UNIVERSITY OF EDUCATION, WINNEBA

THE EFFECT OF THINK-PAIR-SHARE TEACHING STRATEGY ON THE ACADEMIC PERFORMANCE OF STUDENTS IN SELECTED TOPICS IN INTEGRATED SCIENCE

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OCTOBER, 2023

DECLARATION

STUDENT'S DECLARATION

I, Pascal Agwigulo Adagwine, declare that this research work, 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 it has not been submitted, either in part or whole, for another degree elsewhere.

……. ……

Pascal Agwigulo Adagwine Date

SUPERVISOR'S DECLARATION

I hereby declare that the preparation of this thesis was supervised in accordance with guidelines for supervision of research work laid down by the University of Education, Winneba.

…….. ……

Dr. James A. Azure Date

DEDICATION

This work is dedicated to God for the wisdom bestowed on me, my family and especially Abisisare Alex and Agwigulo Albert.

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ABSTRACT

This study examined the effects of Think-Pair-Share (TPS) Teaching Strategy on Senior High Schools students' class participation and performance in Integrated Science in Bolgatanga Municipal. The study adopted a quasi-experimental research design. Two null hypotheses were generated and tested at a 0.05 level of significance. The sample consisted of 100 Integrated Science students selected from Bolgatanga Central Technical Institute and Zamse Senior High/Technical Schools. The study also used a purposive sampling technique. The instruments that were used to collect data were Integrated Science Performance Test (ISPT) and questionnaires. Expert judgments were used to ensure face and content validity. Test-retest method was used to determine the reliability Coefficient of 0.70 was obtained. Data were collected on a 5-point likert scale questionnaire ranging from strongly agree (1) to strongly disagree (5). Both descriptive (mean and standard deviation) and inferential statistics (independent t-test) were used to analyse the data. The key finding of this study showed a p-value of 0.00 which is significantly difference between the experimental and control groups means scores of students exposed to think-pair-share teaching strategy. There was also a p-value of 0.00 which is significantly difference between the post-test means scores of female and male experimental group of students exposed to think-pair-share teaching approach. The findings of this study also showed that about 97% of the students significantly have higt positive attitude and motivation towards think-pair-share strategy of learning. Based on this finding, the researcher recommended that integrated science teachers should adopt think-pair-share strategy in lessons delivery to enable students actively participate and interact to arouse their interest and motivation to learn.

CHAPTER ONE

INTRODUCTION

1.0 Overview

This section of the research discusses the background to the study, statement of the problem, purpose of the study, objectives of the study, research question, and hypothesis, significant of the study, limitation and delimitation of the study.

1.1 Background to the Study

The nature of teaching and learning is a process of interaction between teachers and students in a lesson. This relationship is called the multi-way interaction in the learning process (Saykili, 2018). The teacher is one component in the learning process that has a very important role in the achievement of learning goals, because the teacher scan directly affects, nurtures, guides, and improves intelligence and skills of students. Learning objectives will be achieved in the learning process if students get knowledge and meaningful learning experiences, which are able to involve students actively and optimally. Therefore, teachers must strive to apply learning strategies effectively and efficiently in accordance with the student's character and the character of the materials.

Learning Integrated Science is one of the subjects of students which examine the events, facts, concepts, theories, and related generalizations surrounding the natural environment (Aksela, 2005). The focus of learning science in school is to develop students' competence to be able to explore and understand the scientific and systematic nature which includes knowledge, concepts, and discoveries. Implementation of science teaching/learning in schools should direct empirical approach with the assumption that the universe can be studied, understood, and explained that does not solely depend on the method of causality

but through certain processes, such as observation, experimentation, and rational analysis. Learning science in elementary school is not only glued to the process and the product, but the formation of attitudes and skills. Ajaja (2013) also confirmed that the science is not a real science if it is not accompanied by experiments and laboratory work. Numerous studies have shown that engaging in activities, such as asking questions and contributing to classroom discussions, can support learning processes and enhance academic achievements (Rocca, 2010). However, students have only limited time to elaborate and formulate their idea and to decide whether to raise their hand. Shyness may be a personal trait that hinders students even more from participating in-class because shy students struggle with speaking in front of peers, even though they have good ideas to share (Crozier, 2020). With the present study, we tested a teaching strategy from cooperative learning referred to as Think-Pair-Share (TPS) and investigated its effect on students' in-class participation and associated emotional and motivational processes.

The purpose of education is to develop the ability of individuals to live optimally as members of a society (Siagian & Surya, 2017). Science teaching at the Senior High School (SHS) level is a process of instructing skills, knowledge, and expressions in learning. According to Hasanah and Surya (2017), science knowledge should be provided to all learners, beginning with those in elementary school, to equip them with the ability to think logically, analytically, systematically, critically, creatively, and cooperatively. The contributions of science to human and societal development highlight the need for an effective teaching and learning strategy that would enhance students' academic performance in science so that the youth can fully participate in engineering and technology, which are indicators of national development (Ayinla, 2015).

The teaching of integrated science involves the development of more effective and scientifically aligned strategies to enhance students' understanding (Sunal, 2004). In science teaching, ideas need to be represented in a way that is both a genuine representation of the science concept and yet simple enough to be meaningfully understood by the learners. Science as a discipline consists of different concepts with varying levels of complexity, and therefore, there is a need for a teacher to adopt a different and suitable teaching strategy to map each concept in order to aid the students' understanding (Azure, 2018). Huitt (2007) analysed that we must have an advanced approach to teaching and learning science to enhance students' skill, interests, participation, and aptitude in science. At present, conceptual understanding is more important than the memorization of information. Therefore, we need to develop some teaching strategies that involve students' active participation in peer learning. It is found that some of the teaching strategies were not considered effective for a well-designed understanding of science. According to Risqi and Surya (2017), one of the purposes of teaching in school is to train students in thinking and reasoning in reaching conclusions, develop the ability to solve problems, and provide information or communicate ideas through speech, writing, pictures, graphs, maps, diagram interpreting, etc. It should be noted that learners have different learning needs. Therefore, there is a need to seek a teaching strategy that will address the individual learners' needs.

This study builds its arguments on two variables, which are the teaching strategy of "think pair share" (TPS) and the student's academic performance. Professor Frank Lyman was the first educationist who proposed this think-pair-share model in 1981, and it was later developed all over the world (Sharma & Saarsar 2018). He defined TPS as an active cooperative learning strategy designed to give students in the classroom the opportunity to

think and discuss their ideas together. The fundamental component of this teaching strategy is to improve students' learning through discussion with each other. However, the process of learning will be more effective when students' discussions lead to significant improvements in their learning outcomes (Kaddoura, 2013).

The TPS is a collaborative learning strategy where students work together to solve a problem or answer a question. This strategy requires students to think individually about a topic or answer to a question and share ideas with classmates. Discussing with a partner maximizes participation, focuses attention, and engages students in the comprehension of ideas. The TPS is a model of cooperative learning in pairs that gives students more time to think, respond, and help each other. As stated by Hamdayama (2014), think pair sharing is a simple technique with many advantages. Consider think-pair sharing to improve students' ability to recall information; a student can also learn from other students and convey ideas for discussion to each other before submitting them to the class.

Giving students' time to think about answers to questions and help each other resolve issues within their abilities is what the TPS entails. Sejani (2016, as cited in Akanmu, 2019) concluded from research carried out that think-pair-share enhances the problem-solving and learning outcomes of students. Shadrina (2013, as cited in Napitupulu & Surya, 2019) concluded from a different study that implementing a think-pair-share learning strategy increases student learning outcomes. It creates an active learning environment for all students in the classroom. According to Napitupulu and Surya (2017), TPS is a cooperative learning strategy that is considered to arouse student interest in learning, make students more active and socialize, and encourage cooperation among students in learning the material, so that it can improve student learning outcomes.

Ajiboye and Ajitoni (2008) observed that children learn best by being fully interested in their own work, seeing themselves, doing by themselves, puzzling themselves, verifying their own suppositions, experimenting themselves, and drawing their own conclusions on the strength of the evidence that they have collected themselves. They can always make mistakes that can be rectified by themselves in the light of new information and evidence that they have uncovered themselves.

This educational concept should be participatory through social interaction, togetherness, and action-oriented communication. This strategy was also proposed by Kagan: when teachers work to choose appropriate content during lesson preparation and formulation of cognitive objectives, the cooperatives that form the basis fall into this category. TPS strategy, which will help learners think by giving them time, making them more willing and less apprehensive about sharing with a larger group; it also gives them time to change their response if needed and reduces the fear of giving the wrong answer, thereby encouraging them to participate cooperatively, promote mutual learning between individuals, and ensure that each student's contributions towards work (Bamiro, 2015).

Think-pair-share is a cooperative learning strategy that includes three components: time for thinking, time for sharing with a partner, and time for the pair to share among a larger group (class). The use of the strategy bonds the cognitive and social aspects of learning, promoting the development of thinking and the construction of knowledge. The TPS strategy has many advantages over the traditional questioning structure. It allows all children to develop answers; longer and more elaborate answers can be given; and answers will have reasons and justifications because they have been thought about and discussed. Students are more willing to take risks and suggest ideas because they have already "tested" them with their partner. According to Sharma and Saarsar (2018) TPS learning strategies

used by teachers in classroom interaction help make the classroom environment interactive, lively, cooperative, and democratic. Among such cooperative learning strategy, is one that allows students to interact, process information, develop communication skills, refine their thinking, and also help them participate effectively in the classroom teaching and learning process through discussion. In this strategy, after making a various group, the teacher poses a question to the students, and they start thinking analytically on it before sharing their ideas with the whole group.

1.2 Statement of the Problem

The reality of science teaching faces many challenges in achieving educational goals which cannot be blamed wholly on the students alone, but teachers can also be held responsible because of the teaching strategy they apply during lesson delivery in various schools in Ghana. The performance of many students in higher education institutions is not encouraging due to inappropriate instructional strategies that do not allow the students to be actively involved in the teaching and learning process (Ali et al, 2013).

In Bolgatanga Central Technical Institute, students always try to consult others whenever they are called or given task to perform in the class (answer a question in class). This clearly implies that, students are not sure of their own ideas or answers that they have, whether they are correct or wrong. This has made students feel that teachers/invigilators should offer them help by providing them answers to their final examination (WASSCE). It has so many effects in some schools resulting in students rioting over school authorities' not giving them permission or helps them to answer final questions.

It was also observed by the researcher that Form Two Electrical students of Bolgatanga Central Technical Institute have difficulties understanding some concepts in integrated science from the School Performance Records (SPR) for 2019 to 2021 in Table 1 below.

Table 1, Percentages of student who fail in electrical class in integrated science

Years	No of students	Students passed	Students failed	Percentage of that students fail
2019	91	31	60	66%
2020	89	19	70	79%
2021	107	22	85	79%

Source: School Performance Record (2019-2021)

This Table has shown a massive poor performance in science in these years and the current form two students are not left out. Science in general tends to be disliked by most of these students because of the abstract nature of the concepts. There is the need for teachers to develop strategies that can make learning real and active for learners during teaching.

These situations seem to have diverse effects on the effective teaching and learning of integrated science. It is against the above observations that this research was carried out to investigate the effects of TPS strategy in Bolgatanga Central Technical Institute on students' class participation and performance in Integrated Science.

1.3 Purpose of the Study

The purpose of this research was to investigate the effect of using the TPS teaching strategy on students' academic performance in integrated science at Bolgatanga Central Technical Institute and Zamse Senior High/Technical School. It examined the students' attitude and motivation when taught science using TPS teaching strategy. The study also deterred the effect of the teaching strategy on sex in the two Senior High School students' performance in Integrated Science.

1.4 Objectives of the Study

The objectives of the study were to:

1. Examine the effect of the TPS strategy of teaching on senior high school students' academic performance in selected topics in integrated science.
2. Ascertain the influence of male and female senior high school students' academic performance when taught integrated science using the TPS method of teaching.
3. Examine students' attitude and motivation when taught integrated science using TPS teaching strategy.

1.5 Research Questions

The study sought to answer the following questions:

1. What is the effect of think-pair-share teaching strategy on senior high school students' academic performance in selected topics in integrated science?
2. What is the effect of Think-Pair-Share teaching strategy on male and female students' academic performance in selected topics among the experimental group?
3. What is students' attitude and motivation towards teaching and learning integrated science concepts by think-pair-share method of instruction?

1.6 Null hypothesis

The following hypotheses were formulated for the study:

H_{01}: There is no significant difference in academic performance of control and experimental groups of students when taught selected topics in integrated science using TPS strategy.

H_{02}: There is no significant difference in academic performance of male and female senior high school students when taught selected topics in integrated science using the TPS strategy.

1.7 Significance of the Study

Teachers' effective use of the right teaching strategy is important in achieving the educational goal of a country. Therefore, this study would be an essential tool to deter the appropriate teaching strategy that could be applied by teachers to help students understand some science concepts with ease. The study would serve as a guide for integrated science teachers and other science instructors to use appropriate teaching and learning strategies to help students understand most science concepts.

This study would also guide curriculum developers, policymakers, and other stakeholders in education and educational researchers to adapt to various teaching and learning strategies to assist students' understanding.

To the nation, using think-pair-share (TPS) teaching method would improve students' performance and interest in integrated science and increase the number of students who would go into the study of important science courses like medicine, nursing, agriculture and more. These courses of study would promote the national economic development and also increase the number of scientifically skilled and literate citizens.

Parents would also benefit from the findings of the study in that the better achievement of their ward and children would bring joy and satisfaction for their education and good certification as an assurance of better future and save their money from registration of WAEC many times.

The study might help curriculum planners to develop curriculum that would incorporate new teaching/learning innovations to facilitate the training of integrated science students in senior secondary schools.

For administrators, the result of the study would be of immense importance for organizing conferences, workshops and seminars on new innovations in teaching and learning.

It would give them a chance to think loud with others to increase their sense of participation in the teaching and learning process and include the participation of the largest number of students in the classroom to develop academic achievement and accept colleagues.

1.8 Delimitations of the Study

In this study only Form Two Electrical students of Bolgatanga Central Technical Institute were used. Also, only some selected topics in integrated science were treated in this study. There are other methods of teaching science but only TPS strategy was considered in this study.

1.9 Limitation of the Study

The illness of some students led to poor academic performance of some students because they did not benefit from the treatment. The time frame within which the research was done was a limitation to a detailed investigation. The small sample size used also limits the applicability of the results obtained to only school covered in this study and could be extended to larger populations outside the study area.

1.10 Organization of the Study

The study was organized into five chapters. Chapter one dealt with the background to the study, statement of the problem, purpose of the study, objectives of the study, research

questions, and hypothesis, significant of the study, delimitation and limitation of the study. Chapter two reviewed relevant literature related to the study, which explained the conceptual and theoretical framework. Chapter three described the methodology of the study, which included the research design, research instruments, population, sample size, data collection instruction and method of data analysis. Chapter four described the results and discussions of the study, while the summary, conclusion, and policy recommendations are presented in Chapter 5.

CHAPTER TWO

LITERATURE REVIEW

2.0 Overview

The related literature for this study was reviewed under the following sub-headings: theoretical framework, conceptual framework, and review of previous studies.

2.1 Theoretical Framework

This section reviewed related theories that underpin the think-pair-share teaching strategy employed in this study to improve students' understanding and the effect that one student has on the other.

2.1.1 Social Interaction Theory (Interaction Among Peers)

One of the most often used theories in educational psychology nowadays is the social interdependence theory. It illustrates how other people's behaviours have an impact on each person's ability to achieve their goals (Johnson & Johnson, 2010). It also describes how people's results are influenced by their own and other people's activities. These are the individual acts that encourage the accomplishment of group objectives. In addition to encouraging more frequent use of higher-order thinking and intrinsic motivation, positive interdependent think-pair-share also fosters more positive interpersonal interactions and more social support (Johnson & Johnson, 2010). Additionally, research suggests that think-pair-share instruction, as opposed to competitive or individualistic instruction, fosters more favourable attitudes toward the things being learned (Johnson & Johnson, 2010). These joint efforts' results are typically connected (Johnson & Johnson, 2010). Concerns with the assessment of interdependence are also raised by the interest in interdependence in collaborative learning. Few studies have been done regarding the quality of interaction,

including interdependence for Problem-Base-Learning (PBL) and other group learning approaches (Visschers-Pleijers 'et al., 2005). This is despite the fact that understanding the interactions within collaborative learning approaches is essential to designing and implementing them more successfully.

Johnson and Johnson (2010), developed social interdependence theory into two types: positive (cooperation) and negative (competition). Positive cooperation exists when individuals understand that they can only achieve their goals if other reaches theirs, i.e. they are inextricably linked.

In summary, social interdependence theory is demonstrated by the following features:

1. Other people's actions are substituted for one's own so that an individual recognizes that others' actions can be critical in achieving his/her own goals.
2. There is an emotional investment in achieving goals that benefit others as well as one, which builds caring and committed relationships with those with shared purposes and goals.
3. There is openness to being influenced by and to influencing others so that joint actions are more effective.

It is re-emphasized that all the above perspectives share the common assumption that knowledge must be constructed to be meaningful and this can be achieved through active involvement of a student where the student interacts with other students or even the instructor.

2.1.2 Jean Piaget Cognitive Developmental Theory

Jean Piaget is well-known for his beliefs about how our cognitive development varies from childhood to maturity (Barrouillet, 2015). A child's cognitive growth involves more than just knowledge acquisition; it also involves the creation of a mental model of the world. Children go through several phases of cognitive development, which is mediated by the interplay between innate abilities (nature) and external experiences (nurture) (Cole, 2013).

A further viewpoint on small group learning is based on Piaget's (1932) theory of socio-cognitive conflict, which occurs when children are compelled to re-examine their understandings and perspectives in the light of contradictions that occur from interacting with others. When this happens, children reflect on their own understandings, seek additional information to clarify contradictions and attempt to reconcile their perspectives and understandings to resolve any inconsistencies.

Interacting with peers is a primary impetus for change because children are very forthright when stating their ideas (Gillies & Ashman, 2003). They speak directly to each other in ways that can be understood easily, and children are strongly motivated to reconcile differences between themselves and others (Damon, 1984). Moreover, students are often more amenable to their peers' ideas than to those of their teachers because peers' ideas are seen as more personal and less threatening. From Piaget's theory, it is evident that when it comes to learning, students need to interact with their peers in order to sharpen their understanding.

This theory posits that children's cognitive development and ability to learn can be guided and regulated by their social interactions. This theory holds that learning is an important social process rather than an independent journey of discovery. He expanded on this point

by arguing that children's learning would benefit greatly from being guided by more competent adults. Teachers support learners that can take into account their understanding of concepts (Nilsson, 2014).

Figure 1 below demonstrated the order of which students learn from their colleagues in a TPS classroom.

