# TEACHING METHODS AND LEARNERS' ACADEMIC PERFORMANCE IN CHEMISTRY IN SELECTED UNIVERSAL SECONDARY EDUCATION SCHOOLS IN ARUA DISTRICT, UGANDA

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## DECLARATION

I hereby declare that, this research dissertation on the topic "Teaching methods and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District, Uganda" is my original work and to the best of my knowledge, it has never been presented for any award of any institution.

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## APPROVAL

This research dissertation on the study: "Teaching methods and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District, Uganda" was carried out under the supervision of:

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## DEDICATION

This research dissertation is dedicated to my wife Mrs. Judith Ezaku and our Children: Avasi Laban Jeremiah, Aitasi Hannah Catherine and Zaku Jethro Mark.

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First and foremost, I would like to thank the Almighty God who has been, and continues to be faithful to me throughout my life. Surely, Lord God, you are my shepherd. Though you are invisible, I have seen your hand touch my life. Sincere thanks go to my supervisors; Dr. Paul Edabu and Rev. Fr. Prof. Odubuker Picho Epiphany. I also thank all my lectures, the staff of Muni University Library and all the heads of schools from which I collected data, my colleagues and to all the authors of articles and books whose works I cited. May God bless all of you.

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## LIST OF ABBREVIATIONS

| | |
|---|---|
| CVI: | Content Validity Index |
| IBL: | Inquiry-based Learning |
| NCDC: | National Curriculum Development Center |
| PISA: | Program for International Student Assessment |
| SESEMAT: | Secondary Science and Mathematics Teachers |
| STEM: | Science, Technology, Engineering and Mathematics |
| STIR: | School Teacher Innovation for Results |
| UACE: | Uganda Advanced Certificate of Education |
| UCE: | Uganda Certificate of Education |
| UNEB: | Uganda National Examinations Board |
| USE: | Universal Secondary Education |

## ABSTRACT

This study was aimed at establishing the relationship between teaching methods and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District. This was prompted by the poor academic performance of learners in Chemistry from 2017 to 2022. The objectives of the study were to establish the relationship between group-discussion, inquiry-based and lecture methods of teaching and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District. A correlational cross-sectional survey design was used. Both quantitative and qualitative approaches with a sample of 262 respondents was used. Simple random sampling technique was used to select among the learners while purposive sampling technique was use to select the teachers. A structured questionnaire was used for collecting data from the learners while an observation guide was use to collect data from teachers. The validity of the questionnaire was 0.726 while that of the lesson observation checklist was 0.720. The questionnaire was reliable with a Cronbach Alpha Index of 0.719. The quantitative data collected was analyzed using descriptive statistics (frequencies, percentages and mean) and inferential statistics (Pearson's correlation) while the qualitative analysis used thematic approach. Findings from the study show a statistical insignificant value ($p=.449$) between group-discussion method of teaching and learner' academic performance, a statistically significant value ($p=.000$) between inquiry-based method of teaching and learners' academic performance, and a statistical insignificant value ($p=.344$) between lecture method of teaching and learners' academic performance. It was therefore concluded that teaching methods significantly affected learners' academic performance in Chemistry in selected Universal Secondary Education schools. Finally, the study recommended that Chemistry teachers in the selected Universal Secondary Education schools in Arua District should focus on using inquiry-based method of teaching but not on group-discussion method of teaching and lecture method of teaching.

# CHAPTER ONE

# INTRODUCTION

## 1.1 Introduction

This study aimed at establishing the relationship between teaching methods and learner's academic performance in Chemistry in selected Universal Secondary Education schools in Arua District. This chapter presents; the background to the study, statement of the problem, purpose of the study, objectives of the study, research questions, research hypotheses, scope of the study, conceptual framework, significance of the study, justification of the study and the operational definitions.

## 1.2 Background to the study

The background to the study involved four perspectives namely; historical perspective, theoretical perspective, conceptual perspective and contextual perspective.

