy for students of all abilities had the highest peak of 39.

Majority of the participants (76.92 %,) strongly agreed with item 7, which indicated that: 'Peer tutoring stimulates me to learn general biology'. This perception is captured in Figure 3.

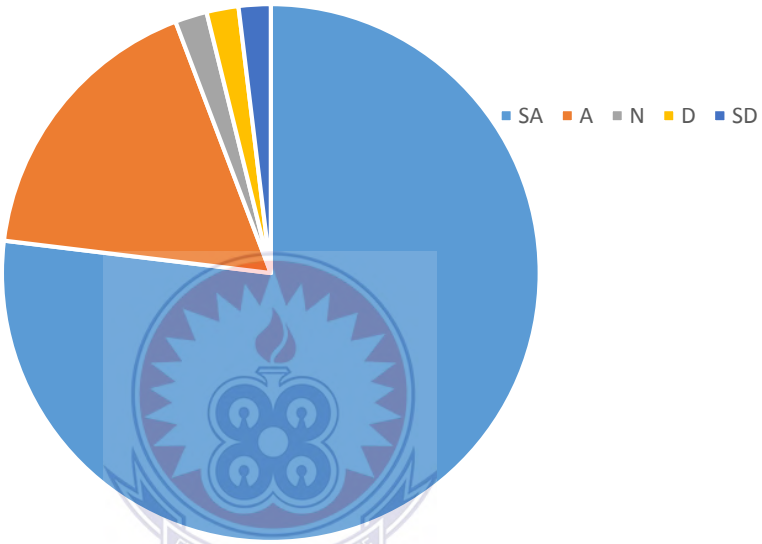

Figure 3: Peer tutoring stimulates me to learn general biology

As seen from Figure 3, students who strongly agreed that peer tutoring stimulate them to learn general biology had the largest sector.

Majority of the participants (57.69 %,) strongly agreed with item 8, which indicated that**:** 'Peer tutoring as instruction would promote the student understanding of concepts and do away with rote learning or memorization of facts'. This perception is captured in Figure 4.

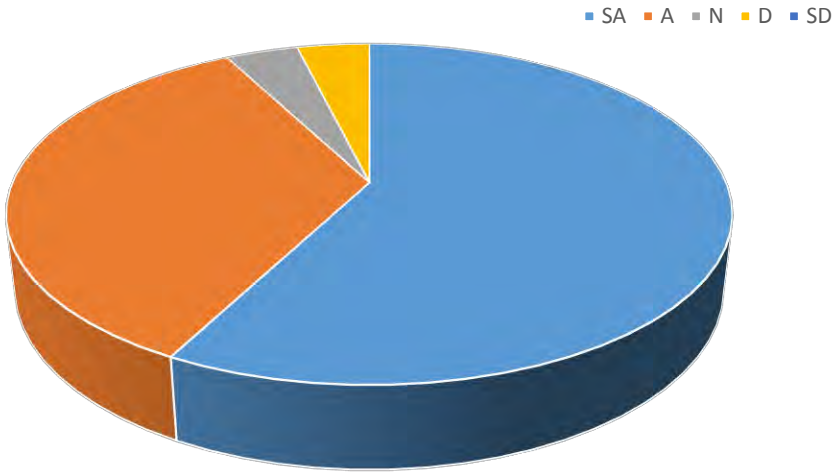

Figure 4: Peer tutoring prevents rote learning and memorization of facts

From Figure 4, it is clearly seen that majority of the students strongly agreed that peer tutoring prevents rote learning and recitation of facts hence the largest sector.

Item 9 was negatively coded, with 73.08% of the respondents strongly disagreeing with the statement that peer tutoring hindered their abilities with learning tasks, as shown in Figure 5. It shows that many of the students or respondent perceived that peer tutoring does not hinder their ability with learning tasks.

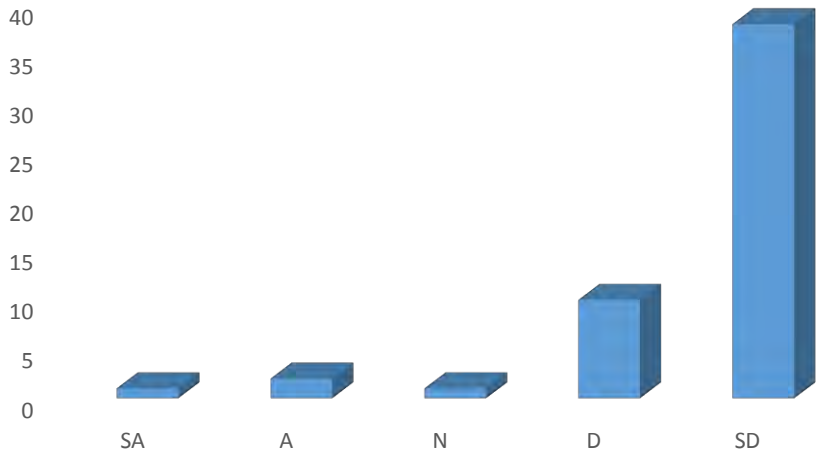

Figure 5: Peer tutoring does not hinder student's ability with learning task

As seen from Figure 5, students who strongly disagreed that peer tutoring hindered their ability with learning tasks had the longest bar of 38. It means that many students perceived peer tutoring does not hinder their ability with learning tasks.