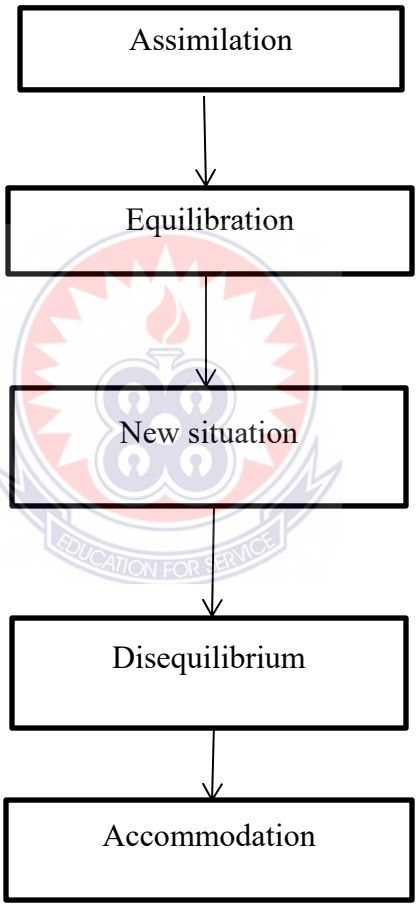


Figure 1: Piaget theory of cognitive development

2.1.2.1 Assimilation

The information gathering process of high and low achieving students is different; in high-achieving students, they have some type of mental or cognitive structure that they use to

interact with the outside world. According to Pritchard and Wollard (2010), assimilation is the acquisition and classification of new information. They have ideas, memories and information about a specific object that the child associates with. This occurs when students naturally recognize a new, familiar situation as part of their existing knowledge structure (i.e. cognitive structure) and are ready to internalize it. Schema is of primary importance in this process and it is a conceptual representation of what an individual knows (or can do) and consists of relevant discrete elements of knowledge together according to the general theme of the diagram. However, it will only be assimilated if it does not contradict that which has already been established as an integral part of what exists (Lewis & Durrant, 2011). During this process, we may need to distort new information to make it relevant. Sometimes existing schemas do not fit the incoming information, so in this case the process will be modified to take the new information into account in the adaptation process.

2.1.2.2 Equilibrium, New Situation and Disequilibrium

A state of balance between a person's mental frameworks and their environment is known as cognitive equilibrium. When their expectations, which are based on existing information, align with the new knowledge, there is a balance. According to Piaget (1932) equilibration is a continuous process that modifies and changes mental structures and forms the cornerstone of cognitive growth. Equilibration also happens when a child's schemas can assimilate the majority of incoming knowledge (Nichols, 2000). However, when new information cannot be assimilated into pre-existing schemas, an undesirable state of disequilibrium arises (Ding. 2023).

People instinctively seek balance because disequilibrium, which results from a mismatch between their mentality and their surroundings, is unsatisfying. People experience disequilibrium when they learn new contradictory knowledge. People can choose to disregard the information or make an effort to manage it in order to get back to an equilibrium condition.

Although assimilation and accommodation are both used in the on-going process of cognitive equilibration, there are some circumstances in which one of the equilibration processes is more likely to occur than the other. When a person is moving from one developmental stage to another and when new knowledge only slightly deviates from present schema, accommodation is more likely to happen. Assimilation, which comes before accommodation, is more likely to take place when new knowledge differs greatly from existing schemata. When fresh knowledge precisely matches pre-existing schema, the person is in an equilibrium state. The basis for disequilibrium and accommodation that advance people to later developmental stages and better levels of adaptation is this equilibrium condition (Brown, 2008). In order to promote cognitive development, equilibration is a regulatory mechanism that maintains a balance between assimilation and accommodation (Labouvie-Vief, 2015).

2.1.2.3 Accommodation

According to Yang (2010), accommodation is the process of altering one's internal knowledge systems to make them more consistent with the outside world. Altering existing schemas to align with contradicting data is another way to look at it. The act of accommodating new information requires modifying pre-existing schemata, or out-dated knowledge, to make room for it. Throughout this process, we update out-dated schemes or develop brand-new ones to better suit newly absorbed data (i.e., new knowledge).

Sometimes neither accommodation nor assimilation is applied. For instance, we tend to dismiss things that are highly unfamiliar to us (Woolfol et al, 2003). Wadsworth (1996) as cited in Aloqaili (2012), draws a distinction between assimilation and accommodation, arguing that the former deals with development (a qualitative change) and the latter with growth (a quantitative change); taken together, these processes account for intellectual adaptation and the evolution of intellectual structures. On the other hand, Rubin (1997 as cited in Aloqaili, 2012) asserts that, in spite of the importance of both assimilation and accommodation as a cognitive process development, children should be aware of making balance between these two processes. Therefore, balancing between assimilation and accommodation is the function of the third cognitive mechanism, which is equilibrium.

2.1.3 Vygotsky Instructional Scaffolding and Zones of Proximal Development

Lev Vygotsky was a Russian psychologist and teacher who developed a theory about how our social interactions influence our cognitive development. This is known as Vygotsky's sociocultural theory and cognitive development (Ageyev, 2003).

Vygotsky believed that learning is an active process rather than a passive one. He said that children were engaged in their own learning and discovery, but that their development happened in the context of social interaction, as opposed to independently or in isolation. He also highlighted the importance of learning that is guided by educators or teachers. Techniques used by the teacher to engage the child such as performing the task themselves as an example or providing verbal instruction, were referred to as cooperative or "collaborative" dialogue by his theory.

Myhill and Warren (2005) stated that, the process in which more competent people provide a temporary framework that supports children's thinking at a higher level than children

could manage on their own. Educational scaffolding is a method of teaching, where a more knowledgeable individual provides a framework that allows a less knowledgeable individual to be able to think at a higher level than they would have been able to think on their own. The goal is for the less knowledgeable individual to eventually be able to think at that level or complete a specific task on their own. This framework can include; demonstrating how a task is done, explaining the overall goal, and helping with the most complex parts of the task.

In general, this is how most parents teach their children throughout their lives, and this type of teaching has also been adopted into educational settings. Through scaffolding, the learner may start by requiring extensive help and then less and less support until they are able to complete the task on their own. It is vital for the more knowledgeable individual to instruct, model appropriately, and use questions to assist and to provide feedback (Sanders & Welk, 2005).

Effective teacher engages in regulated dialogue with students almost naturally. A key phenomenon of such interaction is that teachers maintain the dialogue just above the level at which the students can perform activities independently. As students learn, adults change the nature of their dialogue so that they can continue to support the child but also give the child increased responsibility for tasks (Berk, 2001).

Jerome Brunner and his colleagues view this scaffolding as interaction with peers as an effective way of developing skills and strategies. Brunner believed that when students start to learn new concepts, they need help from teachers and other adults in the form of active support. To begin with, they are dependent on the more knowledgeable adult support, but as they become more independent in their thinking and acquire new skills and knowledge, the support can be gradually faded. The learning process would begin when the child

comprehended the information, absorbed it, and then applied it to guide their own performance. The technique of scaffolding is often used in the classroom to describe ways of teaching students according to their level of ability. With this, the teacher structures the learning and then gradually reduces their role over time. In a very specific way, scaffolding represents a reduction in the many choices a child might face, so that they become focused only on acquiring the skill or knowledge that is required. The simplistic elegance of Bruner's theory means that scaffolding can be applied across all sectors, for all ages and for all topics of learning.

It is important for teachers to provide opportunities for children to constantly learn new things. Some of those may be highly complex and will require support of much focused kind. Teachers need to be aware of the developmental state of each of the students in their class, and should provide scaffolding that is appropriate.

Although this may not be possible to do on their own, teachers can improvise and provide scaffolding through other support, including the use of other adults such as teaching assistants (Para-educators) parent helpers, or more knowledgeable other children within the classroom.

As students gain in confidence and competence in particular areas, teachers might place them in groups to extend each other's learning further. It's also important that teachers recognise when a child is at the point where they begin to learn independently, and decisions can be made to set them free from the scaffolding (Hammond, 2001).

2.1.4 Development of Scaffolding

Over the last century, the concept of scaffolding has been defined, strategized, and implemented both organically and purposefully into many learning environments. Historically, scaffolding derived from the work of tutors, whose main focus was to deliver

information as well as content, to assist the learner in understanding a topic (Wood 'et al'. 1976). Child development theorists, Bandura and Vygotsky, explored this process of learning through scaffolding using two different frameworks. First, Bandura (2023), using social cognitive theories, believed that the environment was a crucial aspect in the way people learn, as we use attention, retention, repetition, and motivation to observe our surroundings, behaviours, and information in front of us. We observe learning in several types of environments: a classroom, at home, or on a playground. It is through the above mentioned learning processes that we pay particular attention to the information we observe and retain what we are interested in or what connects to us. Through repetition, the information moves from our working memory to our long-term memory, and finally, intrinsic and extrinsic motivation to succeed and achieve, allows us to push into more difficult learning scenarios (Bandura, 2023). On the other hand, Vygotsky theorized that our learning derives from exchanges we have with our own cultural groups and when we learn information, we need it to connect to our pre-existing knowledge and social experiences to make better sense of it (Vygotsky, 1980). Vygotsky believed that knowledge construction happens when the individual learner interacts with others around them. According to Vygotsky, the basis of learning is in interacting with other people with a focus on social interaction, the more knowledgeable other, and the zone of proximal development. The zone of proximal development is the difference between what a learner can do without help and what the learner can do with guidance from a more knowledgeable individual. Through guidance and collaboration, this is where students learn to build on what they already know to achieve a higher level of understanding or further knowledge (Black & Allen, 2018). This is where scaffolding comes in, as it is the process of teachers demonstrating how to solve a problem and then taking a step back and offering support

when needed. In other words, the basis of higher order learning is when a child or person interacts with someone who has more knowledge than him or her (Sanders & Welk, 2005). The learner must master tasks in stages and expand on prior knowledge with each stage progression. This is often seen from early on in development, with children from a young age being shown how to complete basic tasks from their parents or caregivers.

2.1.5 Scaffolding in the Classroom

Scaffolding is an important skill for educators to utilize within a classroom setting. Mercer (2013) argues that the best strategies for scaffolding are through appropriation of information, co-construction of information, and transformation of an individual's reasoning or understanding. Scaffolding in Learning: While these strategies are within the framework discussed; these newer strategies also tend to focus on the collaborative aspects of scaffolding, rather than the individual retention and delivery of knowledge (Mercer, 2013). Further, Black and Allen (2018) explained that the best type of information to work with when scaffolding are real-life problems, as students need to be able to relate to the information. When students collaborate with information from real-world experiences or events, they are able to engage and apply that knowledge to different scenarios and the knowledge and skills can therefore become more transferable (Black & Allen, 2018). The use of strong questioning can help the student move between zones of development (i.e., progressing from what they don't know to having said knowledge) as students begin to think about what they know, the perspective they want to take, and how to apply that knowledge to other problems or experiences (Black & Allen, 2018). It is also important to randomly assign students to different groups to work together. If students are not placed in groups with differing perspectives, it is unlikely that the questions will challenge their pre-existing way of thinking and allow them to build from their prior knowledge to transform

their learning, ultimately enhancing their ability to transfer higher level information from one environment to another (Black & Allen, 2018). As scaffolding has moved from tutoring to being integrated into classrooms, teachers and researchers have developed several strategies as to best implement a scaffold learning environment. Strategies for scaffolding range from the process of implementation to the specific content, to reflection, and to questioning afterwards.

Alongside the empirical studies analysing the interactional makeup of scaffolding, there were a number of new approaches to teaching and learning that included scaffolding as a teaching point, which in turn contributed to expanding its definition. It is important to point out that scaffolding, at times, assumes different names, which perhaps serves as evidence of a loosening of the metaphorical term.

Reciprocal Teaching: An early contribution to the definition of scaffolding was found in Palincsar and Brown's (1984) development and study of reciprocal teaching with seventh-grade students struggling with reading comprehension. Reciprocal teaching involved a dialogue between teacher and learner wherein the teacher modelled skills while reading a text, such as asking questions and rephrasing; the learner gradually took on greater responsibility for controlling the collaboration, eventually assuming the role of teacher. In this seminal study, each learner was paired with a teacher, and the teacher, while reading with the student; scaffold the use of the strategies the learner could use to improve his or her comprehension of texts. The scaffolding techniques used by the teacher were rephrasing and elaborating on statements made by the learners, and asking questions. Although no entirely new characteristics were added to scaffolding, the study presented transcriptions of teacher-learner interaction, providing evidence that teacher scaffolding led to increased learner participation and eventual mastery of these strategies. Also, the study

showed, in real time, how scaffolding was gradually taken away when it was no longer needed.

Instructional scaffolding: At approximately the same time as the publication of Palinscar and Brown's (1984) work on reciprocal teaching, instructional scaffolding for teaching reading and writing (Applebee & Langer, 1983) proposed tailoring scaffolding to fit the needs of a whole class, a major leap in the use of scaffolding. Grounding their work in sociocultural theory, Applebee and Langer focused on integrating individual development and the social environment of the classroom. Building on the six characteristics of scaffolding proposed in Wood 'et al'. (1976), they suggested that in addition to guiding learners in grasping novel concepts or skills, teachers should encourage learners to complete those elements of a task which were within their range of competence Applebee and Langer (1983) suggested that working within the range of a learners' competence helped locate the lower end of a learner's ZPD. Applebee and Langer (1983) search for an effective reading and writing instructional model that incorporated scaffolding in this way led to their model of instructional scaffolding (also called instructional dialogue). It included the following five characteristics:

(1) Ownership, or giving the learner a voice and a sense of purposefulness in relation to the task;

(2) Appropriateness through building tasks based on the learners' current knowledge, while at the same time providing guidance aimed at stretching that knowledge;

(3) Structure, by presenting tasks in a context of supportive dialogue that provided a natural sequence of thought and language (Halliday, 1975), as well as by suggesting effective routines for learners to internalize;

(4) Collaboration via building on and recasting student efforts through telling, modelling, questioning, rephrasing, extending, praising, and correcting;

(5) Internalization, or gradually moving control of the interaction from teacher to student, after which the scaffolding self-destructed.

Of these characteristics, ownership, originally called intentionality (Applebee & Langer, 1983) emphasized the contribution of the learner to the dialogic interaction that took place during scaffolding. Applebee and Langer also provided a list of techniques for promoting collaboration, and they explicitly included the self-destruction of the scaffolding in their version of internalization (what Vyogotsky termed appropriation).

Assisted performance: this type of scaffolding formed an integral part of (Tharp & Gallimore, 2014) theory of education, and their proposal to reconstitute schools as educating societies. An important detail was to suggest that the ZPD was not only important to child development, but also to the learning and developmental processes of older children and adults. Basing their work in Vygotskian sociocultural theory and, in particular, the construct of the ZPD, they focused on realizing work within the ZPD. Tharp and Gallimore (2014), also highlighted the difficulty of learning to do this type of work effectively, and called for its inclusion in teacher training programs. This was the first acknowledgement that scaffolding required specialized training. Tharp and Gallimore (2014) assisted performance included six characteristics and was suggested for use with individual learners, small groups, and whole classes. Although their data focused on elementary school contexts, the six means of assisting performance were also considered appropriate for older learners: modelling, contingency management, feeding back, instructing, questioning, and cognitive structuring. Of these, giving praise and encouragement, briefly mentioned, as techniques of contingency management, and feeding

back in the form of both planned and spontaneous assessment, were additions to the definition of scaffolding. These features and techniques had perhaps been implied in previous definitions, but had not been explicitly stated. Importantly, peer assistance was also recognized as constituting assisted performance. Later, this idea was further developed as collective scaffolding in numerous studies (Howe & Mercer, 2007).

Guided Participation: Rogoff's work on children's cognitive development (Rogoff, 1990, 1995) represented a major contribution to shaping the definition of scaffolding. Guided participation was meant to include not only verbal interaction between humans, but also non-verbal interaction through the use of gaze, hesitation, and postural changes. Guidance involved learner interaction with materials and fellow participants in the classroom, but also the specific social and cultural values offered to the learner outside the classroom. This greatly expanded upon what was originally presented as scaffolding by Wood et al., and adhered to the sociocultural and socio-historical aspects of Vygotskian theory of learning and development. Although broadening the scope of scaffolding in this way was perhaps implied in previous descriptions and definitions of the metaphor, it was stated explicitly, perhaps for the first time, in Rogoff's work. The collaborative work performed during guided participation led to what Rogoff termed participatory appropriation, with its heavy emphasis on the role both participation and creativity played in interaction. She also highlighted the work of the adult as requiring constant adjustments to the structuring and pacing of instruction. In fact, the adult and child jointly co-constructed activity, and both played an active role in structuring and pacing instruction. Expert and novice worked collaboratively, Rogoff stated, and in another direct reference to Vygotksian thought, she claimed were both changed through their collaborative interaction. Perhaps due to the numerous additions to both the substance and scope of scaffolding in teaching/learning

approaches, the definition and interpretation of scaffolding generated confusion for educators. Although scaffolding had become a buzzword by the late 1990s, its exact definition and real-time implementation had become fuzzy, having lost the simplicity of its original six features. In the following section, I will document an attempt to refine and streamline the metaphor in the late 1990s.

2.1.5.1 Modelling

In real science learning environments, there are many strategies for modelling. Liew (2004) developed a teaching strategy called (Prediction, Observation, and Explanation) POE. Students in the TPS classroom predicted/provided answers to questions that the teacher asked in class. After that, students explained their answers to colleague students next to him/she during the sharing process. The teacher could help students challenge their preconceptions by arranging a cognitive conflict or demonstration.

Harrison and Treagust (2000) found that it was difficult for students to build a new model and use it. They thought teachers should plan for students' modelling before learning. They proposed (Focus, Action, and Reflection) FAR, a teaching model to help teachers. Focus involves pre-lesson planning where the teacher focuses on the concept's difficulty, the students' prior knowledge and ability, and the analogical model's familiarity. Action deals with the in-lesson presentation of the familiar analogy or model and stresses the need for the teacher and students to cooperatively map the shared and unshared attributes. Reflection is the post-lesson evaluation of the analogy's or model's effectiveness and identifies qualifications necessary for subsequent lessons or modifications the next time the analogy or model is used. Clement (2000) proposed a framework for model-based learning. The framework connects concepts such as an expert consensus model, target model, intermediate models, preconceptions, learning processes, and natural reasoning skills. By

connecting and elaborating on these major areas, Clement (2000) succeeded in moving people another step towards having a theory of conceptual change that can provide guidance to teachers in the form of instructional principles. Taken together, Clement (2000) reminded people that individual cognition, while not the only factor in learning, is a central determining feature of learning.