### 1.2.1 Historical perspective

The primary objective of teaching is to impart knowledge and wisdom in the learner (Tebabal and Kahssay, 2011). This implies that, to bring about this change, a teacher has to devise an appropriate means through which this change can be brought about. Efe, et al., (2016) observes teaching methods as the means through which students are helped to study effectively. They opine that teaching methods are tactics which teachers use to achieve the objectives of teaching. This implies that teaching methods are very important in enhancing learning. Historically, there has been a relationship between teaching methods and learners' academic achievement right from primary education to tertiary education.

In India, a study conducted by Kapur, (2018) found out that teaching methods affect academic performance. He proposes that teachers need to use appropriate methods that help learners to gain courage. Additionally, the teaching methods should be those that benefit the learners. For example, if the learners understand better by reading to them notes, then teachers should provide the notes. If the learners understand better through verbal explanations, then teacher should explain to them verbally. All these strategies should aim at helping learners to understand better (Kapur, 2018).

In a study done by Isa et al., (2020) in Nigeria, the findings showed that, the academic performance of learners in secondary schools was immensely affected by the use of ineffective teaching methods used by teachers while conducting their lessons. This implies that the teaching methods used by teachers greatly affects learners' classroom achievement. If the method is appropriate, learners' achievement is positively affected and if the method is inappropriate, learners' achievement is negatively affected. In South Africa, study done by Schulze and Bosman, (2018) found out that the individual learning style is the most preferred learning style. The study recommended the creation of a positive learning environment coupled with the use of teaching methods that encompass a variety of learning styles.

In Kenya, Nyagah and Irungu, (2013) report that pedagogical practices by teachers impacted the learning achievement of learners. Learners' poor academic performance of especially in science subjects was attributed to the poor teaching methods used by the teachers. In another study by Sibomana et al., (2021) on the factors which affect academic performance of students in secondary schools in Rwanda, it was found out that teaching methods had a greatly affected learners' academic performance in Chemistry. The study recommended that teachers needed to be updated about the factors affecting learners' academic performance in Chemistry as well as the methods

needed to improve students' academic achievements. Although the two studies agree that teaching methods affect academic performance of learners, the studies were not carried out in Chemistry. This therefore leaves a knowledge gap in Uganda, Westnile, Arua District, which needs to be investigated.

In Uganda, a study carried out by Ssempala, (2017) in Kampala found out that teachers' understanding of the inquiry-based learning as a method of teachnig was inadequate. This implies that teachers were using teaching methods which were inappropriate hence affecting academic performance. The study recommended that policymakers and teacher educators of Uganda urgently needed to address both the internal and external factors which influence science teachers' understanding and practice of inquiry-based learning hence improving the teaching and learning of science subjects.

In Arua district, Bileti, (2022) found that there existed a significant influence of Active teaching on students' academic achievement in secondary schools with a positive influence of active teaching and learning influencing academic performance by 40.1%. The study found out that previously, teachers mainly used the teacher centered approach while teaching and as a result, the academic achievement of learners was low. The study recommended that teachers together with other stakeholders needed to be innovative when using Active Teaching and Learning method to improve students' academic performance.

In all the above studies, it can be concluded that teaching methods have an effect on learners' academic performance. This implies that the out any teaching method is reflected in the academic performance of learners.

### 1.2.2 Theoretical perspective

This study was guided by the Active Learning theory postulated by (Bonwell and Eison, 1991). Active learning builds on the constructivist learning theory, which stipulates that for learning to take place, there must a connection between new ideas and experiences with their previous knowledge. Bonwell and Eison, (1991) conceived the idea of active learning as a learner-centered teaching approach in contrast to the traditional teacher centered lecture where students passively receive information.

The theory postulates that, as learners interact with the environment and reflect on their experiences, they build their own knowledge and also incorporate it into the pre-existing one. Teaching methods which involve active learning enable learners to become part of the learning process and own the responsibility of their learning which leads to an increase in their academic achievement (Bonwell and Eison, 1991).

### 1.2.3 Conceptual perspective

Teaching methods is described as a strategy used to enable students learn the contents of a course hence developing goals to be achieved in the future (Sarode, 2018). On the other hand, Liu and Shi, (2007) define teaching method as a set of strategies, procedures or principles teachers implement to achieve desired learning in students. The definition of teaching method was adapted from Liu and Shi, (2007) and it is teaching strategy used by the teacher to achieve the set learning objectives. In this study, teaching methods was characterized by inquiry-based method, group-discussion method and lecture method.