Majority of the participants (61.54 %,) strongly agreed with item 10, which indicated that**:** 'I feel the use of peer tutoring for instruction would affect my learning during my private time in a positive way' as shown in Figure 6.

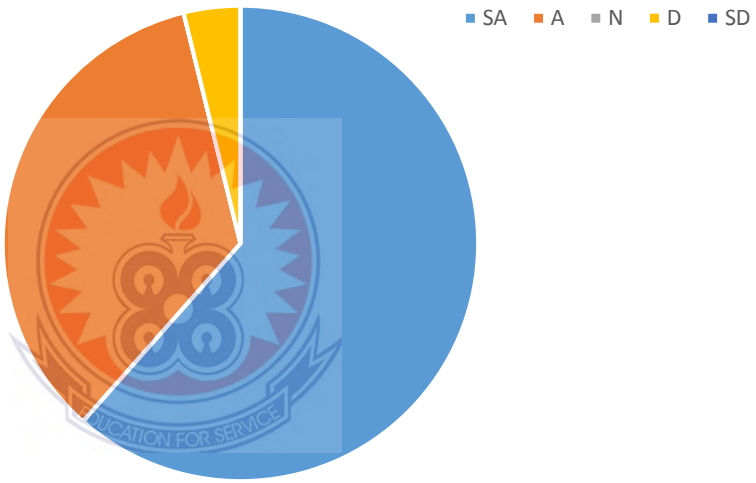

Figure 6: Peer tutoring does not affect private study

As seen from Figure 6, most of the students strongly agreed that peer tutoring will have a positive impact on their private learning. Hence the largest sector of the chart.

Item 11 was strongly agreed by majority of the participants (57.69 %,), which indicated that**:** 'The use of peer tutoring for learning almost and always reduces the personal undue forgetfulness and recitation of mnemonics as well as acronyms during examinations' as shown in Figure 7.

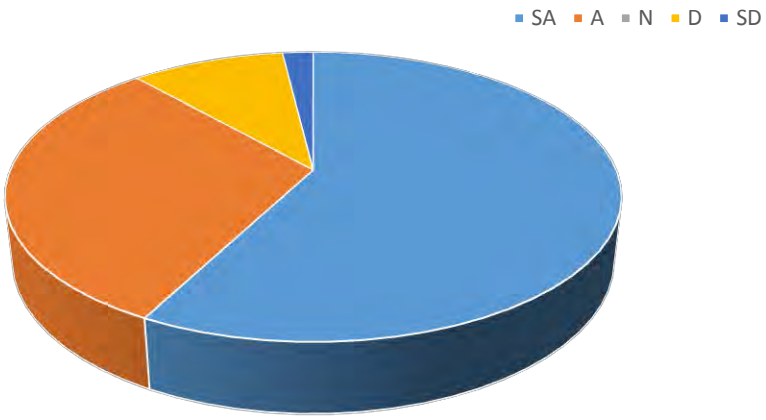

Figure 7: Peer tutoring reduces undue forgetfulness and recitation of mnemonics

From Figure 7, most of the students strongly agreed that peer tutoring for learning almost and always reduces the personal undue forgetfulness and recitation of mnemonics as well as acronyms during examinations.

Item 12 was also strongly agreed by majority of the participants (71.15%,), which indicated that**:** 'The use of peer tutoring would help me to accommodates diverse students within a classroom' as shown in Figure 8.

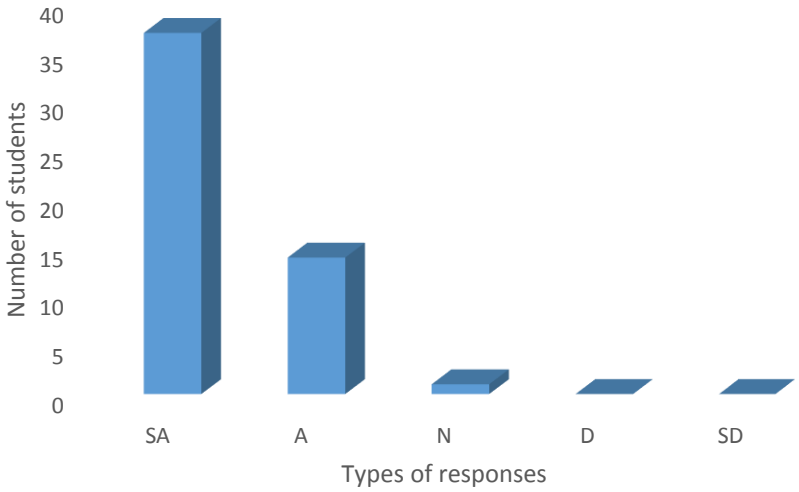

Figure 8: Peer tutoring helps me to accommodate diverse students

From Figure 8, most students strongly agreed that peer tutoring would help themaccommodate diverse students within a classroom.

Majority of the participants (61.54 %,) strongly agreed with item 13, which indicated that**:** 'Peer tutoring promotes higher-order thinking' as seen in Figure 9.