Schwarz et al. (2009) proposed a definition of scientific modelling that included the elements of the practice (constructing, using, evaluating, and revising scientific models) and the meta-knowledge that guides and motivates the practice (e.g., understanding the nature and purpose of models). They designed a learning progression for scientific modelling that includes two dimensions that combine meta-knowledge and elements of practice. Scientific models are used as tools for predicting and explaining, and models change as understanding improves. They stressed modelling practice as the interaction of the elements of practice and meta-modelling knowledge. The two types of goals-sense-making and communication understanding-emerge from the use of the practice elements and meta-modelling knowledge.

Vosniadou (2007) argued that teaching for conceptual change should utilize but not solely rely on cognitive apprenticeship types of methods. Attention must be paid to the appropriate design of curricula and the acquisition of subject matter knowledge, together with the development of instructional methods that utilize socio-cultural processes, like classroom discussion, to develop students' meta-conceptual awareness and the ability to engage in intentional learning. These papers about model teaching have three characteristics: first, the teachers should take into account the preconceptions of students and lead students' learning on the basis of those preconceptions; second, analogy is a key to modelling. The teacher should use analogies well when helping students model; and

third, more attention should be paid to the reaction between the mental model and the information in the external world. Discussing, reflecting, sharing one's opinion, and applying concepts will help students clarify and strengthen their concepts. The instruction design is based on these three characteristics in this study and attempts to help students and teachers in the science classroom learn and teach position concepts more efficiently.

In the teaching and learning process, students observed colleagues by listening and imitation of answers to questions from other students during explanations.

2.1.5.2 Building Schema

Take advantage of what your students already know. Scaffold your instruction by reminding your students what they have learned and helping them fit new information into their brains by finding out what they already know about concepts you haven't taught yet. Prior knowledge also includes a student's personal experiences and areas of expertise. Rather than ignoring differences between your students in an effort to level the playing field, draw on each set of unique knowledge to teach the whole class. Encourage students to connect learning to their own lives and share these connections with others.

In the TPS classroom, students assist others by break new material down into bite-sized pieces and check in with students often. Scaffold instruction should resemble a staircase where every new concept has its own stair. Rather than delivering complicated content all at once and testing for understanding at the end, give challenging concepts their own room to breathe and assess student progress as it is happening. Ask questions to make sure all students understand before taking another step together.

One of the defining features of scaffold instruction is student-directed learning. Scaffolding emphasizes the importance of equipping students with tools that allow them to guide each

other in the learning process and giving them plenty of space to practice using the ideas they acquire others students. Scaffolding makes the journey just as important as the destination. Give students strategies rather than answers. Encourage them to practice asking their own questions, making predictions, and drawing conclusions and teach them that it's okay when they are wrong. Scaffolding allows students to take charge so that they are prepared to approach any problem, not just the one right in front of them.

2.1.5.3 Coaching

Coaching is a process that enables teaching and learning to occur and thus improve performance. To be students, a teacher requires knowledge and understanding of the process as well as the variety of styles, skills, and techniques that are appropriate to the context in which the teaching and learning takes place. Coaching had gained a reputation as an effective means of developing one's capabilities and improving one's performance. Then, from these standard definitions, we can define coaching as a professional partnership between students based on enhancing their shared ideas and encouraged individuals to increase their academic competency.

Education holds a clear affinity for coaching as a method for improving teacher practice and learner outcomes. Coaching is also included as an aspect of effective implementation across various fields, including education (Fixsen et al, 2005). Drawing from this research, coaching has been suggested as a strategy for improving teaching and learning across all systems (Sugai & Horner, 2006), a variety of educational organizations and technical assistance. Although less is known about the degree to which coaching can transform students' practices within an entire system as well as the practice of networks to embraced coaching for this purpose?

2.1.6 Zones of Proximal Development

A central construct of Vygotsky's theory is the Zone of Proximal Development. According to Vygotsky (1978), the concept that each person has an individual range of potential for learning is what is referred in the theory as the Zone of Proximal Development (ZPD).

The concept of the zone of proximal development, also known as the zone of potential development, is used to explain a child's potential for cognitive development and ability when they are guided through a task rather than asked to do it in isolation. If a child is presented with a task that is slightly above their ability level, the zone of proximal development refers to their ability to do it with the assistance of a more knowledgeable person. In this study, students are paired based on the mixed abilities and skills so that they can learn from themselves. This theory also explains why skills present themselves in a more social context when the child is unable to display them by themselves.

With these characteristics of Vygotsky's (1978) theory, cooperative learning such as think-pair-share is appropriate to implement the theory. All students also have a place in Vygotsky's (1978) theory. Since attention is an elementary mental function in every individual therefore learners can be developed by more knowledgeable others within the zone of proximal development in their peer groups. Students' attention development will help their sensation, which in turn develop their perception of learning and boost their memory and recall. The principle of More Knowledgeable Others informs the teacher that the group of students should be heterogeneous in nature, i.e. brilliant students should be mixed with the dull ones in the same group to help the academic growth of the dull ones. When the dull ones stray from right approach to a concept, they will be put through by the more knowledgeable ones in the group.

Vygotsky's (1978) theory also feed into the current interest in think-pair-share learning, suggesting that group members should have different levels of ability so that more advanced peers can help less advanced members operate with their ZPD.

The zone of proximal development can be described as the distance between the actual development level when assessed independently and the level of potential development when assessed in collaboration with peers, mentors, or under the guidance of a teacher.

The zone of proximal development can be divided into three distinct stages in terms of a learner's skillset.

1. Tasks a learner can accomplish without assistance
2. Tasks a learner can accomplish with assistance
3. Tasks a learner cannot accomplish with assistance

This study will focus on the task that learners can do with assistance, it referred a stage where learners need the guidance of a more knowledgeable person to help them complete a task. This theory places the importance on guiding children's learning through their interaction with a more knowledgeable adult. The more knowledgeable other could be anyone with a greater understanding of the concept that the child is trying to complete or learn. The theory is not limited to academic or educational learning; it can also be applied to recreational learning such as playing games or using technology. A more knowledgeable other could also be an electronic tutor in cases where a program is set to guide learning using voice prompts or videos. The theory places importance on guiding children's learning through their interaction with a more knowledgeable adult.

2.1.7 Behavioural Learning Theory

This is a popular theory that explains how students learn. It focuses on the idea that all behaviours are learned through interaction with the environment. This learning theory states that behaviours are learned from the environment and that innate or inherited factors have very little influence on behaviour (Staddon, 2016).

In a TPS classroom, the behavioural learning theory is key to understand how to motivate and help students. Information is transferred from the teacher to the learners through a response to the right stimulus. Students are passive participants in behavioural learning-teachers give them information as an element of stimulus response. Teachers use behaviourism to show students how they should react to certain stimuli. This needs to be done in a repetitive way to regularly remind students what behaviour a teacher is looking for (Porter, 2014).

Behavioural learning can be divided into two categories, such as:

2.1.7.1 Positive Reinforcement

It refers to the introduction of a desirable or pleasant stimulus after behaviour. The desirable stimulus reinforces the behaviour, making it more likely that the behaviour will recur. It's a positive teaching strategy used for a variety of purposes and in a wide range of contexts, as it capitalizes on the good behaviours that are already being displayed, rewarding the natural tendencies towards good behaviour in the individual you are going to train.

Johnston (2016) agreed positive reinforcement is a key component of the behavioural learning theory. Without positive reinforcement, students will quickly abandon their responses because they don't appear to be working. Repetition and positive reinforcement go hand in hand with the behavioural learning theory. Teachers often work to strike the

right balance between repeating the situation and providing positive reinforcement to show students why they should continue that behaviour (Graham, 2008). Students with good conceptual understanding provide a positive reinforcement to the weaker ones elicit their understanding.

2.1.7.2 Negative Reinforcement

This occurs when something unpleasant or uncomfortable is removed or taken away in order to increase the likelihood of the desirable behaviour occurring.

According to Skinner (2014) a negative reinforcement, an unpleasant event that precedes behaviour is removed when the desired behaviour occurs. This procedure increases the likelihood that the desired behaviour will occur. Just as there are positive reinforces, there are the stimuli that strengthen responses that permit an organism to avoid or escape from their presence. Thus, when we perform an action that allows us to escape from a negative reinforce that is already present or to avoid the threatened application of one, our tendency to perform this action in the future increases. Some negative reinforces such as intense heat, extreme cold, or electric shock, exert their effects the first time they are encountered, whereas others acquire their impact through repeated association (Berkowitz, 1993). We see negative reinforcement in schools and in personal life. Teachers apply negative reinforcement when they stop criticizing students whose poor performance has improved. By withholding the criticism, students are more likely to repeat behaviours that enhance their performance. Thus, both positive and negative reinforcement are procedures that strengthen or increase behaviour. Positive reinforcement strengthens and increase behaviour by the presentation of desirable consequences. Negative reinforcement strengthens and increases behaviour by the threat of and the use of an undesirable consequence or the termination or withdrawal of an undesirable consequence (Koob, 2021).

Negative reinforcement is sometimes confused with punishment, because both use unpleasant stimuli to influence behaviour. However, negative reinforcement is used to increase the frequency of a desired behaviour, where as punishment is used to decrease the frequency of an undesired behaviour.

2.1.8 Bandura Social Learning Theory

Bandura's Social Learning Theory of Personality is based on the premise that human behaviour is largely acquired and that the principles of learning are sufficient to account for the development and maintenance of behaviour Bandura, (2001). Bandura is seen by many as a cognitive psychologist because of his focus on motivational factors and self-regulatory mechanisms that contribute to a person's behaviour, rather than just environmental factors. This focus on cognition is what differentiates social cognitive theory from Skinner's purely behaviouristic viewpoint.

According to Bandura (1976), a majority of what we learn in an academic environment is learned through observing and interacting with others.

This is illustrated by the reciprocal influence of environment, personal characteristics, and behaviour as depicted in Figure 2.

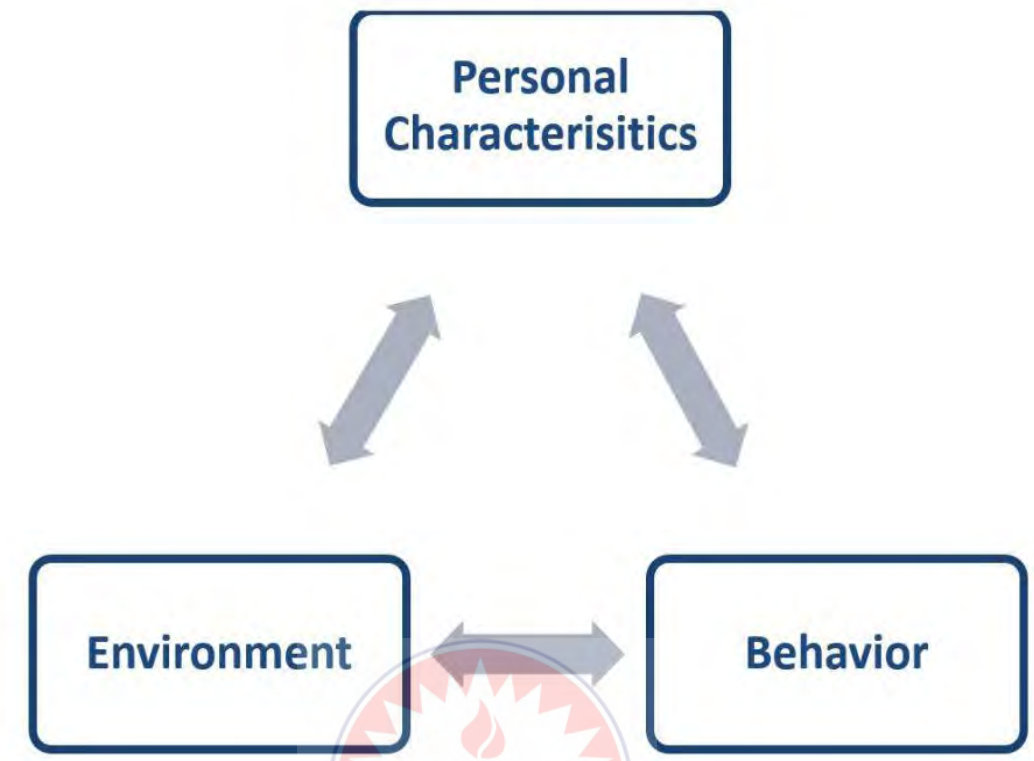


Figure 2: Bandura Social Learning Theory

Environment is both the physical setting (e.g., classroom, library, home) and the elements within the setting with which the individual observes or cognitively interacts. For example, elements of the environment could be teachers and their comments, other students and their comments, library collections, computer programs, or research assignments. Personal characteristics are the cognitive and affective characteristics that each individual brings with them to the learning environment. These include previous content knowledge, literacy skills, self-efficacy beliefs, motivational levels, attitudes, values, and emotions. Behaviour includes the observable performances of the individual. Observable behaviours include academic performance, social and interpersonal interactions, and level of effort (Wagner &

Ruch, 2015). Each of these three components mutually influences one another in a reciprocal manner.

Bandura theory of social learning can also be explained under the following three headings:

2.1.8.1 Reciprocal Determinism

Human behaviour has often been explained in terms of one-sided determinism. In such modes of unidirectional causation, behaviour is depicted as being shaped and controlled either by environmental influences or by internal dispositions. Social cognitive theory favours a model of causation involving triadic reciprocal determinism (Boateng, et al 2016). In this model of reciprortal causation, behaviour, cognition and other personal factors, and other environmental influences all operate as interacting determinants that influence each other bidirectional. Reciprocal causation does not mean that the different sources of influence are of equal strength. It takes time for a causal factor to exert its influence and activate reciprocal influences.

The Guided Reciprocal Peer Questioning method teaches students how to write effective group discussion questions based on course readings or lectures, and then use those questions to collaboratively help everyone in the group gain deep and broad understanding. The central element to the method is to provide prompts designed to elicit questions that solicit high-level cognitive processing. After reading or listening to lectures, students create higher-order application, analysis, synthesis, and evaluation questions built upon generic question stems provided by the instructor, such as: (How would you use . . . to . . ?, What would happen if …? What are the strengths and weaknesses of …? How does … tie in with what we learned before? Explain why . . . Explain how …)

2.1.8.2 Self-System

It is evident from the reciprocal determinism that all the three segments are mutually interactive. Now the question arise that do they have some starting point? Bandura answered in yes and that point is self-system. “In social learning theory, a self-system is not a psychic agent that controls behaviour. Rather it refers to cognitive structures that provide reference mechanisms to set of functions for perception, evaluation and regulation of behaviour”. An understanding of self-generated influences subsumed in the self-system is necessary for the explanation and prediction of human behaviour (Ainley, 2012). According to Bandura (2001) the three component processes involved in self-regulation of behaviour through the activation of self-prescribed contingencies (Bandura, 1976). The three components involved in self-system are self-observation, judgmental processes and self –response.

1) Self-observation: We look at ourselves, our behaviour, and keep tabs on it.

2) Judgment: We compare what we see with a standard. Like I will read a book in a week or we can compete with others, or with ourselves.

3) Self-response: If you did well in comparison with your standard, you give yourself rewarding self-responses. If you did poorly, you give yourself punishing self-responses. These self-responses can range from the obvious to the more covert (feelings of pride or shame).

4) Self efficacy: A very important concept in psychology that can be understood well with self-regulation is self-efficacy. If, over the years, you find yourself meeting your standards and life loaded with self-praise and self-reward, you will have a strong sense of self-efficacy If, on the other hand, you find yourself forever failing to meet your standards and

punishing yourself, you will have a poor sense of self-efficacy. Self-efficacy plays an important role in the Bandura's theory of self-system.

According to Bandura (1994) self-efficacy is the belief in one's capabilities to organise and execute the courses of action required to manage prospective situations. In other words, self-efficacy is a person's belief in his or her ability to succeed in a particular situation. Bandura described these beliefs as determinants of how people think, behave, and feel. Since Bandura published his seminal paper, Self-Efficacy: Toward a Unifying Theory of Behavioural Change, the subject has become one of the most studied topics in psychology. Why has self-efficacy become such an important topic among psychologists and educators? As Bandura and other researchers have demonstrated, self-efficacy can have an impact on everything from psychological states to behaviour to motivation.

The Role of Self-Efficacy Virtually all people can identify goals they want to accomplish, things they would like to change, and things they would like to achieve. However, most people also realise that putting these plans into action is not quite so simple. Bandura and others have found that an individual's self-efficacy plays a major role in how goals, tasks, and challenges are approached. People with a strong sense of self-efficacy have the following characteristics (Bandura, 2013):

2.1.8.3 Principles of Observational

Bandura's social-cognitive approach represents a break from traditional theories by proposing that cognitive factors are central to human functioning and that learning can occur in the absence of direct reinforcement. That is, learning can occur simply through observation of models and in the absence of reinforcement. Bandura (2013) argued that some of the traditional principles of learning such as the laws of reinforcement and punishment are more relevant to performance than to acquisition. According to Bandura

(2023), learning can occur outside the boundaries of pleasure and pain. Thus, people learn a great deal simply by watching or observing others, by reading about what people do, and by making general observations of the world. This learning may or may not be demonstrated in the form of behaviour.

To illustrate that people learn from watching others, Albert Bandura constructed an experiment entitled "Bobo Doll Behaviour: A Study of Aggression." In this experiment Bandura exposed a group of children to a video, featuring violent and aggressive actions. For the experiment Bandura made of film of one of his students, a young woman, essentially beating up a bobo doll. Bobo doll is an inflatable, egg-shape balloon creature with a weight in the bottom that makes it bob back up when you knock him down. The woman punched the clown, shouting "sockeroo!" She kicked it, sat on it, hit with a little hammer, and so on, shouting various aggressive phrases. Bandura showed this film to groups of kindergartners who, as you might predict, liked it a lot. They then were let out to play. In the play room, of course, were several observers with pens and clipboards in hand, a brand new bobo doll, and a few little hammers. The observers recorded that a lot of little kids beat the daylights out of the bobo doll. They punched it and shouted "sockeroo," kicked it, sat on it, hit it with the little hammers, and so on. In other words, they imitated the young lady in the film, and quite precisely at that. This might seem like a real nothing of an experiment at first, but consider: These children changed their behaviour without first being rewarded for approximations to that behaviour! And while that may not seem extraordinary to the average parent, teacher, or casual observer of children, it didn't fit so well with standard behaviouristic learning theory. Bandura called this phenomenon as observational learning or modelling, and this theory is usually called social learning theory.

Attention processes is when individual does not pay attention to the activities she/he will take as a model and perceive correctly, observational learning does not occur. According to Social Learning Theory, three basic factors that affect learning in this process are the qualities of the observer, the qualities of the observed model and the qualities of the observed behaviour (Albert, 2017). The process of paying attention is affected by physical qualities of the perceiver (the capacity of perceiving, state of tendency, preference and emotional state), purpose of the observer, past reinforcement experiences; functional value of the model (simple, clear, interesting and functional); the qualities of the model such as age, gender, character, similarity and status.