This study investigated the relationship between teaching methods and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District. Teaching methods was measured in terms of group-discussion method, inquiry-based method and lecture method as the independent variables while learners' academic performance was the dependent variable.

According to Narad and Abdullah, (2016), academic performance is defined as the knowledge gained by learners which is expressed in form of marks. They added that performance takes place when educational goals set by the teacher or the school are met. The goals are measured by continuous assessment or examinations results. In this study, learner' academic performance was adapted from the definition of Narad and Abdullah, (2016). It was thus defined as a representation of the performance outcomes which shows at what extent a learner has accomplished specific goals which were set in an instructional environment, specifically in education institutions. Academic performance is characterized by classroom assessment results and from standardized tests. However, this study focused on results from standardized tests.

Discussion is an activity in which learners work together in a small group to achieve a clearly assigned learning task (Cohen and Lotan, (2014). Furthermore, Galanes, et al., (2004) state that group discussion is a small group of people who communicate among themselves to achieve a goal. This may be in form of understanding, coordination, or findings solution to a shared problem. The definition of discussion method was adapted from Cohen and Lotan, (2014) as a learning activity in which learners within a small group engage in sharing ideas in order to find solutions to a given task assigned to them by the teacher. Discussion method of teaching is characterized by cooperative learning in the group, learners doing peer teaching, learners discussing their groups and learners actively participating/engaging in their groups.

Inquiry-based learning is described as an instructional practice which puts students are at the center of the learning experience. The students take ownership of their own learning through posing questions, investigating, and answering questions (Caswell and LaBrie, 2017). On the other hand, Spronken-Smith and Walker, (2010) describe inquiry-based teaching as a method of self-directed learning where learners take responsibility for their learning. The definition of inquiry-based teaching method was adapted from Spronken-Smith and Walker, (2010) and it is a teaching strategy in which learners are given the opportunity by the teacher to explore the learning content through systematic investigation. Inquiry-based teaching method will be characterized by learners posing questions, learners solving questions, teacher encouraging more free investigation and the teacher asking probing questions.

The lecture method is described as a strategy in which the lecturer is the source of information while students have to remember what the lecturer says (Newton, et al., 1999). Ekeler, (1994) further defines lecture method as a teaching strategy in which the instructor presents his or her ideas in a highly structured manner and expects and receives no active participation in the dispersal of knowledge from the student audience. In this study, the lecture method was adapted from the two authors and was treated as the approach to teaching in which the teacher is the sole source of information, and plays the active role during lesson delivery, while learners simply do the listening and only take notes which are also given by the teacher. Lecture method of teaching is characterized by activities such as; all instructions coming from the teacher, all information coming from the teacher, the teacher doing all the talking (asking questions) and learners only taking notes from the teacher.

### 1.2.4 Contextual perspective

National Curriculum Development Center (NCDC) as the developers of the Chemistry curriculum recommend the use of teaching methods that engage learners and reinforce knowledge, concepts and skills (NCDC, 2023). The methods also help learners to move from short-term retention and achieve deeper levels of understanding which increase their academic performance. These teaching methods are learner-centered and they include; discussion method, problem-solving method, demonstration method, project method and guided discovery among others (Kamugisha, (2012). The use of these teaching methods enables learners to; concentrate on their learning since they do not merely sit to get knowledge, gives learners a chance to own their learning materials, they learn and own their learning, use core content which is highly engaging and meets their needs, gives feedback to students for their improvement, and use varied teaching techniques which are appropriate for them to achieve their learning goals. All these lead to an increase in learners' academic achievement (Darsih, (2018). However, the performance of learners in Chemistry in Arua District still remains low. Table 1.1 shows the performance of learners in Chemistry in Arua District in Uganda Certificate of Education (UCE) for the years; 2017, 2018, 2019, 2020 and 2022.