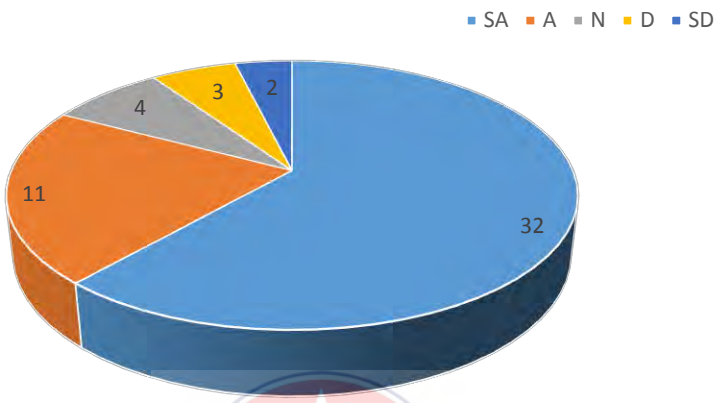

Figure 9: Peer tutoring promote higher thinking order

From Figure 9 it is evident most participants strongly agreed with the perception that peer tutoring promotes higher-order thinking. Therefore, the largest sector of the chart.

In summary, most students had positive perceptions towards peer tutoring. It could be said categorically that, the students' positive perception towards peer tutoring might have caused them to achieve higher in the post-test.

4.1.2 Research question two

What are the effects (statistical differences) of peer tutoring with respect to knowledge, comprehension and application levels of cognitive domain of the Bloom?

The second question sought to test whether there was any statistical significance difference or effect on the academic achievement with respect to knowledge, comprehension and application levels of cognitive domain of the students of the

experimental group. This was done by comparing the pre-test and post-test of essay or section 'B' scores from the GBAT using paired t – test. Each level of cognitive domain of the Bloom taxonomy of the students was analyzed separately. Beginning with knowledge, comprehension and application levels respectively.

Table 2 shows data that indicated that there is statistical difference in achievement of experimental group with respect to knowledge level of cognitive domain of the Bloom taxonomy.

Table 2: Achievementof Experimental Group with Respect to Knowledge level of Cognitive Domain

Group	N	Mean Score	p-value
Pre-test	52	10.69	2.65×10^{-24}
Post-test	52	17.00	

Table 2 results indicated a p-value of 2.65×10^{-24} which meant there is a significant difference between the tests. The mean scores for the pre-test and post-test of the experimental group were 10.69 and 17.00 respectively. Based on this evidence it can be interpreted that the treatment had a significant effect on the academic achievement with respect to knowledge level of cognitive domain of the students of the experimental group.

Table 3 presents the data indicating the experimental groups achievementwith respect to comprehension level of cognitive domain of the Bloom taxonomy.

Table 3: Achievementof Experimental Group with Respect to Comprehension Level of Cognitive Domain

Group	N	Mean Score	p-value
Pre-test	52	10.83	1.29×10^{-32}
Post-test	52	22.88	

Results in Table 3 indicates a p-value of 1.29×10^{-32}, which meant there is a significant difference in students' achievement. The mean scores for the pre-test and post-test of the experimental group were 10.83 and 22.88 respectively. Based on this evidence it can be interpreted that the treatment had a significant effect on the academic achievement with respect to comprehension level of cognitive domain of the students of the experimental group.

The data indicating the experimental groups achievementwith respect to application level of cognitive domain of the Bloom taxonomy is shown in Table 4.

Table 4: Achievementof Experimental Group with Respect to Application Level of Cognitive Domain

Group	**N**	**Mean Score**	**p-value**
Pre-test	52	10.65	4.35×10^{-37}
Post-test	52	22.63	

As indicated in Table 4, the mean scores for the pre-test and post-test of the experimental group were 10.65 and 22.63 respectively and a p-value of 4.35×10^{-37}, which meant there is a significant difference in students' achievement. Based on this evidence it can be interpreted that the treatment had a significant effect on the academic achievement with respect to application level of cognitive domain of the Bloom taxonomy of the experimental group.

Tables 2, 3, and 4 are evidence to reject the null hypothesis 1, which states that, there are no effects of peer tutoring with respect to knowledge gain, comprehension and application levels of cognitive domain of the Bloom Taxonomy.

4.1.3 Research question three

What is the significant difference in achievement between students taught with peer tutoring and those taught with the traditional technique method?

The question above sought to test whether there was any statistical significance difference in achievement between students taught with peer tutoring and those taught with the traditional method. Preliminary analysis was done by comparing the control and the experimental groups' scores from the pre-test using unpaired t – test. Pretest was used to find out the academic level of students in general biology. The pre-test was also to determine the homogeneity or the heterogeneity of the control and experimental groups before the intervention was given.

Table 5 presents the amount of knowledge the students had in general biology before the treatment.