In order to learn, you need to be paying attention. Anything that detracts your attention is going to have a negative effect on observational learning. If the model is interesting or there is a novel aspect to the situation, you are far more likely to dedicate your full attention to teach (Keller, 2009). Thus if you are going to learn anything, you have to be paying attention. Likewise, anything that put off a damper on attention, is going to decrease learning, including observational learning. If, for example, you are sleepy, groggy, drugged, sick, nervous, or "hyper," you will learn less well. Some of the things that influence attention involve characteristics of the model. If the model is colourful and dramatic, for example, we pay more attention. If the model is attractive, or prestigious, or appears to be particularly competent, we will pay more attention. And if the model seems more like ourselves, we will pay more attention.

The process of retention is also called "the process of bearing in mind." Making use of the information acquired through observation requires remembering this information. The observed information is symbolized and coded and then kept in memory (Eyyam et al, 2016). While coding may be limited to the observed behaviour, it may also include why,

how and when behaviour is displayed. According to Bandura, most of the cognitive processes that organize behaviour are mostly verbal rather than visual. Fictitiously and verbally stored information should be repeated mentally or implemented after observation.

The ability to store information is also an important part of the learning process. Retention can be affected by a number of factors, but the ability to pull up information later and act on it is vital to observational learning (Anusha & SwethaReddy, 2015). Thus, you must be able to retain and remember what you have paid attention to. This is where imagery and language come in. We store what we have seen the model doing in the form of mental images or verbal descriptions.

This reproduction process is the step that determines turning what is learned into performance. It is necessary for the individual to have appropriate physical and psychomotor qualities, and the individual should possess enough wishful thinking, belief in success, and self-sufficiency capacity in order to have cognitive learning turn into behaviour. It is necessary to do the behaviour mentally at first, and mistakes should be corrected if there are any. This process should continue until behaviour becomes similar to the model's behaviour.

Once you have paid attention to the model and retained the information, it is time to actually perform the behaviour you observed. Further practice of the learned behaviour leads to improvement and skill advancement. Through the reproduction processes you have to translate the images or descriptions into actual behaviour. So you have to have the ability to reproduce the behaviour in the first place. Another important thing about reproduction is that our ability to imitate improves with practice at the behaviours involved. And also, it has been noted that our abilities improve even when we just imagine ourselves performing!

Many athletes, for example, imagine their performance in their mind's eye prior to actually performing.

Alderman (2013) stated that motivation is a process that helps what is learned turn into performance. At the end of the observed behaviour, the reaction given to the individual who is taken as a model is also influential in the observing individual's decision-making about displaying the same behaviour or not. If the individual who is taken as a model is rewarded at the end of the observed behaviour, this motivates the individual who is observing. However, if the observed behaviour damages or results in punishment, the observing individual avoids this behaviour.

And yet, with all this, you're still not going to do anything unless you are motivated to imitate that is, until you have some reason for doing it. Hence, in order for observational learning to occur and be successful, you have to be motivated to imitate the behaviour that has been modelled. Reinforcement and punishment play an important role in motivation. While experiencing these motivators can be highly effective, one can also observe other experiences, such as some type of reinforcement or punishment that others are being subjected to. For example, if you see another student rewarded with extra credit for coming to class on time, you might start to show up a few minutes early each day.

2.2 Conceptual Framework

Science teachers at all level generally agree that the teaching and learning of science concepts must expose students thinking scientifically help students to solve scientific problem and also provide applicable scientific knowledge and skills fit well in the scientific world.

Therefore, for learners to participate fully in chemistry, with excitement, full understanding and apply it in their daily lives there is the need for good teaching strategies. These

strategies are the type that should involve full participation of the learner. This point of view makes instructional strategies fundamental to any effective instruction. Teaching approach used by a teacher is very important to the success of learning. As a result teachers employ varying teaching strategies to accomplish their educational objective since no one method of instruction will work all of the time and under every circumstance.

It is however, important to note that the traditional or teacher centred strategy could be regarded as the hitherto existing conventional method of instruction in the normal classroom setting. There exists several of such conventional method which has permeated our educational system over the years. It generally makes a specific teaching method student centred is the ability to involve students actively in the teaching process.

The schema figure 3 below shows the conceptual framework on the effects of think-pair-share instructional strategy on students' achievements and interests in science.

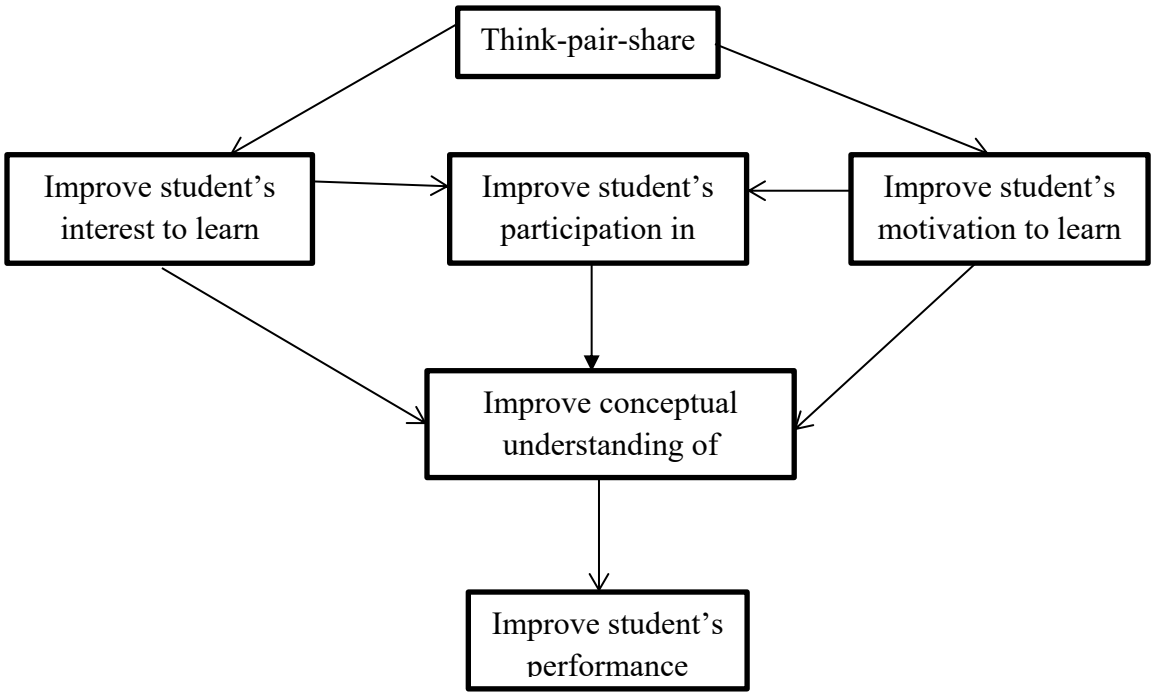


Figure3: Conceptual Framework of the Study

2.2.1 The Interest and Motivation of Students to Learn Science Using TPS

In the teaching and learning process, the selection of the appropriate strategy is important in determining the success of the process (Ahmed, 2023). The appropriate strategy can generate the students' interest and motivation to learn science. In this case, the teacher has the responsibility to make the students interested and motivated in the learning process. The teacher has to use a suitable teaching strategy to teach in order to make the students enjoy the learning and easy to understand the materials.

Conceptual understanding improves by sharing with a partner in an appropriate time. TPS is the perfect way to get students back on track and back to the task. It allows them to think about new concepts, processes, opinions, or observations without interruptions or distractions. It helps students understand what they know and need, increasing engagement levels during lessons.

It also improves their communication skills of by reflecting their knowledge and experiences in class room (Abulibdeh, 2013). Learning occurs better in peers through communication and collaboration. TPS creates the background for interaction which is a prerequisite of concept understanding and retention. When students work in partners, they may feel more confident to express their ideas and more open to feedback than directly sharing opinions or observations with the whole class. It provides the validation they need to speak out in front of the entire class. In general, the most active and confident students take over most classroom discussions, but TPS allows everyone to be involved and feel included during lesson delivery? Students like to experience new ways of learning and manifest more curiosity and engagement as a result.

Some students may have good ideas but feel too scared or intimidated to share them. By utilizing the think-pair-share strategy, your shy or quiet students will be persuaded to share their taught on a more intimate level in pairs before going to a whole class with their views. By sharing with one another first, the shy students will have a chance to see that their ideas aren't wrong and may have less anxiety about delivering them to the group.

Understanding is the uptake of a material being studied. If the student has understood concepts, it will facilitate the mechanics techniques in studying the concepts of the next more complex (Baser, 2006). If the students can understand the concepts very well, it is expected that students are able to master the ability of reasoning, problem solving and communication. One learner to do is cooperative learning Think Pair Share. The steps of cooperative learning Think Pair Share is Thing king, Pairing, and Sharing.

2.2.2 Think Pair Share Teaching Strategy Criteria

Think-pair-share (TPS) is a modern teaching strategy that aims to provide students with success by stimulating their energies and developing their abilities. It is also suitable for

students of all ages and those engaging in cooperative learning for the first time (Ahmed, 2016). Think-pair-share (TPS) consists of three steps including period of thinking, sharing ideas with fellow and finally expressing views in front of class (Schoolcraft, 2015). The time given for "thinking" integrates the conceptual thoughts regarding the subject matter.

2.2.2.1 Think

The teacher provokes students' thinking with a question, prompt, or observation. This strategy started when the teacher posed an exciting question that made students think about a solution to the question that related to the topic of the lesson. The students should take a few moments to think about the question alone to resolve the issue or problem at hand on their own first, and much time should not waste for that. The time is determined for individual reflection on the basis of the students' knowledge, the nature of the question, and the degree of complexity. The teacher can participate with each pair of students to facilitate their thinking and come up with the answer, which will save time and effort for the teacher (Salah, 2021).

2.2.2.2 Pair

Using designated partners, nearby neighbours, or a desk mate, the pairing is done with high and low performing students are pair up to discuss their understanding of the task given to them. In general, typical students should be paired with students who are bit above-average thinkers, and higher students should be paired with other students who are capable of higher-level thinking. Integrated Science Student Learning (ISSL) students should be paired with a student with grade-level/average vocabulary. They compare their mental or written notes and identify answers they think are the best, most convincing, or most unique and finally they achieve same set of views regarding to the topic. Flexible grouping allows teachers to call students from centres based on the students' interests and needs,

recognizing that as these needs change, so do the grouping arrangements. Teachers can then plan for and adjust to variations in students' progress; as students are often different points on the continuum of literacy development.

2.2.2.3 Share

After students discuss in pairs for a few moments, the teacher calls one student from each pairs to share their views with the rest of the class. The teacher can do this by going around and calling on each pair to take answers as they are called out (or as hands are raised). Often, the teacher or a designated helper will record these responses on the board or on the recording sheet. As you listen to students talking to their partners, provide feedback and clarify misunderstandings that students may have (by asking simplifying questions, as appropriate). At the end of the students' discussion time, choose a few students who seem to have mastered the concept and have made good connections, and ask them to share their thoughts and responses with the entire class.

Think-pair-share was developed by Frank Lyman of the University of Maryland in 1981 (Lyman, 1981). Success for all Appiah (2022) affirmed that think-pair-share is a questioning technique that is used to keep all the students actively involved in class discussions and provides an opportunity for everyone to share an idea and answer to every question posed by the teacher. Think-pair-share is a cooperative learning strategy that aims at promoting reading comprehension skills (Carss, 2007). Allen (2014) ascertained that the think-pair-share strategy is designed to differentiate instruction by providing students time and structure for thinking on a given topic, question or problem, helping them to construct individual ideas and share these ideas with at least one other student. The operational definition of think-pair-share is thus a co-operative teaching strategy that includes four

components: time for teacher to pose a question, time for students to think, time for sharing in pairs and time for each pair to share back to the whole class.

According Abdulrahman (2015), think-pair-share is a strategy designed to provide students to think on a given topic by enabling them to formulate individual ideas and share the ideas with another student. To implement the think-pair-share cooperative strategy, the teacher poses a question, preferably one demanding analysis, evaluation, or synthesis, and gives students about one minute to think through the appropriate responses to the teacher's questions in the teaching and learning process. Students then turn to a partner and share their responses with others. During the third step, student's responses can be shared within a four-person learning team, within a larger group, or with an entire class during a follow-up discussion.

In using think-pair-share, it is affirmed that teacher should give clear guidelines to every student and ensures that roles are clearly defined before the activity begins. First, teachers ask the class a question about a concept, issue or a problem. Then the think-pair-share strategy follows three procedures:

a. **Time for thinking:** After the teacher asks the class a question, the teacher pauses for about one minute (depending on the complexity or technicality of the question) to allow students to think about their answers individually and independently.

b. **Time for each pair to share back to the whole class**: The teacher gathers the students back together as a class. Then one person may be randomly selected from each pair to share the pair's answer with the class or few students may be randomly selected if the class size is large. Another way is to have all pairs stand, and after each representative shares with the whole class, the representative would sit down alongside any student with similar ideas and answers. This continues until everyone is seated.

c. **Time for sharing with a partner**: Students are divided into pairs. Then students share their ideas about the answer with their partner for about four minutes.

Of course, some of the representatives may get the answer, some may not get it correctly; some may not be able to adequately and competently present what they have already discussed with their pairs, while some pairs will only come out with a tentative answer. This is why in cooperative learning, the teacher is called a coach or a facilitator, to harmonise the various answers given by the representatives. The teachers will not say a particular answer is right or wrong but they would use their wealth of knowledge and skills, creativity, initiative and resourcefulness to sieve out the chaff from the wheat. In addition, think-pair-share cooperative strategy breaks up the lesson to give the student time to reflect on challenging contents; it allows students to negotiate meaning with each other or discuss their proposed solution; and the strategy also provides a diagnostic point for teachers to ensure students are on track.

2.2.3 Think-Pair-Share Teaching Strategy

This is a cooperative learning strategy, which is a student-directed, instructor-facilitated instructional strategy in which two or a pair of students are responsible for their own learning and the learning of all class members. In the think-pair-share teaching strategy, students interact with each other in many ways, including:

2.2.3.1 Peer Assisted Learning (PAL)

According to Topping and Ehly (1998, cited in Wadoodi & Crosby, 2002), Problem Assisted Learning (PAL) is defined as the acquisition of knowledge and skill through active help and support among status equals or matched companions. PAL is essentially about peer learning and individual development. Glynn (2006) argue that pairing low and high performing SHS students provides psychological support and aids professional and

personal development. This enhances the knowledge and skills of individuals during PAL sessions. Capstick et al. (2004) confirm that PAL sessions are intended to offer a safe, friendly place to help students adjust to school life faster, improve their study habits, acquire a clear view of course direction and clear expectations, and enhance their understandings of the subject matter of their study through group discussion and interaction. Capstick et al. (2004) posit that PAL may be defined as a scheme for learning support and enhancement that enables students to work cooperatively under the guidance of senior students.

Donelan (1999, cited by Capstick and Fleming, 2004) presents some research evidence to suggest that PAL is able to affect positive outcomes through the consolidation of knowledge through participation; cooperative, informal learning through discussion; and enabling social integration of students. Lundeberg and Moch (1995, cited by Capstick & Fleming, 2004) also suggest that the personal, cooperative approach of PAL influences the cognition of students in positive ways, including enhancing the ability to apply abstract ideas. According to Johnson and Johnson (1989, cited by Chapstick & Fleming, 2004), cooperative learning consistently produces higher achievement than either competitive or individual effort. Johnson and Johnson (1994, cited by Killen, 2010) mention five basic elements that need to be present in small-group work to be considered cooperative, namely:

(i) Students must depend on one another by working together to achieve a specific goal, which means interdependence

(ii) There must be continuous, direct interactions where students have discussions and exchange ideas on tasks. They are aware that each member of the peer is responsible and that they will only be successful if their partners are successful: this leads to accountability towards each other.

(iii) Each member of the peer is responsible for a part of the learning and accountable for the success of each member of the peer, and is thus responsible for their learning;

(iv) Every member of the peer must apply interpersonal skills such as listening to other members, asking questions to eliminate uncertainties, discussing, negotiating and constructively solving problems and differences: this means collaboration is fostered

(v) Groups must reflect on the outcomes and how they function as a peer, to digest information learnt and reflect on information and understanding of the subject.

2.2.3.2 Team-based Learning (TBL)

Team-Based Learning (TBL) is an instructional approach designed to combine the principles of problem-based learning, student centred instruction, and constructivism. TBL is a team-based, peer teaching strategy that focuses on fostering positive team dynamics through intra-team communication. Team-based learning (TBL) is an active learning and small group instructional strategy that provides students with opportunities to apply conceptual knowledge through a sequence of activities that includes individual work, team work, and immediate feedback. TBL provides students with opportunities to expose inconsistencies between their current and new understanding in order to build new knowledge (Hrynchak & Batty, 2012; Samad et al, 2015). One of the values of TBL is that it can be used as a complete course framework strategy but is versatile enough to be effective when delivered as part of a hybrid design (Michaelsen & Sweet, 2008). In this active learning and teaching strategy, students have an active role in their learning; it is a method where the instructor facilitates learning. TBL is also a very structured teaching strategy based on cognitive learning theory. Team formation, the readiness assurance

process, application activities, and peer evaluation are the four pillars of TBL. TBL has become popular and is a preferred teaching method in nursing education in many institutions.

2.2.3.3 Sequence of Team-based Learning

A TBL sequence typically consists of three stages. The stages can take place within a single course meeting sessions. These stages are student preparation, readiness assurance, and application. In the student preparation stage students are provided learning resources to study individually before the TBL session. Students should review the materials prepared before coming to class. Upon arrival to class, the instructor proceeds with the readiness assurance tests. Students first complete the Individual Readiness Assurance Test (IRAT). The IRAT could be a multiple choice test assessing knowledge gained from the learning resources provided by the instructor. The application stage requires students to apply the knowledge learned in problem-based scenarios. This stage involves intra-team discussion and larger class discussions, with the emphasis on the application of knowledge as opposed to simple rote learning. Application exercises (AE) are provided during this stage which focus on students working together to solve a common problem.

Principles of Team-Based Learning in McMahon's (2010) analysis of TBL, he states four essential principles. The first principle is team formation and maintenance. Teams should be formed at the beginning of the course and members should stay together throughout the course. Instructors should be deliberate and thoughtful in team formation and ensure that members come from different knowledge base and backgrounds. The process of groups actualizing into efficient teams may be bumpy and require maintenance but this process should be worked out by the members themselves without much intervention from the

instructor. This allows students to learn to work with each other instead of relying on themselves as individuals.