**Table 1.1**

*UCE Chemistry Results (%) for Arua District from 2017 – 2022*

| Year | D1 | D2 | C3 | C4 | C5 | C6 | P7 | P8 | F9 |
|---|---|---|---|---|---|---|---|---|---|
| 2022 | 0.000 | 0.000 | 1.593 | 1.238 | 0.883 | 2.831 | 9.607 | 33.100 | 50.791 |
| 2020 | 0.000 | 0.000 | 0.000 | 0.000 | 0.556 | 2.402 | 6.464 | 21.271 | 69.307 |
| 2019 | 0.000 | 0.000 | 0.000 | 0.513 | 1.563 | 5.167 | 19.580 | 41.179 | 31.998 |
| 2018 | 0.000 | 0.000 | 0.000 | 0.000 | 0.257 | 3.667 | 13.075 | 28.955 | 54.046 |
| 2017 | 0.000 | 0.000 | 0.000 | 0.000 | 0.924 | 1.879 | 8.633 | 18.132 | 70.432 |

**Source**: *UNEB, (2023)*

Table 1.1, shows that from 2017 to 2022, more than half of the learners failed Chemistry. Table 1.2 shows the performance of learners in Chemistry in Arua District in Uganda Advanced Certificate of Education (UACE) for the years; 2017, 2018, 2019, 2020 and 2022.

**Table 1.2**

*UACE Chemistry Results (%) for Arua District from 2017 – 2022*

| YEAR | A | B | C | D | E | O | F |
|---|---|---|---|---|---|---|---|
| 2022 | 0.000 | 0.000 | 6.667 | 0.000 | 13.333 | 66.667 | 13.333 |
| 2020 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 21.053 | 78.949 |
| 2019 | 0.000 | 0.000 | 0.000 | 8.333 | 8.333 | 37.500 | 45.833 |
| 2018 | 0.000 | 0.000 | 0.000 | 30.000 | 30.000 | 10.000 | 30.000 |
| 2017 | 0.000 | 0.000 | 0.000 | 11.765 | 5.882 | 76.470 | 5.882 |

**Source**: *UNEB, (2023)*

Table 1.2, shows the performance of the majority of learners passed with a weak pass (E and O) while the rest obtained F (Fail) in Chemistry in Uganda Advanced Certificate of Education (UACE) from 2017 to 2022 in the selected schools in Arua District. There could be a number of factors at the backdrop of this discrepancy in performance of learners in the subject such as poorly equipped laboratories, negative attitude of learners towards learning, low cognitive abilities of learners, lack of teachers and poor teaching methods. However, this study focused on the teaching methods used by teachers while delivering Chemistry lessons. Therefore, this study intended to establish how teaching methods influence learners' academic performance in Chemistry.

## 1.3 Statement of the problem

The Ministry of Education and Sports has come up with interventions such as SESEMAT (2005), STiR education (2014) and enhancement of salaries for science teachers (2022/2023 financial year) to motivate and improve science teachers' pedagogical capabilities so as to increase learners' academic performance in science subjects including Chemistry.

However, results from UNEB (2017 -2022) indicate that the performance of learners in Chemistry in Arua District has been poor with 55.314% of learners failing and 19.79% of the learners obtaining weak passes in UCE while 34.79% of the learners failing and 42.34% of the learners obtaining weak passes in UACE. There could be others factors contributing to the observed poor academic performance as stated by UNEB (*UCE Results 2020 Released*). If this trend is left unchecked, the observed trend of poor academic performance of learners in Chemistry is likely to continue. There could be others factors contributing to the observed poor academic performance as stated by UNEB (*UCE Results 2020 Released*). If this trend is left unchecked, the observed trend of poor academic performance of learners in Chemistry is likely to continue.

Therefore, it is the gap in performance of learners which prompted this study to establish the relationship between group-discussion, inquiry-based and lecture teaching methods and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District.

### 1.4 Purpose of the study

This study was intended to establish the relationship between teaching methods and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District.

### 1.5 Objectives of the study

This study aimed at achieving the following objectives.

1. To examine the relationship between discussion method of teaching and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District.

2. To investigate the relationship between inquiry-based method of teaching and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District.
3. To establish the relationship between lecture method of teaching and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District.

## 1.6 Research questions

This study aimed at answering the following questions.

1. What is the relationship between discussion method of teaching and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District?
2. What is the relationship between inquiry-based method of teaching and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District?
3. What is the relationship between lecture method of teaching and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District?