Table 5: Pre-test Results of Experimental and Control Groups in GBAT

Group	**N**	**Mean Score**	**SD**	**p-value**
Experimental	52	43.17	5.38	0.57
Control	40	42.53	5.45	

When the p-value is less than 0.05 it means there is a significant difference between the tests, but when the p-value is greater than 0.05 then there is no significant difference between the tests. Results from Table 5 indicates a p value of 0.57. This shows that there was no statistically significant difference between performance of students in the experimental group and control group. The mean scores (control group was 42.53 and experimental group was 43.17) of both the groups before the treatment were almost same. The standard deviations (control group was 5.38 and experimental group was 5.45) show that both groups were normally distributed. This indicated that students in both groups had similar knowledge about osmosis and diffusion, which were the topics examined in this study before the intervention began.

Table 6 shows data that indicated that there is statistical difference in achievement between students taught with peer tutoring and those taught with the traditional method.

Table 6: Post-test Results of Experimental and Control Groups in GBAT

Group	N	Mean Score	SD	p-value
Experimental	52	78.83	3.45	3.26×10^{-19}
Control	40	68.73	3.78	

As could be observed in Table 6 both the peer tutoring and traditional approaches to teaching had significant effect on students' achievement in general biology. The P value was $\mathbf{3.26 \times 10^{-19}}$. This meant that there was a statistical significant difference between performance of students in the experimental group and the control group. The mean scores for the post-test of the experimental group was 78.83, and that for the control group was 68.73. The difference in mean scores for the experimental group indicated that when peer tutoring was used as an instructional strategy in teaching general biology, students shared ideas and easily understood the concepts.The values of standard deviation show that the experimental group (3.45) was not only better in achievement but also showed less variation compared to the control group (3.78).The corresponding increase in the mean score of the control group also showed that they also understood the concept.

This is evidence to rejects the null hypothesis 2. This finding concurs with Philip and Council (2010), and Romano and Walker (2010), who observed that peer tutoring has an effect on students' performance. It can be deduced from the result reported above that peer tutoring transformed the classroom from a place for the dispensation of knowledge into a place where knowledge is approached from multiple and missing perspectives, thereby allowing students to learn from one another. The results of the study support the findings explored by Brost (2011), that peer tutoring may enhance students' grades; however, the study recommended additional research for further confirmation.

Similarly, the results also confirm the findings of Rizve (2012), that peer tutoring may enhance the learning of students who are in the zone of proximal development. The results also supported the claims of studies such as (Ezenwosu, & Nworgu, 2013; Comfort, & McMahon, 2014), that peer tutoring has significant effects on academic performance in the subject of biology. One of the reasons for improvement in academic performance may be learning from peers, which further supports Skinner's idea of learning. Likewise, the cause of improvement in academic achievement may be linked to interaction during tutoring and pre-preparatory sessions for peer tutoring, which was Piaget's main learning idea during peer tutoring. The results are in the line with the study findings reported by Haider and Yasmin (2015).

4.2 Interest in Peer Tutoring

Interview was conducted to corroborate the responses from the questionnaire. Many of the students who were interviewed said that teaching and learning with peer tutoring was interesting. When a student was asked whether he found peer tutoring to be an interesting learning technique, he said, 'Yes. It made me to share my ideas with my friends". Others also responded "It helped me to accommodate diverse views and I was confident to lead the discussion". Student D commented, "It is interesting because it is easy for presenting knowledge and answers. It seems that students developed interest in peer tutoring because of how it gave them clear understanding of the Biology content. Student F commented "it is interesting because it's a new way of learning". Student B said "it makes you creative, makes you know what you don't know. Student C commented "it is good and nice approach to use. After using you find out that you have a wide collection of information and knowledge of the topic of study". Student E and F said 'peer tutoring increased their opportunities to interact in smaller groups which increases their self-confidence and self-efficacy'.

When participants were asked how peer tutoring has impacted them. Responses indicated that they are more comfortable talking and sharing ideas with their peers, have self-confidence as Biology learners, and have better leadership skills. Tutors and tutees seemed to enjoy personalized attention provided in student-centered instruction that characterizes peer-to-peer-tutoring approach. Student comments after peer-tutoring were overwhelmingly positive with comments such as, "My peer tutor and I worked more efficiently," "I got more work done with my peer tutor than I ever did," "Working with my peer tutor helped me understand more," "I learned so much more with my peer tutor," "I did better on my assignment after working with my peer tutor."

Overall, the interview with students indicated that they had positive perceptions about peer tutoring compare to the traditional approach. They believed that peer-tutoring was effective to promote tutors and tutees' academic success, leadership skills, self-perceptions as biology learners, enjoyment in learning biology.

4.3 Findings from the Observation

The results of classroom observations also indicated that peer tutoring depends on the process of mutual help between classmates, allowing the transfer of control to the students in the classroom. Peer tutoring allowed the teacher to accommodate a classroom of diverse students, including students with learning disabilities. It was observed that peer tutoring helped to promote both students' outcomes in biology classrooms as well as improve understanding of difficult biological concepts. The students were more involved in the lesson and participated fully. Observations gathered during students' exposure to peer tutoring suggest that the quality of students' interaction with their peers improved significantly both socially and academically. Although not everyone may gain equally from participation, peer tutoring offered the opportunity for each participant to become aware of their weaknesses. The result

indicated that those exposed to peer tutoring performed better than those exposed to using traditional method in their performance.