The second principle is that all students should be accountable for their contribution to the team. This is crucial because students learn best when there is an immediate need and an appropriate incentive (McMahon, 2010). TBL holds students accountable through their individual grades and their contributions to the team score. To increase accountability, peer evaluation can also be strategically incorporated into parts of the course. A key to effective peer evaluation is facilitating a frank discussion with honest, constructive criticism given. Instructors should ensure that students understand the importance of honest peer evaluation by team members.

The third principle of TBL is the provision of real-time feedback to students. Real time feedback is crucial for the consolidation of learned knowledge and reinforces student learning by addressing small increments of the overall learning objectives. Corrections to misconceptions can be offered immediately by peers or the instructor to strengthen learned knowledge. The fourth principle stated by McMahon (2010) is that team assignments in the application phase should promote both student learning and team development. Assignments and AE should be designed to require team interaction. This covers an important aspect of TBL peer teaching. The assignment should not be able to be broken into individual assignments with each student covering one assignment; it is the peer teaching that drives team formation.

2.2.4 Benefit of Think Pair Share Strategy

In the teaching and learning process, the selection of the appropriate strategy is important in determining the success of the process. The appropriate strategy can generate the students' motivation to learn science. In this case, the teacher has the responsibility to make

the students interested and motivated in the learning process. The teacher has to use a suitable and interesting strategy to teach in order to make the students enjoy the learning and easy to understand the materials.

A study conducted by Hasibuan (2019) proved that the use of the Think-Pair-Share technique successfully creates a conductive and comfortable classroom atmosphere. It immediately helps students gain their motivation and enthusiasm to learn and to get involved in the class activity and also a better understanding of the material given.

Another research carried by Kagan (2009) pointed out some aspects of TPS that supports its implementation in science:

The participation in "think time" has led to improve the critical thinking and response in a given context. Critical thinking has been considered as a valuable tool for teaching and learning science in the time of Socrates. One of the important goals in education is to develop and enhance the students' ability to think critically about their knowledge, their actions, and their belief. More recently, researchers and educators have described the need of critical thinking as important as ever, particularly in today's information age. With access to more and more information, the students must be able to analyse the information systematically to solve certain problem (Ali & Frew, 2013). To enhance the students' critical thinking, there are some indicators that should be implemented. A critical thinking should be able to: accurately interpret evidence, graphics, statement and questions, identify the relevant arguments reasons and claims, thoughtfully analyse and evaluate major alternative point of view, justify key result and procedure, explain assumptions and reasons and fair minded follow where evidence and reasons lead.

Conceptual understanding improves by sharing with a partner in an appropriate time. TPS is the perfect way to get students back on track and back to the task. It allows them to think

about new concepts, processes, opinions, or observations without interruptions or distractions. It helps students understand what they know and need, increasing engagement levels during lessons.

It also improves their communication skills of by reflecting their knowledge and experiences in class room. Learning occurs better in peers through communication and collaboration. TPS creates the background for interaction which is a prerequisite of concept understanding and retention. When students work with a partner, they may feel more confident to express their ideas and more open to feedback than directly sharing opinions or observations with the whole class. It provides the validation they need to speak out in front of the entire class. In general, the most active and confident students take over most classroom discussions, but TPS allows everyone to be involved and feel included during lesson delivery? Students like to experience new ways of learning and manifest more curiosity and engagement as a result.

Some students may have good ideas but feel too scared or intimidated to share them. By utilizing the think-pair-share strategy, your shy or quiet students will be persuaded to share their taught on a more intimate level in pairs before going to a whole class with their views. By sharing with one another first, the shy students will have a chance to see that their ideas aren't wrong and may have less anxiety about delivering them to the group

2.3 Empirical Literature

There are many studies that support the idea that think-pair-share teaching strategy is an effective strategy for teaching and learning of science. The review of these studies would help to throw more light on the effects of the use of think-pair-share teaching strategy in teaching and simplifying learning of science.

Siburian (2013) employed think-pair-share to solve the problem of low students' achievement in writing descriptive text. Action research was conducted and qualitative and quantitative techniques were applied in the study. The class of the research was grade VIII in Junior High School, Rantau Parapat, and North Sumatera in Indonesia. In the first test, the students got the mean of mark 66.4375. It dramatically increased on the second test, which were 78.125. Additionally, on the third test the mean of students' mark reached a pick on 87.5625. Observation result showed that the students gave their good attitudes and responses during teaching and learning process by applying the application of think-pair-share method. Questionnaire and interview report showed that students agreed that the application of think-pair-share method had helped them in writing descriptive text.

This study is relevant to the present study because both investigated the effect of think-pair-share instructional strategy on students' performance. However, the present study differs because the reviewed study examined the effect of think-pair-share on students' performance and attitude in writing descriptive text while the present study investigated on the effects of think-pair-share on students' performance in selected topics in integrated science. The area of study also differs, while the reviewed study was done in Indonesia, the present study was done in Ghana.

Utama, et al (2013) investigated the effect of think-pair-share teaching strategy on students' self-confidence and speaking competency. The study was conducted on students of the second grade in SMPN 6 Singaraja, in Indonesia, during the academic year 2012/2013. There were 121 students selected as sample put in experimental and control groups. The study used a post-test only control group design. The analysis was made by using Manova facilitated by SPSS version 16.0 for windows. The results indicated that: (1) there was a significant effect of think-pair-share on students' self-confidence (F = 754.104 and sig =

0.000; p<0.05). (2) There was a significant effect of think-pair-share on students' speaking competency (F = 60.325 and sig = 0.000; p<0.05). (3) Simultaneously, there was significant effect of think-pair-share on students' self-confidence and students' speaking competency.

This study is relevant to the present study because both studies are on think-pair-share instructional strategy. However, the present study differs because the reviewed study examined the effect of think-pair-share teaching strategy on students' self-confidence and speaking competency while the present study investigated the effects of think-pair-share on students' performance in selected topics in integrated science. The area of study also differs, while the reviewed study was done in Indonesia, the present study was done in Ghana.

Jebur, et al (2013) carried out a study on the effect of using think-pair-share (TPS) technique on students' achievement in English as First Language (EFL) subject in Mustansiryah University, Iraq. The study specifically sought to experimentally investigate the effect of using TPS technique on EFL students' achievement in General English (GE). The quais-experimental design used in the study was a non-equivalent group post-test only type. The population of the study was 50 students; however, after purposefully excluding all the repeaters of the subject in the class, a sample of 41 students (20 and 21 for control and experimental groups respectively) was used for the study. The students were given a moment to 'think', 2 minutes to discuss (pair stage) ideas and another moment to 'share' what they have with the remaining class. The instrument used was a General English Achievement Test (GEAT) developed by the researchers. After t-test analysis of the data obtained, findings inferred revealed that TPS process is a technique for effective teaching of GE in Mustansiryah University, Iraq.

The relationship between the reviewed study and the present study is that in both studies, TPS learning process is used for enhancing students' performance. However, the studies differ in terms of the subject, area of study and educational levels of the students. The reviewed study was carried out using TPS process on undergraduate EFL students for the learning of General English speaking in Mustansiryah University Iraq, while the present study is concerned with the effects of think-pair-share on senior high school students' performance in selected topics in integrated science.

Althelab and Omar (2013) investigated on the impact of think-pair-share strategy on the achievement of second grade intermediate female students in mathematics and their reasoning thinking. A sample of forty-four (44) female students were chosen and distributed to two classes consisting each of twenty-two (22) female students. The first class represented the experimental group which studied according to the think-pair-share strategy and the second is the control group which studied according to the traditional method. The study made use of two tools: the first is an acquisitive test consisting of (25) items while the second tool is the reasoning thinking test which consisted of (30) test items. After collecting and statistically analysing the data by using the t-test for two independent samples, the results revealed the superiority of the experimental group who studied according to think-pair-share strategy to the control group in achievement and reasoning think.

This study is relevant to the present study because both studies investigated the effect of think-pair-share instructional strategy on students' achievement. However, the present study differs because the reviewed study examined the effect of only think-pair-share on female students' achievement in mathematics and their reasoning thinking while the

present study investigated on the effects of think-pair-share on the effects of think-pair-share on academic performance students in selected topics in science.

Ogunyebi (2018) carried out a research on the effect of think-pair-share strategy on the students of biology achievement in Algas and their attitude toward it. To fulfil this aim, the following decimal hypothesis was made:

1) There are no statistical differences in the achievement on level 0.05 of significance between the students who study according to think-pair-share strategy and those who study according to the ordinary way of teaching.

2) There is no statistical difference in scientific on level 0.05 of significance between of the students who study according to think-pair-share strategy and those who study according to the ordinary way. The samples were two groups of students who were chosen from the third grade of biology department, college of education for pure Sciences, University of Diyala. The first experimental group which was composed of forty-five (45) students studied according to think-pair-share strategy. The second standard group which was composed of forty-five (45) students studied according to the ordinary method of teaching. After equating the two groups, the researchers used the post achievement test and measuring of attitudes which is prepared for this purpose. The results showed that first experimental group were superior in achievement and attitude than the second standard group.

This study is relevant to the present study because both investigated the effect of think-pair-share instructional strategy on students' achievement. However, the present study differs because the reviewed study examined the effect of only think-pair-share on students' achievement in biology while the present study investigated on the effects of think-pair-share on academic performance students in selected topics in science.

Ahmad (2016) carried out a research which was aimed at identifying the effect of think-pair-share and sequenced questions strategies on fifth primary students' achievement and retention in sciences. The sample of the study consists of seventy (70) students. The sample was distributed as follows: twenty-four (24) students in the first experimental group which were taught according using think-pair-share strategy and twenty-three (23) students in the second experimental group which were taught according to sequenced questions strategy and twenty-three (23) students in the control group which were taught according to the traditional way of teaching. The three groups were matched in terms of the following variables: the students' age (in months), their intelligence, their parents' academic level of education and their achievement in sciences (in the fourth primary stage). The researcher constructed an achievement test which included twenty (20) items. These items were multiple choice items. The validity of this test was ascertained and also reliability was obtained by using Pearson Correlation Formula which yielded 0.83 coefficients. After analysing the results statistically, a statistically significant difference was revealed in favour of the first and second experimental groups in achievement and retention.

The reviewed study and the present study are related since think-pair-share learning process was used in both instances for enhancing students' achievement. However, the studies differ in terms of class of students and the area of the study. The reviewed study was carried out on primary school students while the present study was carried out on senior secondary school students.

Saleh and Ibrahim (2015) carried out a research on the effect of think-pair-share strategy on the students of biology achievement in Algas and their attitude toward it. To fulfil this aim, the following decimal hypothesis were made: 1) There is no statistical differences in the achievement on level .05 of significance between the students who study according to

think-pair-share strategy and those who study according to the ordinary way of teaching. 2) There is no statistical difference in scientific on level .05 of significance between of the students who study according to think-pair-share strategy and those who study according to the ordinary way. The samples were two groups of students who were chosen from the third grade of biology department, college of education for pure Sciences, University of Diyala. The first experimental group which was composed of forty-five (45) students studied according to think-pair-share strategy. The second standard group which was composed of forty-five (45) students studied according to the ordinary method of teaching. After equating the two groups, the researchers used the post achievement test and measuring of attitudes which is prepared for this purpose. The results showed that first experimental group were superior in achievement and attitude than the second standard group.

This study is relevant to the present study because both investigated the effect of think-pair-share instructional strategy on students' achievement. However, the present study differs because the reviewed study examined the effect of only think-pair-share on students' achievement in biology while the present study investigated on the effects of think-pair-share on students' performance in selected topics in integrated science.

Hamdan (2017) investigated the impact of think-pair-share strategy on the achievement of third grade student in sciences in the educational district of Irbid. The sample of study consisted of one hundred and twenty (120) students of third grade student in the educational district of Irbid. They were distributed into two groups: the control group which consisted of thirty (30) male students and thirty (30) female students; and the experimental group which consisted of thirty (30) male students and thirty (30) female students. The findings of the study showed that there were statistical differences in grades

of students due to group variable at the significance level (0.05), and the differences were in favour of the experimental group. Also, there were statistical differences due to gender at the significance level (0.05) in favour of females. The study recommended think-pair-share strategy within the teaching strategies used by teachers during the teaching and the involvement of teachers in training courses on think-pair-share strategy.

The relationship between the reviewed study and the present study is that in both studies, TPS learning process is used for enhancing students' performance. However, the studies differ in terms of area of study and educational levels of the students. The reviewed study was carried out using TPS process on third grade students while the present study was concerned with the effects of think-pair-share on the effects of think-pair-share on academic performance students in selected topics in science.

Many studies have not been conducted in the area of students' attitudes towards think-pair-share teaching strategy. A number of studies have been conducted in collaborative learning indicated that students have positive attitudes towards collaborative learning.

A similar study was conducted by Onwuegbuzie and DaRose-Voseles (2001) on the role of collaborative learning in research methodology courses: a mixed-methods analysis. The primary thrust of the study was to investigate the effectiveness of collaborative learning in a graduate-level research methodology course and the secondary was to determine the effects of collaborative learning on students' attitudes towards group activities and overall learning in research methodology courses. Respondents comprised 193 graduate students enrolled in several sections of this course. Eighty-one students were in sections wherein collaborative learning groups were formed to undertake the major course requirements; 112 were in sections wherein all assignments were undertaken individually. Students' conceptual knowledge of research concepts, methodologies and applications were

measured individually in both groups via midterm and final examinations. A scoring rubric was used to evaluate proposals and articles critiques, with detailed feedback provided. Students in the control group received individual scores, on a 100-point scale for their research proposals and article critiques. Students in the collaborative learning groups were given group scores for these assignments. Students were told to keep reflexive journals. A split-plot analysis of variance revealed a group by examination time interaction, whereby collaborative learning students had statistically significant lower performance levels on the midterm examination than did individual students (effect size = 0.48). However, no statistically significant difference in achievement was found with respect to the final examination. Analysis of reflexive journals indicated that most students (70.4%) tended to have positive overall attitudes towards their collaborative learning experiences.

In a similar study, Akhtar, Perveen, Kiran, Rashid, and Satti (2012) conducted a study on students' attitudes towards collaborative learning. The purpose of the study was to examine the views about collaborative in the domain of group projects of graduating students of the Departments of Statistics and Economics of Arid Agriculture University Rawalpindi. The population comprised graduate students of statistics and economics of Pir Mehr Ali Shah Arid Agriculture University Rawalpindi. A structured questionnaire measuring the attitudes on a three-point Likert scale was adopted for data collection. Data was analysed using frequencies and percentages. Analysis of the data revealed that students were favourable to do work on group projects along with associated collaborative learning methods. The results further indicated that collaborative learning is an effective approach and the study suggested that students could be developing different attitudes towards teamwork from their educational experiences.

These studies are relevant to the present study because both studies are tried to find out the students attitude towards the use cooperative instructional strategy. However, the present study differs because the reviewed study examined the effect of think-pair-share teaching strategy and these studies also examined the effects of collaborative learning.

2.4 Summary of the Chapter

The emphasis of TPS has been that of students working in pairs together to maximize their own and each other's learning. The concept of TPS is Digitized by Bolgatanga Central Technical Institute and Zamse Senior High/Technical School, supported by the social interaction theory, Jean Piaget cognitive development theory, Vygotsky's theory of scaffolding and the ZPD and Albert Bandura social learning theory where individual learners need the help of other learners in other to reach their potential growth (maximized learning). Even though TPS has been beneficial as espoused by the review on the justification for the use of TPS and the empirical findings on the benefits of TPS, researchers have found students to have challenges in participating in such a teaching strategy. Studies indicated that female students perform higher than male students towards TPS whilst others indicated the vice versa. The empirical review also indicated that students had high attitudes and motivation towards TPS teaching strategy dimension. Yet, other studies have indicated negative attitudes towards TPS among students, implying that some students do not prefer TPS. The issue of students preference for TPS has been a problem and hence the need to determine if Electrical students at the Bolgatanga Central Technical Institute prefer this teaching strategy.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Overview

This section of the study outlines the research design, population of the study, sample and sampling techniques, research instruments, validity and reliability of the instruments, data collection procedure, data analysis techniques and ethical issues.

3.1 Research Design

A research design is a basic plan for a piece of empirical research (Johnson & Christenson, 2008). The research adopted a quasi-experimental research design and was chosen to establish the use and effect of think-pair-share on the performance of students at Bolgatanga Central Technical Institute and Zamse Senior High/Technical School. According to Havor (2015), quasi-experiment involves conducting an experiment, usually in a real-life setting, without the benefit of random assignment of participants to conditions or other controls. According to Davis and Rose (2000)., a research design must enable the researcher to maintain and control the situation in terms of the assignment of subjects to groups, who gets the treatment condition, and the amount of treatment condition that subjects receive. According to Creswell (2007), the quasi-experimental research design aims to test the impact of a treatment (or an intervention) on an outcome, controlling for all other factors that might affect the outcome. In this research design, two schools are used: Bolgatanga Central Technical Institute, as an experimental school, and Zamse Senior High/Technical School, as the control school. Both schools were assessed with the same pre-test items to establish their entry knowledge and the pairing process. Akayuure et al (2016) also reported that the pre-test allows us to assess whether the students of the schools are equivalent on the dependent measure before the treatment is given to the experimental

school. When the pre-test is over, the researcher carry out the treatment (TPS) with the experimental group (Bolgatanga Central Technical Institute) and the control group (Zamse Senior High/technical School) with the normal traditional teaching strategy. The male and female performance in the post-test for the experimental group is also compared using null hypotheses testing.

3.2 Population

According to Salaria (2012), a population is any group of individuals who have one or more characteristics in common that are of interest to the researcher. Population is also the number of members of a defined class of people, objects, places, or events selected because they are relevant to your research question.

3.2.1 Target Population

Asamoah-Gyimah, and Duodu (2004) target population refers to the population that the researcher would ideally like to generalize the findings to. This population comprised all the students in the two schools that are used for the study.

3.2.2 Accessible Population

The accessible population refers to the population that a researcher can genuinely select his sample from. The "accessible population consisted of Form Two Electrical class students at Bolgatanga Central Technical Institute and Zamse Senior High /Technical School.

3.3 Sample Size and Sampling Procedure

Kombo and Delmo (2006) defined sampling as a procedure the researcher uses to gather people, places, or things to study. Wilmot (2018) also defines sampling as the act, process, or technique of selecting a suitable sample or a representative part of a population in order to determine parameters or characteristics of the entire population. It is a process of

selecting a number of individuals or objects from a population such that the selected group contains representative characteristics found in the entire group.