## 1.7 Research hypotheses

This study sought to prove the following hypotheses.

1. There is a relationship between discussion method of teaching and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District.

2. There is a relationship between Inquiry-based method of teaching and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District.
3. There is a relationship between Lecture method of teaching and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District.

## 1.8 Scope of the study

The scope of the study involved: the content scope, the geographical scope, and the time scope.

### 1.8.1 Content scope

This study concentrated on investigating the relationship between; discussion method of teaching, inquiry-based method of teaching, and lecture method of teaching only and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District. This is because, the group-discussion teaching methods and the inquiry-based method of teaching a are some of the methods that promote active learning. On the other hand, the lecture method though often discouraged, is the commonly used method that teachers prefer to use.

### 1.8.2 Geographical scope

This study aimed at only investigating the relationship between teaching methods and learners' academic performance in Universal Secondary Education (USE) schools in Arua District. This is because, these are the only schools implementing the Universal Secondary Education government program in the Arua District.

### 1.8.3 Time scope

The study investigated the relationship between teaching methods and learners' academic performance for a period of five years (2017, 2018, 2019, 2020 and 2022). This is because, research experts recommend that, for any study to be authentic, information should have been got from a period of not less than five years (Amin, 2005)

## 1.9 Conceptual framework

The conceptual framework indicates the relationship between teaching methods and academic performance.