4.4 Discussion

The main purpose of this study was to compare the effectiveness of the peer tutoring method with the traditional technique method for teaching and learning some selected topics in general biology at the Colleges of Education in Ghana. This study focused on finding out whether the peer tutoring could positively affect students' academic achievement in the study of general biology and enable them to learn meaningfully or otherwise. This section focuses on the discussion of the findings relating to the literature and research questions/hypothesis that guided the study.

4.4.1 Research question one

What are the perceptions of students towards peer tutoring? The question sought to find out the perceptions of students towards peer tutoring.

On student perceptions, 67.31% agreed that peer tutoring improved their academic achievement, increased time on task and improved classroom behavior, improved attitudes towards schools and the subjects being studied, increased self-esteem and self -confidence, and increased positive social and emotional skills. This results confirms the studies by (Miller, Topping, & Thurston, 2010; Okilwa, & Shelby, 2010).

Some specific social and emotional outcomes that peer tutoring seems to target include a sense of belonging and social acceptance, self-concept, and attitude towards subject matter (Robinson, Schofield, & Steers-Wentzell, 2005), as well as self-esteem and self-worth (Miller, Topping, & Thurston, 2010).

The study also showed that, peer tutors provide students with one-on-one attention. They are able to explain topics from a "students' perspective" and answer the questions that students have about the subject. Finally, they are able to help the students with their

homework and studying for tests and quizzes. This confirmed the findings by Miller, Topping, and Thurston, (2010), peer tutoring has successfully enhanced comprehension, accuracy, and knowledge in subjects such as mathematics, social studies, science, and reading across all different groups of students. Robinson, Schofield, and Steers-Wentzell (2005), also discussed a study in which students who participated in peer tutoring in 10th grade mathematics classes received higher scores on the Texas Assessment of Academic Skills (TAAS) mathematics exam than those who had no tutoring. The interview with students and the observation by the researcher indicated that students had positive perceptions about peer tutoring.

4.4.2 Research question two

What are the effects (statistical differences) of peer tutoring with respect to knowledge, comprehension and application levels of cognitive domain of the Bloom?

The second question sought to test whether there was any statistical significant difference or effect on the academic achievement with respect to knowledge, comprehension and application levels of cognitive domain of the students of the experimental group.

On statistical difference in achievement of experimental group with respect to knowledge level of cognitive domain of the Bloom taxonomy. The results from Table 3 shows that, the mean (17.00) of the posttest was higher than that of the pretest (10.69) on the experimental group. Based on this evidence the null hypothesis is rejected, and it may be interpreted that the treatment had a significant effect on academic achievement of the students of the experimental group with respect to knowledge level of the cognitive domain. The findings are in the line with the results reported by Mehra, and Mondal (2005), that peer tutoring is an effective strategy for improving academic

learning at knowledge level of cognitive domain. This further confirms the claim of constructivist school of thought that children can easily learn something through interactions and discussions by Ali, Anwer, and Jaffar (2015). In addition, learning from tutors or teaching to tutees may be an agent for motivation of learning for students; this idea may be traced back to behaviorist school of thought as expressed by Ullah, Tabassum, and Kaleem (2018).

On experimental groups' achievement with respect to comprehension level of cognitive domain of the Bloom taxonomy. Table 4 shows the mean scores for the pre-test and post-test of the experimental group as 10.83 and 22.88 respectively. Based on this evidence it can be interpreted that the treatment had a significant effect on the academic achievement with respect to comprehension level of cognitive domain of the students of the experimental group.

The findings are in the line with the study results reported by Mehra, and Mondal (2005), that peer tutoring is an effective strategy for improving academic learning at comprehension level of cognitive domain. Similarly, the findings are also supported by Galaviz (2009), and Ullah, Tabassum, and Kaleem (2018), that peer tutoring may develop high level of comprehension skills of students.

On experimental groups' achievement with respect to application level of cognitive domain of the Bloom taxonomy as shown in table 5. The mean scores for the pre-test and post-test of the experimental group were 10.65 and 22.63 respectively. Therefore, based on this evidence the null hypothesis is rejected, and it may therefore be interpreted that peer tutoring had a significant effect on the academic achievement of the experimental group with respect to application level of cognitive domain. The findings were in line with the study results reported by Ullah, Tabassum, and Kaleem

(2018), that peer tutoring is an effective strategy for improving academic learning at application level of cognitive domain.

4.4.3 Research question three

What is the significant difference in achievement between students taught with peer tutoring and those taught with the traditional technique methods?

The question above sought to test whether there was any statistical significance difference in achievement between students taught with peer tutoring and those taught with the traditional method. Based on the mean scores for the post-test of the experimental group 78.83, and that for the control group 68.73. The values of standard deviation show that the experimental group (3.45) was not only better in achievement but also showed less variation compared to the control group (3.78). This is evidence to reject the null hypothesis 2.

The results of the study correspond with the findings of Ali, Anwer, and Jaffar (2015), who observed that peer tutoring has an effect on students' performance. It can be deduced from the results reported above that peer tutoring transformed the classroom from a place for the dispensation of knowledge into a place where knowledge is approached from multiple and missing perspectives, thereby allowing students to learn from one another. The results of the study support the findings explored by Brost (2011), that peer tutoring may enhance students' grades; however, the study recommended additional research for further confirmation.