The purposive non-probability sampling technique was used in the selection of respondents for the study. Donkor and Alhassan (2018) define purposive sampling as a technique where the researcher purposely targets a group of people reliable for the study. As the name suggests, the sample has been chosen for specific purpose. The researcher choose the sample based on who he thinks would be appropriate for the study, and this is used primarily because there a limited number of students that have expert knowledge in the area being researched at Bolgatanta Central Technical Institute and the Zamse Senior High/Technical School.

Two classes were purposely sampled and used; one class was from Bolgatanga Central Technical Institute and the other one class was in Zamse Senior High/Technical School. The class in Bolgatanga Central Technical Institute was used as the experimental group and that in Zamse Senior High/Technical School was used as the control group. Both students studied electrical.

3.4 Research Instruments

According to Karim (2017), research instrument is a device used by the researcher while collecting data to make his work become easier and to get better result, complete and systematic in order to make the data easy to process. Test and questionnaire were the instruments used.

3.4.1 Test

The researcher used pre-test and post-test to assess students. The tests are aimed to measure the students' progress and result of teaching learning activities. Test is a list of questions to be answered by a group of people to get information. The pre-test was used to establish the

entry level of students' knowledge before the intervention is given. The post-test was later administered and results compared with the pre-test to find out if TPS teaching strategy have an effect on students' academic performance. This study used a test as the instruments to collect the data for the study; the Integrated Science Performance Test (ISPT) was developed by the researcher and given to students to respond to. The questions of the ISPT were used as a pre-test and later test items with the same content and difficulty were used as a post-test after the treatment. The post-test was re-administered as a retention test a few days after the treatment exercise.

3.4.2 Questionnaire

A questionnaire is simply a 'tool' for collecting and recording information about a particular issue of interest. It is mainly made up of a list of questions, which also includes clear instructions and space for answers or administrative details. The questionnaires have a definite purpose that is related to the objectives of the research, and also made clear for students about the finding will be used (Amoah, 2012).

Again, the questionnaire was used because it is less expensive since respondents are not interviewed which saves time and financial resources. Also, it offers greater anonymity as there is no face to face interaction between respondents and interviewer. Also, the respondents can read and write. Despite these strengths, the weaknesses are that: for any reason respondents do not understand some questions, there is no opportunity for them to have the meaning clarified (Ajith-Kumar & Ganesh, 2011).

Closed-ended (open question) questions are used, where the researcher provides the respondent with set answers from which to choose.

The questionnaire was made up of a five-point Likert scale item of strongly agree (5), agree (4), undecided (3), disagree (2), and strongly disagree (1). Respondents were required to

respond by ticking the appropriate level regarding statements on the Likert scale. The questionnaire was made up of two sections: Section A (attitude questions) and Section B (motivational questions)

3.5 Validity of the Instruments

Gyamfi and Yeboah (2022) defined validity as the soundness of the interpretation and use of students' assessment results. Patton (2011) also refer to validity as the appropriateness, correctness, meaningfulness and usefulness of the specific referees researchers make based on the data they collect. The validity of both the pre-test and post-test was ensured by structuring the test items in accordance with the demands of the integrated science syllabus. Also, the items were given to experts in the field to ensure the face and content validity of the research instrument. The difficulty level of both the pre-test and post-test were at the same level for the students.

According to Johnson and Christensen (2019) one method for obtaining validity evidence of the instrument is to study the construct to measure, examine the test content, and make decision whether the test content adequately represents the construct. This is usually done by expert according to Johnson and Christensen (2019). Another method for validating an instrument according to Jonson and Christensen (2019) is to relate test scores to a known criterion by collecting concurrent and or predict evidence.

The researcher cross checked to see whether the test items covered the entire research questions posed in this study. Also the test items prepared on the bases of selected topics was submitted to some experience integrated science teachers in the two schools and the researcher's supervisor for security. The items were subjected to critical examination to ensure that they measured the predetermined criterion; objectives or content of the study. The necessary, corrections were made and so the items were certified adequately.

3.6 Reliability of the Instruments

Reliability is the degree of consistency of an assessment instrument's result. It is the degree to which assessment results are the same or consistent. This means that the reliability of a score is how much one would generate consistent results over several trials with different respondents in the same setting or circumstances.

According to Johnson and Christensen (2019), reliability is determined by the method of repeated forms (test-retest), internal consistency, inter-scorer and equivalent forms. The same tasks are completed on two different occasions.

1. On the same or different occasions, different but equivalent tasks are completed.
2. Two or more ratters' performance on the same task.

A Statistical Package for Social Scientist (SPSS), version 25 for window 8 computer software was used for the analysis of the instruments. The overall reliability coefficient alpha for test instrument was found to be 0.70. According to Opoku and Essien, (2011), a reliability coefficient of 0.70 or better is acceptable. In support of this assertion, Bassah (2020) also emphasized that such a reliability coefficient is good and the instrument can be judged to collect useful data. The results proved that the item in the instrument had a good internal consistency and therefore capable of measuring what they were purported to measure. The reason being that, according to Johnson and Christensen (2019), as a popular rule, the size of coefficient alpha should generally be a minimum, greater than or equal to 0.70 ($\geq$0.70) for research purposes and somewhat greater than that valve (e.g. $\geq$0.90) for clinical testing purposes.

3.7 Data Collection Procedure

The following procedure was followed to collect data for this study: An experiment was conducted to determine whether teaching students using the "think-pair-share strategy would "cause" them to perform better academically in science. The researcher establish a good rapport with the students which made them express their views without fear the test distributed and answer without putting pressure on respondents in other to obtain a good responses. The researcher personally administered the test items. The test (pre-test) which lasted for one hour was supervised by the researcher and other science teachers in the school. The pre-test administered was collected by the researcher the same day. None of the test items were missing and the marked and scored over 100% and the scores recorded.

The researcher carried out the treatment to the experimental group at Bolgatanga Central Technical Institute and students at Zamse Senior High/Technical School, was not given any treatment (control group). The control group was taught the same topics using traditional mode of instruction. The post-test in a form of class test was administered after some time after the treatment activities. A post-test was administrating to the same selected group of students to ascertain the effect of think-pair-share teaching strategy on students' academic performance.

The duration for the post-test was one hour. The post-test was supervised by the researcher and other sciences teachers in Zamse senior High/Technical school. Again, the post-test was administered and collected the same day and none of the students was missing. The post-test was also marked over 100% and recorded.

The questionnaire was administered in person. The advantage of administering in person is summarized by Asare (2016) that the researcher has the opportunity to brief respondents to understand exactly what the items mean so as to obtain the right responses. However, due

to the limited time those teachers had to teach, two science teachers help in the administration of the questionnaire. It is ethical in research to assure respondents of their confidentiality and anonymity, hence the questionnaire was accompanied with a cover letter (Appendix C) to this effect and to crave their maximum co-operation.

3.8 Analysis of Data

Data analysis is the process of simplifying data in order to make it comprehensible (Cohen et al, 1996). After recording the scores from the pre-test and the post-test, the Statistical Package for Social Sciences (SPSS) version 27 for window 8 was used for analysis of the data. The following statistical tools were used to analyse the data that were collected for the study. Research questions 1 and 2 were analysed using a t-test, and research question 3 was analysed using descriptive statistics. The discussions were done according to the major findings of the study and were used to answer the questions.

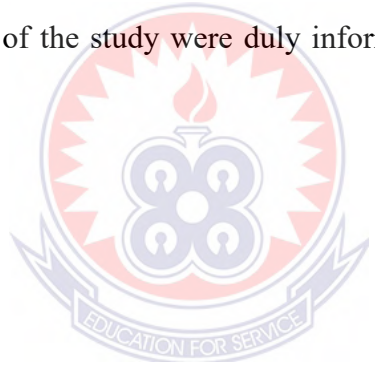
The research also sought to determine students' attitudes and motivation towards TPS. It was measured on a five-point Likert scale and coded as 1 (strongly agree), 2 (agree), 3 (neutral), 4 (disagree) and 5 (strongly disagree). It was then analysed using percentage, mean and standard deviation. The mean was used to determine students feeling on each item on the questionnaire. The standard deviation provided information on the congruence of the responses given by the students. A mean value below 2.5 indicated that students had a negative attitude towards TPS and a mean value above 3.4 indicated that students had a positive attitude towards TPS.

3.9 Ethical Considerations

The researcher sought permission from the heads of the schools to carry out the research. Introductory letter was given to both school heads and permission was granted before the data was collected.

In this study, the researcher selected the sample respondents in the two schools and gave them orientation on the purpose and the benefit of the study. Again the researcher briefed the students on how the various items were to be responded to. Concerns raised by the students were addressed and clarified to enable them understand issues and provide the appropriate responses.

The researcher ensured that prospective participants of the study were made aware about the nature of the study and what it seeks to achieve and their rights as participants. The researcher provided sufficient information regarding the aim of the study. Also students were made not to write their names and index numbers in the answer booklet in other to ensure confidential. Therefore, do not write your name or index number on this questionnaire. Participants of the study were duly informed and how data collected about them will be handled.



CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 Overview

In this chapter, the analysis of data and presentation of results are based on the research questions and null hypotheses that guided the study. The chapter opens with a description of characteristics of the actual sample. The presentation of the results is organized according to the research questions. Results pertaining to the first question are presented first, followed by the other research questions one after another.

4.1 Biographical Description of the Research Participants

Biographic information provides data regarding research participants and is necessary for the determination of whether the individual in the study are a representative sample of the target population for generalization purpose. The profiles of the respondents in this study are presented in terms of their age and sex. There were 100 students involved in the present study, out of this total number, 58 of them were boys and 43 were girls in the experimental group, 48 students came from Bolgatanga Central Technical Institute and out of this number, 19 were girls and 29 were boys. The control group, consist of students from Zamse Senior High/Technical School in which, 52 students were used and 24 were girls and 28 were boys.

Table 2: Students bio-data information

Schools	Number of Students	percentage
BCTI	Boys = 29	29%
	Girls = 19	19%
	BCTI Total = 48	48%
Zamse	Boys = 28	28%
	Girls = 24	24%
	Zamse Total = 52	52%
	Grant total = 100	100%

The age of the participants involved in the study ranged from 16-21 years, where, the male age ranged from 17-21 and the female age also ranged from 16-19. The students were form two electrical students from both schools.

4.2 Research Question One

What is the effect of think-pair-share teaching strategy on senior high school students' academic performance in selected topics in integrated science?

The first question sought to find out whether educational intervention in the form of Think-Pair-Share (TPS) would yield significant results on the academic performance of the sampled students that participated in the study. In the light of this, both groups were given a pre-test to determine their performance in the selected topics (acid, base and salt, soil conservation and water) in integrated science before any treatment or intervention. A null hypothesis was used to help answer and address the issue. Its state as "there is no

significant difference in academic performance of the control and experimental groups of students when taught selected topics in integrated science using think-pair-share teaching approach". Table 3 capture the results of the students' performance in the pre-test.

Table 3: t-test analyses of the pre-test scores for both experimental and control groups of students.

Group	N	Mean	SD	Df	t-value	p-value
Experimental	48	39.50	18.380	98	0.323	0.745
Control	52	38.37	16.275			

Significant at $^{*}P \leq 0.05$

The result presented in Table 3 showed that the t-value of 0.323 and p-value of 0.745 which were greater than the level of significance at $\alpha = .05$ with Df = 98. This means that there was no significant difference in performance between the students in the experimental and control groups of students who were both taught integrated science using traditional/conventional teaching strategy. This implies that, student in both experimental and control groups in study showed the same level of academic abilities in terms of the selected topics integrated science.

After the pre-test, the experimental group was taught these topics (acids, bases and salt, soil conservation and water) using the think-pair-share technique whilst the control group was taught the same topics and content with the traditional method.

After a period of 6 weeks both were administered a post-test. Students' performances are indicated in Table 4.

Table 4: Independent t-test analysis for post-test scores of students in the control and experimental group

Group	N	Mean	SD	Df	t-value	p-value
Experimental	48	64.81	16.765	98	6.139	0.00
Control	52	44.63	16.039			

Significant at *P≤0.05

The results in Table 4 indicate that the experimental group with mean of 64.81 performed higher than the control group with mean of 44.63 with their mean difference of 20.18. To test whether there was a significant difference, a no null a hypothesis one (H_{01}), that "there is no significant difference in academic performance of control and experimental groups of students when taught selected topics using TPS strategy" was used and tested using t-test statistics at $p \leq .05$.

The result presented in Table 4 showed that the p-value were 0.000 which were less than the level of significance of α .05 with Df of 98. This means that there was a significant difference between the post-test scores of the two groups in favour of the experimental group. Thus the null hypothesis was rejected.

This means that the experimental group taught selected topics in integrated science using think-pair-share teaching strategy performed significantly higher based on the scores they had. It also implies that this teaching strategy is effective for the conceptual understanding of students.

The control group taught the same selected topics using traditional method or conventional teaching method but the students under this group do not performed well as compared to the experimental group.

This finding is in consonance with Jacobson and Baribor (2012) who observed that think-pair-share could arouse students' learning interest cultivate their exploring ability and creative thinking and improve their team spirit and social communication skills. Similarly, the study by Crosby and Owens (1993) found that TPS teaching strategies can be employed to help low ability students to improve achievement, who had difficulties making success in the traditional classroom. The results of this finding showed that students performed academically high when used TPS instructional strategy.

4.3 Research Question Two

What is the effect of Think-Pair-Share teaching strategy on male and female students' academic performance in selected topics among the experimental group?

This question sought to find out whether the think-pair-share teaching strategy employed in teaching would yield significant results on the academic performance on female as the same as male students. The results are shown in Table 5 below. In order to answer the null hypothesis that "there is no significant difference in academic performance of male and female senior high school students when taught selected topics using the TPS teaching strategy was used". Male and female students' results in the post-test were captured by performing the t-test analysis at $p \leq .05$.

Table 5: t-test analysis of female and male post-test scores of students in the experimental group

Group	N	Mean	SD	t-value	DF	p-value
Female	19	71.740	0.494	25.992	47	0.000
Male	29	62.410	16.762			

Significant at *P≤ 0.05

The results in Table 5 indicated that the female group with mean of 71.74 performed significantly higher than the male group with mean of 62.41 and mean difference of 9.33. To test whether the difference is significant or not, null hypothesis two (H_{02}) was formulated and tested using t-test statistics.

From Table 5 above the results indicate that, p-value is less than the critical value of 0.05 which shows that there is significant difference between male and female students when they were taught using think-pair-share teaching strategy.

The result presented in Table 5 with a p-value of 0.000 which is less than the level of significance of α of 0.05 with Df is 47. This means that there is significant difference between the female and male scores of the two groups in favour of the female students. Thus the null hypothesis was rejected. This means that the female group taught selected topics in integrated science using think-pair-share learning strategy performed significantly higher. Female students have been found to be more oriented to connection with others and nurturance which was closely related to the gender difference in TPS is neither here nor there.

The male counterparts taught the same selected topics using the same think-pair-share strategy but the performed was not well as compared to the female students

Reda in a different research found out that, student had positive performance towards TPS which this study confirms, findings that there were differences between the sexes was consistent with the finding of this study. Ajaja and Eravwoke (2012) affirmed the ability of TPS learning when used as an instructional strategy to bring about non-significance in performance scores between male and female students in the TPS. Onah and Ugwu (2010) who indicated that performance in integrated sciences in Secondary School level, is dependent on gender.

The results, however, disagreed with Ajaja (2018), Crosby and Owens (1993), Steven and Slavin (1995), Mégnin (1995), Webb, Tropper and Fall (1995) who found that the TPS learning is not limited to a particular ability level or sex, but to all who engage in it. Similarly, Glassman (1989) and Johnson, Johnson and Stanne (1986) found that TPS learning emphasizes status and respect for all members, regardless of gender.

4.4 Research Question Three

What is students' attitude and motivation towards teaching and learning integrated science concepts by Think-Pair-Share method of instruction?

Attitude questions were given for students to response to. The main purpose of these questions was deterred the students feeling towards Think Pair Share (TPS) teaching strategy during lessons delivery. A likert scale is constructed with five options i.e. (strongly agree, agree, undecided, disagree, and strongly disagree) for respondents to tick in their preferable feeling about a TPS questions.

Students' attitudes towards the use of think-pair-share strategy for studying integrated science are portrayed in Table 6 below.

Table 6 Students' responds on attitude question about TPS teaching strategy

Attitude of students towards (TPS) items	SA	A	U	DA	SDA	M	SD
1. I normal study integrated science on my own.	3 (6.3%)	1 (2.1%)	2 (4.2 %)	17 (35.4 %)	25 (52.1 %)	4.13	0.914
2. I often study integrated science in TPS.	31 (64.6%)	12 (25%)	0 (0%)	4 (8.3%)	1 (2.1%)	4.42	1.007
3. I gain more knowledge by discussing with my peers.	24 (50%)	19 (39.6 %)	1 (2.1 %)	1 (2.1%)	3 (6.3%)	4.25	1.062
4. I contribute fairly during TPS work.	21 (43.8%)	20 (41.7 %)	0 (0%)	4 (8.3%)	3 (6.3%)	4.08	1.164

5. I prefer to work on my own.	7 (14.6%)	4 (8.3%)	4 (8.3%)	17 (35.4%)	16 (33.3%)	3.73	1.317
6. I learn more from direct teacher instruction.	7 (14.6%)	10 (20.8%)	3 (6.3%)	10 (20.8%)	18 (37.5%)	2.54	1.529
7. I relate well with other TPS members.	20 (41.7%)	11 (22.9%)	0 (0%)	8 (16.7%)	9 (18.8%)	3.52	1.611
8. Other TPS members explain things I don't understand.	19 (39.6%)	15 (31.3%)	0 (0%)	6 (12.5%)	8 (16.7%)	3.65	1.523
9. I help others who don't understand during discussing.	21 (43.8%)	20 (41.7%)	1 (2.1%)	4 (8.3%)	2 (4.2%)	4.13	1.084
10. I solve more integrated science problems with colleagues.	30 (62.5%)	15 (31.3%)	0 (0%)	0 (0%)	3 (6.3%)	4.44	1.009
11. TPS does not improve my performance.	0 (0%)	2 (4.2%)	1 (2.1%)	17 (35.4%)	28 (58.3%)	4.48	0.743
12. It is fair to use TPS effort in schools.	29 (60.4%)	18 (37.5%)	0 (0%)	1 (2.1%)	0 (0%)	4.56	0.616

This part of the research question was established to assess students' attitude towards the think-pair-share teaching strategy.

In item1, 25 participants representing 52.1% strongly disagree, 17 participants representing 35.4% disagree, 2 respondents representing 4.2% was not decided about item 1, while 3 participants representing 6.3% also strongly agree and 1 of them representing 2.1% of the participants agreed that they normally study integrated science on their (with 4.13 mean and standard deviation of .914) this implies that students general preference for TPS teaching strategy was high. It can be concluded that students have developed positive attitude towards TPS strategy and therefore prefer such teaching strategy. Students are therefore expected to welcome more use of TPS activities in the teaching and encounter due to the positive attitude they have towards the teaching strategy.