Similarly, the results also confirm the findings of Rizve (2012), that peer tutoring may enhance the learning of students who are in the zone of proximal development. The results also supported the claims of studies such as (Ezenwosu, & Nworgu, 2013; Comfort, & McMahon, 2014), that peer tutoring has significant effects on academic

performance in the subject of biology. One of the reasons for improvement in academic performance may be learning from peers, which further supports Skinner's idea of learning. Likewise, the cause of improvement in academic achievement may be linked to interaction during tutoring and pre-preparatory sessions for peer tutoring, which was Piaget's main learning idea during peer tutoring. The results are in the line with the study findings reported by Haider, and Yasmin (2015).

The results also confirm the findings of the study conducted by Ullah, Tabassum, and Kaleem (2018) which concluded that peer tutoring enhanced the academic achievement of students in the experimental group significantly as compared to the control group; hence, it was an effective method of instruction for teaching. Peer tutoring increased academic achievement and motivation in tutors and students being tutored (Robinson, Schofield, & Steers-Wentzell, 2005).

CHAPTER FIVE

SUMMARY, CONCLUSIONS, RECOMMENDATIONS AND SUGGESTIONS FOR FURTHER RESEARCH

5.0 Overview

This chapter presents the summary of findings of the study, conclusions drawn and recommendations based on the findings. It also presents suggestions for further research.

5.1 Summary of Findings

A pre-test - post-test non-equivalent quasi-experimental design was used for the study. The experimental group received treatment using the peer tutoring method while the control group received treatment using the traditional method. Both groups however covered the same content in general biology. In this study, the achievement of the students was the dependent variable while the teaching approaches (peer tutoring and the traditional method) were the independent variables.

The first research question sought to examine the perceptions of students towards peer tutoring. The findings show that peer tutoring has positive impacts on student learning, motivation and socialization. Peer tutoring was found effective in the development of creativity and problem-solving skills of both tutors and tutees. Due to its interactive nature, peer tutoring helps the tutor in understanding the conceptual level of the tutees and concept about the topic.

The second question sought to test whether there was any statistical significant difference or effect on the academic achievement with respect to knowledge, comprehension and application levels of cognitive domain of the students of the experimental group. It was found that the mean score of the posttest was better than that

of the pretest of experimental group with respect to knowledge, comprehension and application levels of their cognitive domain.

Finally, the third question sought to find out the significant difference in achievement between students taught with peer tutoring and those taught with the traditional technique method. The findings revealed that, the difference in mean scores for the experimental group indicated that when peer tutoring was used as an instructional strategy in teaching general biology, students shared ideas and easily understood the concepts. The values of standard deviation show that the experimental group (3.45) was not only better in achievement but also showed less variation compared to the control group (3.78). The corresponding increase in the mean score of the control group also showed that they also understood the concept. This is evidence to rejects the null hypothesis.

5.2 Conclusions

Based on the findings represented through statistical analysis of data, the following conclusions were drawn:

There were statistical differences between the experimental and the control groups in favor of the experimental group. The results of the study showed that peer tutoring is more effective for teaching General Biology at the Colleges of Education than the traditional method. Peer tutoring has the ability to improve student's achievement in Biology. Also, peer tutoring makes students learn meaningfully to improve upon their capacity to answer high order cognitive level questions.

The posttest scores provide evidence that the participants of the experimental group seemed to have performed better than the students of control group, which may be an indication of the effectiveness of peer tutoring in biology.

The posttest scores of experimental group show that the participants performed better than the pretest scores with respect to knowledge, comprehension and application levels of cognitive domain. This is also evidence that peer tutoring in biology may be somewhat effective in contrast to traditional lecture method at colleges of education level, in the first three levels of cognitive domain of the Bloom taxonomy.

Also, the participants have positive perception towards peer tutoring. Students are able to summarize, organize and logically present their work effectively

5.3 Recommendations

Based on results and conclusions of the study the following recommendations were made:

1. Since peer tutoring was found to be more effective than the use of traditional instruction in teaching General biology, if resources allow and if it is feasible, the peer tutoring technique may be incorporated in teaching other subjects as well at the Colleges of Education.
2. Peer tutoring should be introduced in the curriculum of Colleges of Education. This will enable the teacher- trainees to be acquainted with numerous teaching methods as one instructional technique (Traditional) could lead to boredom on the part of the students.
3. Teachers should be around to supervise students during peer tutoring to limit unwarranted arguments and also avail themselves to new teaching methods lest they are relegated to the background.

5.4 Suggestions for Further Research

Future researchers can look into perceptions of students using peer tutoring in other institutions. It would be interesting to see if students in other levels of education perceive the same level of effectiveness as the students who participated in this study.

Additional research could look into the effect that peer tutoring has on its tutors. This type of research could present a more rounded view of the effectiveness of peer tutoring. More research could provide the support that colleges and universities need to support the implementation and use of peer tutoring centers.

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APPENDICES

APPENDIX A

QUESTIONNAIRE ON PERCEPTION OF STUDENTS TOWARDS PEER TUTORING

Introduction

A research is being conducted to find out students' perception towards peer tutoring in the teaching and learning of general biology. I have the honour to involve you in this research. Kindly read the questions carefully and tick/write in the appropriate box or make a response against each question. Copying your friend's opinion will make this work worthless. Confidentiality of your responses is assured. Thanks for your co-operation.

A. Background information

1. Students' Code…….
2. Sex……
3. Age……
4. Class/Year……

B. Perceptions of the effectiveness of peer tutoring on teaching and learning.

Please respond to each of these items in this section by ticking (√) the appropriate response. Strongly agree (SA), agree (A), Neutral (N), disagree (D), strongly disagree (SD)

Statement	SA	A	N	D	SD
5. I was more enthusiastic and motivated during peer tutoring.					
6. Peer tutoring as instructional technique is an effective strategy for students of all abilities.					
7. Peer tutoring stimulates me to learn general biology.					
8. Peer tutoring as instruction would promote the student understanding of concepts and do away with rote learning or memorization of facts.					
9. Peer tutoring hinder students' ability on learning tasks.					
10. I feel the use of peer tutoring for instruction would affect my learning during my private time in a positive way					
11. The use of peer tutoring for learning almost and always reduces the personal undue forgetfulness and recitation of mnemonics as well as acronyms during examinations.					
12. The use of peer tutoring would help me toaccommodates diverse students within a classroom.					
13. Peer tutoring promotes higher-order thinking.					

APPENDIX B

STRUCTURED INTERVIEW ON PEER TUTORING

1. Did you find teaching and learning with peer tutoring interesting?
2. How did you find peer tutoring as a teaching method?
3. How did you find your performance in general biology after being exposed to peer tutoring?
4. What did you like or dislike about peer tutoring?

APPENDIX C

GENERAL BIOLOGY ACHIEVEMENT TESTS (GBAT 1)

ANSWER ALL QUESTIONS **1 HOUR**

1. **Which process is responsible for gas exchange in the lungs?**
   a. Diffusion
   b. Osmosis
   c. Active transport
   d. Passive transport

2. **What happens to the rate of diffusion as the temperature increases?**
   a. It decreases.
   b. It increases.
   c. It stays the same
   d. It diffuses

3. **Why do large multicellular organisms need transport systems while simple unicellular organisms do not?**
   a. Large organisms have a much smaller surface area to volume ratio compared to smaller ones.
   b. Diffusion does not work in large multicellular organisms.
   c. Unicellular organisms have a much smaller surface area to volume ratio than multicellular organisms.
   d. To maintain structure

4. **When the concentration of solute molecules is higher outside the cell water will move out of the cell. This process is known as _____**
   a. Hypertonic
   b. Hypotonic
   c. Isotonic
   d. Homeostasis

5. **When concentration of solute molecules is lower outside the cell water will go into the cell. This process is known as _____**
   a. Hypertonic
   b. Hypotonic
   c. Isotonic
   d. Homeostasis

6. **Concentration of solute molecules outside the cell is equal to that inside the cell. This is known as …….**
   a. Hypertonic
   b. Hypotonic
   c. Isotonic
   d. Homeostasis

7. **Diffusion of water across a semi-permeable membrane from an area of high concentration to an area of low concentration is described as _____**
   a. Hypertonic
   b. Osmosis
   c. Diffusion
   d. Homeostasis

8. **As molecules diffuse, they create this, which is a difference in concentrations across space**
   a. Osmosis
   b. Diffusion
   c. Semi-permeable
   d. Concentration gradient

9. **Chamber A contains 40% helium and Chamber B contains 20% helium. Chambers are connected by a tube the molecules are free to cross. Which of the following will occur?**
   a. some helium will move from chamber A to chamber B
   b. some helium will move from chamber B to chamber A
   c. helium will remain concentrated in chamber A
   d. all of the helium will move into chamber B

10. What will happen to an animal cell placed in a salt water solution?

a. The cell will shrink
b. the cell will expand
c. the cell will burst
d. the cell will shrink and then expand and then shrink again

11. Which of the following is a type of active transport?

a. sodium potassium pump
b. endocytosis
c. exocytosis
d. all of these

12. Active transport requires:

a. a concentration gradient
b. osmosis
c. energy
d. a hypertonic solution

13. The shrinking of the cytoplasm away from the cell wall is referred to as

a. Active transport
b. Osmosis
c. Plasmolysis
d. Translocation

14. Plant cells do not burst when placed in a hypotonic solution because

a. Rigidity is provided by the cell
b. The influx of solvent is the same in opposite direction
c. Excess water is extruded by the membrane
d. Osmosis has no effect on plants

15. Which of the following processes is brought about by diffusion?

a. Shrinking of cell in hypertonic solution
b. Passage of water from the soil into the root hair
c. Bursting of erythrocytes in hypotonic solution
d. Passage of digested food from the villi into the blood

16. Permeable means

a. things can pass through
b. the concentration levels are different
c. it is permanent
d. things are stuck

17. What is the definition of Selective Permeability?

a. The movement of materials across the cell membrane that requires no energy from the cell.
b. The movement of materials through (or across) the cell membrane
c. The ability of the cell membrane to allow some things to pass through while preventing other things from passing through.
d. The movement of molecules from an area of high concentration to an area of low concentration