In this sense, 31 of the participants representing 64.6% strongly agree, 12 respondents representing 25% agree, but all of the participants are decided while 4 respondents representing 8.3% disagree and 1 participant representing 2.1% strongly disagree that they often study integrated science in group, (with 4.42 mean and 1.007 standard deviation). This seems to be the highest congruence in students' positive attitudes at this point where students' convergence on the response was highest is certain meeting the learning preference of students. This claim might be right due to how students were willing to participate in group work activities without being compelled to do so. According to Şimek, Byilar and Kucuk (2013), TPS learning is a process aimed at facilitating the performance of a specific end product or objective through students working together in peers.

Also in item 3, 24 strongly agree and represent 50%, 19 participant representing 39.6% agree, 1 participant representing 2.1% is undecided and also disagree respectively 3 respondents representing 6.3% strongly disagree that they gain more knowledge by discussing with my peers, (4.25 mean and 1.062 standard deviation). This means that TPS help students gain more conceptual understanding when they work in peers. Since each

member of the group might come with different experiences, it is possible to shape and refine the way each member individually address issues on their own. Students get a better picture of the way they are to approach their individual task. This in effect is expected to help them to be individually independent thereafter just as indicated in the ZPD.

With reference to item 4, 21 participants representing 43.8% strongly agree, 20 respondents representing 41.7% agree, all participants have decided, 4 respondents representing 8.3% disagree and 3 participants representing 6.3% strongly disagree that they contribute fairly during group work. Again, the majority (mean is 4.08, standard deviation is 1.164) of the students asserted that TPS helps them to share their ideas. Most often, it is believed that students find it difficult to contribute to the whole class discussion. It is believed that they are shy most of the times to stand in the bigger class to talk. This might be due to their inability to express themselves well. It is however expected that group work will help students to develop the skills of expressing themselves well so that they could stand to speak at anywhere they find themselves. Students' confidence building is, therefore, envisaged. Typically, in TPS learning, academic assignments are structured or divided so that everyone can participate fairly and all students are responsible (Candler, 2013).

Taking item number 5, 17 respondents representing 35.4% strongly agree, 16 participants representing 33.3% agree, 4 participants representing 8.3% are not decided while 7 respondents representing 14.6% disagree and 4 participants representing 8.3% strongly disagree that they prefer to work on my own. After students went through TPS teaching strategy, majority disagreed that working alone help them to perform good academically. This indications is clearly shown with a lower mean as 4.11 and a standard deviation of 1.019

Again in item 6, 7 respondents representing 14.6% strongly agree, 10 respondents representing 20.8% agree, 3 participants representing 6.3% that are not decided while 10 participants representing 20.8% are disagree and 18 respondents representing 37.5% strongly disagree that they learn more from direct teacher instruction. With the mean of 2.54 and standard deviation of 1.529 implies that students have clear answer as to which they learn best from teacher discussions or TPS teaching strategy. In addition to this, which gives a undecided option from students as they learn best from teacher and TPS discussion which help them academically.

Within item 7, 20 respondents representing 41.7% strongly agree. Above 11 participants representing 22.9% agree, all participants responds to this item, 8 participants representing 16.7% disagree and 9 respondents representing 18.8% strongly disagree that they relate well with other group members. It can be concluded that many agree that the Think Pair Share method can increase student cooperation. Because this Think Pair Share method is defined as any broad concept in the form of group work either involving the teacher or with teacher guidance. In as much as students are able to socialize more in TPS teaching strategy, they also end up developing a positive work relationship. This argument was supported by the fact that students agreed (mean is 3.52, standard deviation is 1.611) that group work enhances good working relationship. McLeish (2009) found out that TPS facilitates good working relationship. A good working relationship implies that a good rapport has been created between students where each student respects each other and are ready to work and share ideas. As study earlier revealed, students had developed positive attitudes towards group work due to the fact that they are able to share ideas. This confirms that a good work atmosphere has been created where students are ready to work with

colleagues. It is deduced that students will, therefore, feel comfortable and satisfied working in a group.

In reference to item 8 the Table 5 above, 19 participants representing 39.6% strongly agree, 15 respondents representing 31.3% agree, all participants responds this item 6 participants representing 12.5% disagree and 8 participants representing 16.7% strongly disagree that other group members explain things I don't understand. Also, new things are learned when students are involved in group learning (mean is 3.63, standard deviation = 1.523). This is possible in that issues students might not be in tune with may pop out during the discussion and this may help them learn something new. Some group members might have obtained more experiences by interacting with other agents of socialization outside the classroom and the school. These experiences can be made available to the group members during group work or group discussion. Consequently, students may be exposed to new and useful information. Hence, students learning more lead to good academic performance. Because this process makes students independent, so that if a teacher is absent or meeting students are able to discuss alone in class.

In addition, 21 participants in item 9 representing 43.8% strong agree, 20 participants representing 41.7% agree, 1 participant representing 2.1% did not decided, while 4 respondents representing 8.3% disagree and 2 participants representing 4.2% strongly disagree that they help others who don't understand during discussing. This is evident from Table 4.4 when the majority (mean is 4.13, standard deviation is 1.084) of the students were of the view that group members like to help them learn the material. Students will not be interested learning in a group where they know they will not achieve anything. This creates the onus on instructional members to design peers in such a way that members have varying level of abilities so as each one could tap from each other in the group. In this

regard peers in the group will help each other to reach their potential levels of development. Jacobson and Baribor (2012) also added that, when working with peers in a group, students are encouraged to articulate their ideas and question the ideas of others.

It is indicated in item 10 that, 30 respondents representing 62.5% strongly agree, 15 respondents representing 31.3% agree, all participants have decided and no participant has disagree, 3 respondents representing 6.3% strongly disagree that they solve more integrated science problems with colleagues, (mean is 4.44 and standard deviation is 1.009) Looking at the achievement students attain when they work with other students and their ability to understand the material when they work in a peer, students have come to enjoy the material more when they work with other students. The majority (mean is 4.44) of the students indicated that they enjoy the material when they work with other students. This has led students to have positive attitudes towards TPS learning. Students were highly congruent in their responses (standard deviation of 1.009). The enjoyment students have when learning in the group might motivate them to always engage in group work since they will find learning in groups entertaining. This in effect might help the business students to develop the social skills and the ability to function well in teams in the corporate world. Similarly, Ruel and Bastianns (2003) see TPS learning as a method of instruction that allows students to independence use of mental processes to contribute to knowledge.

In item 11, 28 respondents representing 58.3% strongly agree, 17 respondents representing 35.4% agree, 1 respondent representing 2.1% has not decided about this item, 2 respondents representing 4.2% disagree and no participant has strongly disagree that TPS does not improve my performance. However, the majority (mean is 3.87, standard deviation is 1.116) of the students indicated that TPS does not improve my performance. Students will find it very comfortable to learn from their peers to better their understanding

and personal development. Students also remained undecided to the statement that, a lot of personal schedules prevent them from enjoying the group.

Lastly, 29 participants in item 12 representing 60.4% strongly agree, 18 participants representing 37.5% agree, all participant has decided, 1 participant representing 2.1% has disagree and one has disagree that It is fair to use group effort in schools, (mean is 4.56 and standard deviation is .616). Referring to the findings so far, the majority of the students agreed that they prefer instructors to use more TPS activities in more of their academic works. This undoubtedly shows that students have realized the essence of working in a peers rather than working alone and have therefore developed a positive attitude towards group work. Researchers can see that the Think Pair Share method is an effective method to use in the learning process, because this method has many benefits and good improvements for students. For example, it can increase student cooperation and student response.

The study also sought to find out about students motivation when the think-pair-share teaching instruction is used. Information about this is contained in Table 7 below.

Table 7 shows students responds on motivation question about TPS teaching strategy

Motivation of students towards (TPS) items	SA	A	U	D	SD	ME	STD
1. Group TPS discussion can improve my motivation towards work.	30 (62.5%)	17 (35.4 %)	0 (0%)	1 (2.1%)	0 (0%)	4.58	0.613
2. TPS encourages me to participate more in class.	29 (60.4%)	10 (20.8 %)	1 (2.1%)	5 (10.4%)	3 (6.3%)	4.19	1.266
3. I learn science with great interest with my colleagues.	26 (54.2%)	17 (35.4 %)	0 (0%)	1 (2.1%)	4 (8.3%)	4.25	1.158
4. It always concerns me that other students perform better in science.	15 (31.3%)	21 (43.8 %)	3 (6.3%)	7 (14.6%)	2 (4.2%)	3.83	1.155
5. I seek to understand if I find difficulty in learning complex science concept.	28 (58.3%)	17 (35.4 %)	0 (0%)	3 (6.3%)	0 (0%)	4.46	0.798
6. During science activities, I prefer to ask other people for the views rather than think for myself	16 (33.3%)	12 (25%)	4 (8.3%)	9 (18.8%)	7 (14.6%)	3.44	1.486
7. When I find the science content difficult, I try to consult my friends.	18 (37.5%)	11 (22.9 %)	2 (4.2%)	8 (16.7%)	9 (18.8%)	3.44	1.583
8. When I do not understand a science concept, I would discuss with the teacher to clarify my understanding.	19 (39.6%)	13 (37.1 %)	1 (2.1%)	9 (18.8%)	6 (12.5%)	3.63	1.482
9. All science teachers should use TPS in teaching.	29 (60.4%)	16 (33.3 %)	3 (6.3%)	0 (0%)	0 (0%)	4.54	0.617

Table 7 above represents questionnaire about students' motivation to learn science through think-pair-share teaching strategy. A summary of students responds to each item is shown as:

Students were asked if TPS group discussions can improve their motivation towards academic work. Thirty participants for item 1 representing 62.5% strongly agree, 17 participants representing 35.4% agree, all participants have decided while 1 participant representing 2.1% disagree and no participant has disagreed that Group TPS discussion can improve my motivation towards work. The majority (mean is 4.56, standard deviation is 0.613) of the students indicated that group work helps them to improve their motivation towards work. Students might have seen the way individual members in the TPS approach work and this might have influenced them to have a positive motivation towards work. In this learning process students conduct discussions, then present. And this method makes students more active such as asking questions, refuting, adding, and exchanging opinions. Even according to researchers, the Think Pair Share method is still used by students when they do lectures, where in this method we are trained to be clever and courageous to convey opinions, and speak or public speaking.

For item 2, 29 respondents representing 60.4% strongly agree, 10 respondents representing 20.8% agree, 1 respondent representing 2.1% has not decided about this item, 5 participants representing 10.4% disagree, and 3 respondents representing 6.3% strongly disagree that group work encourages me to participant more in class. Students have indicated in Table 4 by agreeing that they willingly participated in group work activities (mean is 4.58). There seems to be the highest congruence in students' positive motivation at this point where students' convergence on the response was highest. The use of TPS at the school is certainly meeting the learning preference of students. This claim might be right due to how

students were willing to participate in group work activities without being compelled to do so. Based on the percentage description above, it can also be seen that many students agreed that Think Pair Share method can prevent student boredom while learning, because in this method, students play a very important role in the learning process. If the teacher is not good at choosing learning methods, it would cause students to be bored or bored while making students lazy, because in this method the teacher is taught to be creative. With creative teachers it can increase the enthusiasm of students, so they don't easily feel bored and bored. This Think Pair Share method really causes many benefits and advantages in the student learning process. Boredom is often the main factor in declining student interest and results.

In the Table 6, item 3, 26 participants representing 54.2% strongly agree, 17 participants representing 35.4% agree, all participants have decided, 1 participant representing 2.1% disagree and 4 respondents representing 8.3% strongly disagree that they learn science with great interest with my colleges. There is a highest positive responds to this of mean 4.25 and a standard deviation of 1.158 meaning that students have a great interest to learn science with their colleagues. Jacobson and Baribor (2012) reiterated that group work arouse students' learning interest, cultivate their exploring ability and creative thinking and improve their team spirit and social communication skills.

Interestingly 15 participants representing 31.3% strongly agree, 21 participants representing 43.8% agree 3 participants representing 6.3% did not decided about this item, 7 respondents representing 14.6% disagree and 2 respondents representing 4.2% strongly disagree that it is always concerns me that other students perform better in science. A high mean of 3.83 and a standard deviation of 1,155 which concern with other students to his/her paired partner understand about the learning process.

In item 5, 28 respondents representing 58.3% strongly agree, 17 respondents representing 35.4% agree, all participants has decided while 3 respondents representing 6.3% disagree and no participant strongly disagree that they seek to understand if I find difficulty in learning the complex science concept. Again, the majority (mean is 4.46, standard deviation is 0.789) of the students agreed that they are able to the consult their peers in a TPS learning situation. Such learners are seen to be cooperative. Learners being able to operate at this higher level of knowledge communicate well enough to instructional leaders to make use of more group work and also to ensure that their weak students are submerged in such a learning situation. This finding corroborates that of McLeish (2009) that CL facilitates creativity. Beebe and Masterson (2003) were also of the view that groups stimulate creativity and that with regard to problem solving, the old adage can be applied that 'two heads are better than one'. However, the nature of members in the group should be well taken into consideration if such outcome is expected.

With this item 6, 16 participants representing 33.3% strongly agree, 12 respondents representing 25% agree, 4 participants representing 8.3% are not decided, 9 participants representing 18.8% disagree and 7 participants representing 14.6% strongly disagree that during science activities, I prefer to ask other people for the views rather than think for myself. Students also had positive attitudes towards group work because they achieve intellectual growth in such a learning situation. Majority (mean is 3. 99) of the students indicated that when they work with other students they achieve more than when they work alone. By implication, there is increased learning when the learning task is approached in a collaborative manner. When each task is researched by each student in the group, unique ideas might be generated which will help to provide rich information to the students in the group. A particular student might not be in the capacity to fully research all areas of a

particular task. This is why students might have positive attitudes towards TPS. However, the degree of homogeneity in the responses of the respondents was very low (standard deviation is 1.456). Naseem and Bano (2013) believe that when students of different cognitive, intellectual and physical levels are exposed to solving a given task, they have the opportunity to interact and work as a team.

Also 18 respondents in item 7 representing 37.5% strongly agree, 11 respondents representing 22.9% agree, 2 respondents representing 4.2% are not decided, 8 respondents representing 16.7% disagree and 9 respondents representing 18.8% strongly disagree that when I find the science content difficult, I try to consult my friends. There are a lower responds of mean 3.44 and a standard deviation of 1.583 which give a negative implication and it favour to the test item.

In item 8, 19 participants in item 9 representing 39.6% strongly agree, 13 participants representing 37.1% agree, 1 participant representing 2.1% is not decided while 9 participants representing 18.8% disagree and 6 participants representing 12.5% strongly disagree that when I do not understand a science concept, I would discuss with the teacher to clarify my understanding. This test item give a of mean of 3.63 and a standard deviation, it implies that whenever students find it difficult to understand by them. Based on the percentage results above, many students agreed that the Think Pair Share method can increase students discuss and exchange ideas. This method used a discussion and group system, because this system teaches students to respect the opinions of friends and discuss what we know and accept what we don't know. Sometimes there are some children who have a high self-centered motivation so they do not want to accept opinions or are difficult to discuss. This can have a bad impact and harm to the child. Therefore, in this school,

students are taught to discuss and exchange opinions so that they have the nature of respecting other people's opinions and tolerance and high social attitudes.

Finally, 29 respondents representing 60.4% strongly agree, 16 respondents representing 33.3% agree, 3 respondents representing 6.3% are not decided while no respondent has disagree or strongly disagree that all science teachers should use TPS in teaching. Consequently to the findings so far, the majority (mean is 4.45, standard deviation is .617) of the students agreed that they prefer instructors to use more TPS activities or group assignments. This undoubtedly shows that students have realized the essence of working in a TPS rather than working alone and have therefore developed a positive attitude towards TPS work.

4.5 Discussion of Findings

Discussion are based on the questions on the study; what is the effect of think-pair-share teaching strategy on senior high school students' academic performance in selected topics in integrated science?

Table 3 shows the result of pre-test about students' conceptual understanding of selected topics in integrated science. The t-value and p-value shown that both experimental and control groups are not significantly different. It was found that there performance is very low in conceptual understanding of integrated science subject in both experimental and control groups.

While Table 4 shows the results of post-test about conceptual understanding of selected topics in integrated science. T-value and p-value show that the experimental and control groups are significantly different in their academic performance. It was found that their performance is high in conceptual understandings of selected topics in science subject in

the experimental group than the control group which implies that, the treatment have an effect on the students' performance.

Findings from the study also show that think-pair-share teaching strategy significantly increases students' performance in integrated science more than the conventional method of teaching. This finding agrees with the results of Hamdan (2017) that revealed the superiority of the experimental group who studied according to think-pair-share strategy to the control group in performance. The superiority of think-pair-share learning strategy over the conventional lecture method can be due to the fact that it is a strategy that differentiate instruction by providing students with time and structure for thinking on a given topic, question or problem, helping them to construct individual ideas and share these ideas with at least one other student. Also, while interacting and sharing ideas, students take ownership of their learning and negotiate meanings rather than relying fully on their teachers. Consequently, the learning and knowledge acquired become part of them for easy application to real life. This was also supported by Bamiro (2015) who noted that the use of think-pair-share learning strategy had great potential for improving performance in integrated science learning generally. Through the use of think-pair-share teaching strategy help students to understanding multiple intelligences, teachers can offer a paradigm shift where students take responsibility for their own learning (Meyer, 2010). If implemented with fidelity and consistency, (TPS) could be used as a way to help eliminate the achievement gap. The curriculum taught would continue to be standards-based; however, teaching would become more student-focused. Using multiple intelligences in conjunction with (TPS) in groups allows students to make choices about their learning. In turn, rather than merely memorizing facts for a test, students are inspired to seek out knowledge for a purpose, which increases retention (Meyer, 2010).

Table 5 shows the result of data analysis which was found that both male and female students are agreed that think-pair-share teaching strategy helpful to share learning problems with classmates which increase performance of students.

Also, the findings from this study revealed the effect of Think-Pair-Share teaching strategy on male and female students' academic performance in selected topics among the experimental group, that think-pair-share teaching strategy have effect on the performance of sex of students when taught selected topics using the strategy. From the results it is seen that female students perform better than the male students who taught selected topics in integrated science using this teaching strategy. The p-value is .00 with a mean difference of 9.33 clearly shown that there is a significant difference between male and female students in favour of the female who taught integrated science using think-pair-share.

Findings discovered disprove the findings of Nausheen, Alvi, Munir, and Awar (2013) and Er and Atac (2014) who found out that there are no significant differences in the performance of male and female students towards TPS.