18. This cell organelle helps organisms maintain homeostasis by controlling what substances may enter or leave cells.

a. Vacuole
b. Nucleus
c. cell membrane
d. cell wall

19. Ideally, your cells should be in a(n) _____ solution

a. Isotonic
b. Hypertonic
c. Hypotonic
d. Isometric

20. **Diffusion is the movement of molecules from an area of _____ concentration to an** _____ concentration

a. High, low
b. Low, high
c. Low, low
d. High, high

Section B

1.

a. Give three examples of diffusion in plants

b. Describe an experiment to demonstrate diffusion in air.

c. Explain the role of diffusion in the activities of the living cell.

2.

a. Define tonicity of a solution.

b. Discuss the factors that affect the rate of diffusion and osmosis.

a. Demonstrate osmosis in a non-living tissue with the aid of a diagram.

APPENDIX D

GENERAL BIOLOGY ACHIEVEMENT TESTS (GBAT 2)

ANSWER ALL QUESTIONS 1 HOUR

1. **Which of the following statements about kidney structure and function is true?**

a. Cells and large proteins are filtered into urine from the glomerulus
b. No filtration occurs after Bowman's capsule, only reabsorption and secretion
c. Each kidney is composed of approximately one thousand nephrons
d. All of the answer choices are correct

2. **Where does blood go after it leaves the glomerulus?**

a. It runs parallel to the nephron via the efferent arterioles
b. It re-enters pulmonary circulation
c. It returns to the heart via the inferior vena cava
d. It runs parallel to the nephron via the efferent venules

3. **A patient is found to have abnormally high concentrations of glucose in his urine. Which of the following portions of the nephron is most likely the cause of this excess of glucose?**

a. Collecting duct
b. Distal convoluted tubule
c. Loop of Henle
d. Proximal convoluted tubule

4. **Which of the following are located in the cortex of the kidney?**

a. Ascending limb, descending limb, and collecting duct
b. Glomerulus, proximal tubule, and distal tubule
c. Loop of Henle
d. Glomerulus and proximal tubule

5. What structure surrounds the glomerulus and serves as the site of filtrate production?

a. Bowman's capsule
b. Proximal tubule
c. Renal pelvis
d. Distal tubule

6. What is the first structure encountered as blood interacts with a nephron?

a. Distal convoluted tubule
b. Collecting duct
c. Glomerulus
d. Proximal convoluted tubule

7. What is the functional unit of the kidney?

a. Renal corpuscles
b. Nephrons
c. Neurons
d. Renal medulla

8. Which of the following organs is involved in exocrine function?

a. All of these choices are correct
b. Kidneys
c. Skin
d. Pancreas

9. What is a commonality between excretory systems of worms, insects, and vertebrates?

a. Reabsorption mechanisms for water and ions
b. A large surface area
c. A complex network of tubules
d. All of these answers

10. What is the skeletal system?

a. All the bones in the body

b. All the muscles and tendons

c. All the body's organs, both soft and hard tissue

d. All the bones in the body and the tissues that connect them

11. How many bones are there in the average person's body?

a. 33

b. 206

c. 639

d. It varies by the individual

12. Which of the following statement is INCORRECT?

a. Bone is where most blood cells are made

b. Bone serves as a storehouse for various minerals

c. Bone is a dry and non-living supporting structure

d. Bone protects and supports the body and its organs

13. Which bone protects the brain?

a. Calcium

b. The cranium

c. The cerebrum

d. The cerebellum

14. The purpose of the rib cage is to...

a. protect the stomach

b. protect the spinal cord

c. protect the heart and lungs

d. provide an object to which the lungs can attach

15. What makes bones so strong?

a. Silica

b. Cartilage

c. Blood and marrow

d. Calcium and phosphorous

16. What is the difference between cartilage and bone?

a. Bone is rubbery, and cartilage is firm

b. Cartilage is rubbery, and bone is firm

c. Bone is a more primitive tissue than cartilage

d. Bone is inside the body, and cartilage is outside

17. The hollow space in the middle of bones is filled with .....

a. Bone marrow

b. Air

c. Blood

d. Bone cells

18. What is the difference between compact bone and spongy bone?

a. They have different bone marrow

b. They are made of different materials

c. They have different sizes of bone cells

d. They have different arrangement of bone cells

19. What are muscles made of?

a. Silica

b. polyester threads

c. calcium and phosphorous

d. groups of cells called fibres

20. What is the function of a tendon?

a. To link bones to bones

b. To link muscles to bones

c. To link muscles to ligaments

d. To bind the cells in compact bone closer together

Section B

1.

a. State four functions of the mammalian skeleton.
b. Describe the process involved as the human arm is being raised.
c. Using a suitable example, explain the role of skeletal joints in movement in a mammal.

2.

a. List the main excretory products in the body of mammals.
b. Describe how a constant body temperature is maintained in a mammal.
c. Explain the mechanism of urine formation in humans.

APPENDIX D

OBSERVATIONAL GUIDE

Observe if students are discussing the given topic

Observe students' participation