This finding is in accordance with those of Nzewi (2010) and Oludipe (2012) also disagree with the present study, that sex had no effect on the academic achievement of students in co-operative learning such as think-pair-share learning. This result indicates that think-pair-share learning strategy favours both male and female students, and the strategy is more effective in enhancing both male and female students' achievement in chemistry. This suggests that when teachers use the right strategies and activities, female students would learn equally as their male counterparts. It can also be deduced that think-pair-share learning strategy bridges the gap in achievement between males and females.

The findings of this study agree with the findings of Kaenzig, et al (2007); Farrah (2011) and Reda (2015) who found out that there are significant differences between male and

female students' performance towards TPS. They indicated that female students had more negative performance towards TPS than the male students. This study found that male students have positive performance towards TPS. Which is the same as the present study but the only difference is that while that study female students have negative performance using TPS, this shows that female students have positive performance towards TPS.

Therefore, Fultz and Herzog (1991) argument that female students have been found to be more oriented to connection with others and nurturance which was closely related to the sex difference in TPS is neither here nor there.

The environment students seem to find themselves could be the factor resulting in these differences as already indicated that students' attitude and motivation towards teaching and learning integrated science concepts by think-pair-share method of instruction? If students develop a negative performance towards TPS then it is possible that the TPS environment is not well structured for them to enjoy such a learning situation. Students' positive performance towards TPS is not sex sensitive as far as this study is concerned.

In an informal setting within the school, students of both sexes are always found interacting with their colleagues on academic content. Therefore if students have differences in performance towards TPS, then something must be wrong with the structure of the TPS group. It is therefore very paramount for instructional leaders to use, as well as encourage both sexes to use more of TPS to enhance their learning.

This study also discusses students' attitude and motivation towards think-pair-share teaching strategy. Students' attitude towards think-pair-share teaching strategy is similar to many studies that are discussed in the background of the study in chapter one and two in the empirical framework. The findings of this study shown a significant high number of school students have positive attitude and motivation towards think-pair-share strategy of

learning. However, a significant number of students have positive attitude towards TPS. They also provide suggestions regarding the advantages and disadvantages and other related points for the implementation of this teaching strategy.

Among the negative impact of using think-pair-share on students: it is difficult for teacher to control the class, who is distributing and who engages on the discussion or not. Even though, the teacher is circulating in the class, it is somewhat difficult in controlling as who is working productively and who is not, since there is a noise of different small groups.

In addition to this implementation of think-pair-share teaching strategy it takes a long time, leads students and teacher into conflict, invites students to joke during the normal discussion, it make some teachers to be less responsible and not prepared very well.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.0 Overview

This chapter consist of the summary of the research findings, conclusion, recommendation and suggestions for future study.

5.1 Summary of the Study

Though not every student learns at the same pace or in the same way, all students can learn. The implementation of think-pair-share instruction is a way to teach students in a new and different way. The purpose of this study was to determine the effect of using the TPS teaching strategy on students' academic performance in integrated science in Senior High Schools. It also sought to investigated students' attitude and motivation when taught science using TPS teaching strategy and the study also examines the possible effect of the teaching strategy on sex in the various Senior High School students' performances in Integrated Science. The study also highlighted the theoretical, conceptual and empirical frameworks of the study.

A quasi-experimental research design was adopted for the study and a purposive sampling was also used to select respondents for this study. The instruments that were employed to gather the data were test and questionnaires and the data was analysis using statistical package for social sciences (SPSS).

The following key findings were obtained after a thorough discussion of the results:

1. There was a statistically significant difference between students in the experimental and control in favour of the experimental group when taught selected topics in integrated science using TPS. This means that the experimental group taught selected topics in integrated science using think-pair-share learning strategy

performance significantly higher than the control group taught the same selected topics using traditional method or conventional

2. There was a statistically significant difference between female and male students when both taught selected topics in integrated science using TPS teaching strategy. This means that the female group taught selected topics in integrated science using think-pair-share learning strategy performed significantly higher than their male counterparts taught the same selected topics using the same think-pair-strategy.
3. Senior High Schools and Technical Institute students had positive attitudes and motivation towards TPS teaching strategy. The findings of this study shown a significant high number of school students have positive attitude and motivation towards think-pair-share strategy of learning. However, a significant number of students have positive attitude towards TPS. They also provide suggestions regarding the advantages and disadvantages and other related points for the implementation of this teaching strategy.

Furthermore, Senior High Schools may want to develop methodology courses that implicitly teach future educators not only how to implement think-pair-share but also its benefits as well. Further research must be done on this subject to determine if it is a method that should be adopted at all levels nationwide. The only way for that to occur is if further research is done to determine its efficacy. The positive results of this study warrant further investigation and anyone interested in increasing student achievement may want to explore cooperative learning as a means to reach that goal.

5.2 Conclusion

From this study, it had gathered that using think-pair-share in my classroom allowed me to increase the amount that students participated in class discussion, increase the number of

long explanations students gave, and increase their comfort when sharing their thoughts and ideas. By increasing student participation in class discussion and by increasing students' long explanations; students were communicating their thinking more to me and other students. This has many benefits including providing the opportunity for students to learn from each other, practice using and developing their science reasoning skills, and providing students with a form of formative assessment. Using this technique also seemed to help a few students increase their confidence in their problem solving abilities and ability to contribute in class discussion. These results reinforce the decision to use think-pair-share in my instruction and would continue to use this (TPS) technique. Although I did get very positive results, this may only be due in part to using think-pair-share. Many students expressed to me that the content we covered while we were not using think-pair-share was more challenging for them. This difference in difficulty for students could lead to students feeling more comfortable and confident with the content they enjoy more and that is easier for them to understand. Also, if students understand the content more they may be more willing to contribute to discussion, and they may have a greater ability to give long explanations. The researcher would like to study students' participation and confidence during different units so that I can determine whether the content is playing a significant role in the results. However, reviewing hours of video was very time consuming, and I do not think that this would be very practical for a longer study.

The Discussion allows teachers to gain insight into their students‟ understanding. Gaining this insight can be very beneficial to teachers and students because it can allow teachers to tailor their instruction to their students‟ needs. Discussions in small groups provide students a platform to practice critiquing others‟ reasoning and to practice constructing their own arguments. These are important skills for students to master and will help in their

future learning and future lives outside of school (Freeman, 2013). TPS promotes classroom participation by encouraging a higher degree of pupil response, rather than using a basic recitation method in which a teacher poses a question and one student offers a response. This strategy provides an opportunity for all students to share their thinking with at least one other student which, in turn, increases their sense of involvement in classroom learning and critical thinking. Think-Pair-Share can also be used as an information assessment tool; as students discuss their ideas, the teacher can circulate and listen to the conversations taking place and respond accordingly. It also can be used to gauge conceptual understanding, filter information, draw conclusions and encourage peer learning among students.

5.3 Recommendation

The study recommended think-pair-share strategy within the teaching strategies used by students during the teaching and the involvement of teachers in training courses on think-pair-share strategy, and to conduct further studies on the strategy for in service training in the form of workshops, conferences, seminars should be organized by governments to equip teachers to incorporate think-pair-share teaching strategy in science teaching to ensure meaningful learning.

Science educators and curriculum planners should incorporate innovative pedagogical strategies like (TPS) learning instructional strategy into their various teacher education programmes another stages.

Teachers together with the Counselling Centre of the Schools should emphasize the benefits of think-pair-share to students. This will help more students to develop an interesting to this learning strategy. Teachers should also pay more attention to group

dynamics when using think-pair-share technique so that students are not hindered in their participation in group work.

5.4 Suggestions for Further Studies

1. Generally, the implementation of think-pair-share teaching strategy can enhance the students' critical thinking and the class climate during the teaching and learning process. Somehow, think-pair-share is not the only thing that can enhance Senior High School students' critical thinking.
2. It should be supported by the other strategies in the class and the student's activeness in order to achieve the maximum result of the students' critical thinking in solving science problem in class. The science teacher should create an enjoyable learning activity in which the students are provided plenty opportunities to explore their ideas and to derive knowledge and information. This way, the students will learn more to be critical in thinking.
3. The science teachers can also implement various methods in teaching writing in order to maintain the students' interest toward the lesson. For the students, (TPS) assists the students to develop multiple arguments. The multiple ideas can encourage the students' thinking. Thus, it will improve their critical thinking as they improve their problem solving skill. Listening to another student's idea will also facilitate them to find out more knowledge.

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APPENDIX 1

PRE- TEST

Test questions that is use to assesses students' knowledge in both experiment and control group. The following questionnaire is part of a study being conducted for a master of philosophy degree. You are required to respond to the items as sincere as possible. The information you provide will only be used for the purpose of research and will be **kept confidential.** Therefore, **do not write your name or index number on this questionnaire.** Please note that there are no right or wrong responses to these items but what is only appropriate to you. Please, the questionnaire consists of two parts A is design to collect personal information and B is also design to collect general information. Each item is followed by five options; choose the option that best describes your opinion by indicating tick (√) in the appropriate box.

Thank you for your co-operation.

A. Personal information

1. Sex: Male ☐ Female ☐

   Age 16-21 □

A. General information

Choses the correct option that best answer the question

1. $Zn(NO_3)_2$ is the salt produced by the reaction of
   i. $ZnCO_3$ and HNO_3
   ii. ZnO and HNO_3
   iii. $Zn(OH)_2$ and HCl
      a. I only
      b. II, III
      c. I, II, III
      d. I, II
2. Purple colouration of older leaves of plants is a major deficiency symptoms of

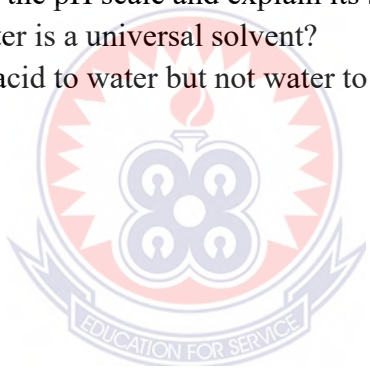
a. Calcium
b. Nitrogen
c. Potassium
d. Phosphorus

3. Waterlogging in soil could be controlled through
   a. Mulching
   b. Irrigation
   c. Drainage
   d. Leaching
4. Which of the following ions can cause permanent hardness in water
   a. Ca^{2+}
   b. K^{+}
   c. Na^{+}
   d. Zn^{2+}
5. Which of the following processes does not contribute to the water cycle?
   a. Evaporation of sea and soil water
   b. Deforestation
   c. Running water into sea
   d. Rainfall
6. Which of the following indicators can measure pH value most accurately?
   a. Litmus piper
   b. Methyl orange
   c. Phenolphthalein
   d. Universal indicator
7. The removal of plants nutrients by water percolation downwards from the reach of plants is called
   a. drainage
   b. erosion
   c. infiltration
   d. leaching
8. The type of soil erosion cause by water from exposed land on a gentle slope is referred to as
   a. Gulley erosion
   b. Rill erosion
   c. Sheet erosion
   d. Splash erosion
9. Acid react with many reactive metal to give off
   a. Hydrogen gas
   b. Oxygen gas
   c. Ammonia gas
   d. Carbon dioxide gas

10. The best way to reduce soil erosion in hilly is by
    a. mulching
    b. erected barrier
    c. practicing terracing
    d. apply organic fertilizer
11. The number of ionisable hydrogen atoms in one molecule of an acid is its
    a. acidity
    b. alkalinity
    c. atomicity
    d. basicity
12. Which of the following method is use for seed showing and fertilizer application
    a. Drilling
    b. Band placement
    c. Side placement
    d. Top dressing
13. Which of the following method of treating water would make it soft
    a. chlorination
    b. filtration
    c. addition of alum
    d. ion exchange
14. Humus content in the soil can be improved through the application of
    a. compost
    b. NPK
    c. urea
    d. sulphate of ammonia
15. Removing rubbish and sediments from gutter is called
    a. Filling
    b. Opening
    c. Desilting
    d. Mending

Section **B**

1. I. what is acid?
   ii. With the help of an equation explain neutralization reaction
   iii. Mention three negative effects chemical fertilizers on the soil.
   iv. Explain how boiling remove temporal hardness of water
2. i. What is soil nutrient?
   ii. Differentiate between major and minor nutrients
   iii. Differentiate between organic and inorganic acid
   iv. Outline four ways in which cover cropping maintains soil fertility
3. i. Explain why an ion exchange method would not be good for softening seawater.
   ii. Explain why a piece of chalk does not dissolve in water as much as much as salt
   iii. Name three properties of base
   iv. What is soft water?
4. i. What is soil erosion?
   ii. Give the range of the pH scale and explain its significance
   iii. Explain why water is a universal solvent?
   iv. Why do we add acid to water but not water to acid?



APPENDIX 2

POST-TEST

Test questions that is use to assesses students' knowledge in both experiment and control group. The following questionnaire is part of a study being conducted for a master of philosophy degree. You are required to respond to the items as sincere as possible. The information you provide will only be used for the purpose of research and will be **kept confidential.** Therefore, **do not write your name or index number on this questionnaire.** Please note that there are no right or wrong responses to these items but what is only appropriate to you. Please, the questionnaire consists of two parts A is design to collect personal information and B is also design to collect general information. Each item is followed by five options; choose the option that best describes your opinion by indicating a tick (√s) in the appropriate box.

Thank you for your co-operation.

B. Personal information

2. Sex: Male ☐ Female ☐

   Age 16-21 □

B. General information

Section **A** answer all questions

1. Which of the following compounds will accept hydrogen ions in solution
   a. H_2SO_4
   b. NH_4Cl
   c. NH_3
   d. NaCl

2. When the pH values of two solutions are 4 and 7 respectively, it indicates that the solution are:
   a. Acid and base
   b. Base and acid
   c. Neutral and acid
   d. Acid and neutral
3. The classification of nutrient into micro-and micro-nutrients is based on
   a. Their solubility
   b. The amount require by plants
   c. Their sizes
   d. The types of plants that use them
4. One example of a micro-nutrient is
   a. Phosphorus
   b. Calcium
   c. Manganese
   d. Magnesium
5. The treatment of water for public consumption can be done by:
   i. Sedimentation
   ii. Filtration
   iii. Adding chlorine
   iv. Distillation
      a. I, II
      b. III, IV
      c. I, II, III
      d. I, II, III, IV
6. The scale formed on kettle after prolonged use, may be removed by adding
   a. Ethanol
   b. Hot water
   c. Turpentine
   d. Vinegar
7. Which of the following compounds will accept hydrogen ions in solution
      a. H_2SO_4
      b. NHCl
      c. NH_3
      d. NaCl
8. The following is not a process stage in the making of water potable
   a. Sedimentation and coagulation
   b. flocculation
   c. chlorination
   d. boiling
9. Which of the following factors does not deplete soil resources

a. Soil erosion
b. Liming
c. Deforestation
d. Surface mining

10. Which of the following indicators can measure pH values most accurately?
    a. litmus
    b. methyl orange
    c. phenolphthalein
    d. universal indicator
11. A 100kg NPK (15:15:15) compound fertiliser has a filler make-up weight of:
    a. 30kg
    b. 40kg
    c. 45kg
    d. 55kg

12. One example of a soil macro-nutrient is:
    a. phosphorus
    b. calcium
    c. manganese
    d. magnesium
13. Water is polar because it:
    a. Boils at 100^0c
    b. Is attracted by charged materials
    c. Falls by gravity
    d. Contains an oxygen atom in the molecule
14. Which of the following is a compound fertilizer?
    a. Urea
    b. NPK
    c. Superphosphate
    d. Muriate of potash
15. Distilled water has a pH of 7. After leaving it in air for three day, the pH changes to 6.8. The following deductions can be made:
    i. Air has dissolve in distilled water
    ii. The acid concentration of the distilled water has increased
    iii. The alkalinity of the distilled water has increased
        a. I
        b. I, II
        c. II
        d. II, III

Section **B** answer three question in this part

1. i. What is a base?
   ii. Distinguish between arhnious and bronsted-lowry definition of acid
   iii. Outline the way through which soil moisture can be reserved
   iv. Explain three method of softening what
2. i. What is water pollution?
   ii. Explain two chemical properties of acid and base
   Iii. State three importance of compost
   iv. Mention three chemical properties of water
3. i. What are fertilizers?
   ii. Outline three activities that farm can undertake to enhance soil productivity
   iii. Explain why industries use soft water rather than hard water?
   iv. Explain how to test for the presence of water in a substance
4. i. What is a salt?
   ii. State three types of salt
   iii. Use cabbage, beans, carrots and onion to explain crop rotation
   iv. Explain how compost is prepared

APPENDIX 3

QUESTIONS FOR STUDENTS TOWARDS THINK PAIR SHARE (TPS) TEACHING STRATEGY

Questions that is use to assesses students' knowledge in both experiment and control group. The following questionnaire is part of a study being conducted for a master of philosophy degree. You are required to respond to the items as sincere as possible. The information you provide will only be used for the purpose of research and will be ***kept confidential.*** Therefore, ***do not write your name or index number on this questionnaire.*** Please note that there are no right or wrong responses to these items but what is only appropriate to you. Please, option that best describes your opinion by indicating a tick (√) in the appropriate box.

C. Personal information

3. Sex: Male ☐ Female ☐

4. Age 16 - 21 □

D. ATTITUDE QUESTIONS FOR STUDENTS TOWARDS THINK-PAIR-SHARE TEACHING STRATEGY

Please tick (√) the appropriate column of the response that best suits your interest

Attitude and motivation of students towards (TPS)	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
13. I normal study integrated science on my own.					
14. I often study integrated science in (TPS) group discussion.					
15. I gain more knowledge by discussing with my peers.					

16. I contribute fairly during (TPS) group work.					
17. I prefer to work on my own.					
18. I learn more from direct teacher instruction.					
19. I relate well with other group members.					
20. Other group members explain things I don't understand.					
21. I help others who don't understand during discussing.					
22. I solve more integrated science problems with colleagues.					
23. TPS group work does not improve my performance.					
24. It is fair to use group effort in schools.					

E. **MOTIVATION QUESTIONS FOR STUDENTS TOWARDS THINK-PAIR-SHARE TEACHING STRATEGY.**

Please tick (√) the appropriate column of the response that best suits your interest

Motivational questions	Strongly agree	Agree	Undecided	disagree	Strongly disagree
10. TPS discussions can improve my motivation towards work					
11. TPS group work encourages me to participant more in class.					
12. I learn science with great interest with my colleges.					
13. It always concerns me that other students perform better in science.					
14. I seek to understand if I find difficulty in learning the science.					
15. During science activities, I prefer to ask other people for the views rather than					

think for myself.					
16. When I find the science content difficult, I try to consult my friends.					
17. When I do not understand a science concept, I would discuss with the teacher or other students to clarify my understanding.					
18. All science teachers should use TPS work in teaching students in schools.					