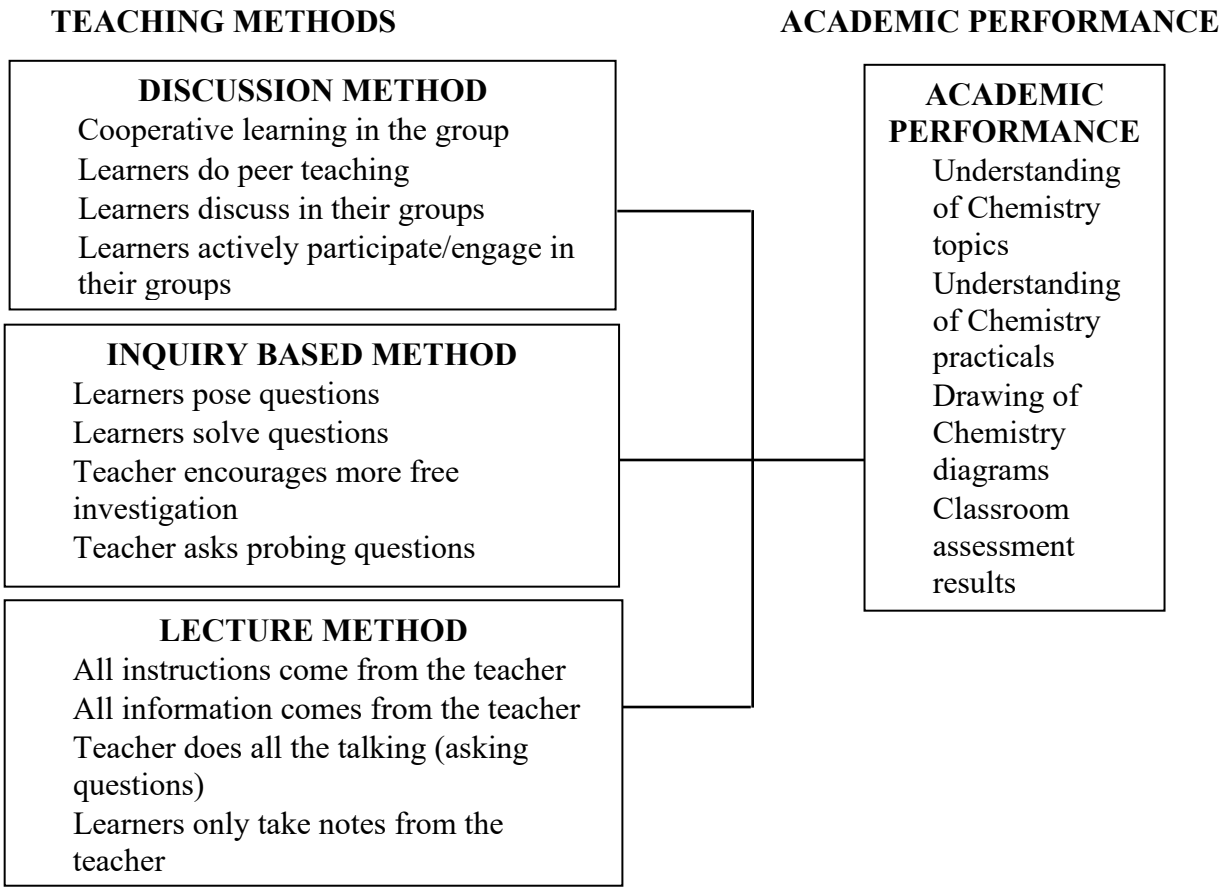


**Fig 1:** *Conceptual Diagram Showing the Relationship between Teaching Methods and Academic Performance of Learners in Chemistry*

**Adapted from**: *Picho, (2014) and modified by the researcher (2023)*

The conceptual framework is based on the theoretical framework that the teacher's achievement of lesson objectives depends on the appropriate teaching strategies employed by the teacher. This is shown by the grades the learners get which translate into academic performance.

In Figure 1, teaching methods is conceptualized as discussion method, inquiry-based method and lecture method while academic performance is conceptualized as understanding of Chemistry topics, understanding of Chemistry practicals, drawing of Chemistry diagrams and classroom assessment results.

### 1.10 Significance of the study

This study aimed at finding the relationship between teaching methods and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District. The study can be useful in the following ways.

This study can be a great resource to teachers and school administrators in planning for their schools in terms of capacity building and refresher courses for their teachers. It can also help schools lay strategies for improving on the academic performance of their learners not only in Chemistry, but also in other subjects.

The findings of this study can be used by the Ministry of Education in formulating policies in regard to the teaching of science subjects, science teachers and the overall achievement of educational objectives.

### 1.11 Justification of the study

As the nation and the world at large focus on sciences as the key ingredient for development, the government of Uganda has over the years, touted the need for sciences in order for the country to

develop. In order to achieve this, it has come up with a number of strategies, which among others include; distribution of science kits in many government-aided Universal Secondary Education schools, built and furnished science laboratories in many government-aided Universal Secondary Education schools, focused on the recruitment of more science teachers for secondary schools, enhanced the salaries of science teachers and also introduced an in-service program called SESEMAT for science teachers to retool them on pedagogical approaches of teaching sciences. However, in spite of all these, the performance in sciences with Chemistry inclusive has continued to be poor. The persistent low scores by learners in Chemistry as one of the science subjects needs to be addressed. If this is not done, the number of learners who take Chemistry at high school will reduce. This will result in a reduction in the number of candidates who would enroll for science-based courses that require Chemistry at tertiary institutions. As a result, the number of professionals in some fields such medicine and chemical engineering will reduce, which will affect service delivery to the country and thus the goal of science-led development may not be achieved, if the learners who lay the foundation for this development continue to fail at a lower level. Therefore, this study aimed at establishing the relationship between the teaching methods used by teachers and the observed trend of learners' academic performance in Chemistry.

### 1.12 Operational definitions

**Academic performance**

According to Yusuf et al., (2016), academic performance is defined as a measurable and observable behavioral change of a student within a specific period. In this study, academic performance is the assessment result which a learner gets in any subject. The result is in from of a grade. In this study, academic performance was determined by results from classroom assessment.

The grades are assigned as follows; Distinction (D), Credit (C) and Fail (F) where; Distinction (D) indicates the highest level of achievement, Credit (C) indicates an average level of achievement and while (F) indicates the lowest level of achievement.

**Group-discussion method**

Group-discussion as an activity in which learners share information within their group to find solutions to a task given (Arends, (2007). In this study, discussion method meant a teaching method in which learners are divided into small groups by the teacher, given tasks by the teacher, discuss these tasks in their groups and make their presentations to the class while the teacher harmonizes the learners' presentations at the end.

**Inquiry-based learning method**

Inquiry-based method is described as a teaching method in which a teacher sets up an experiment, directs, and provides hints along the way to enable students come to solutions (Krisnwati, 2015). In this study, inquiry-based method meant an approach to learning in which learners are engaged in problem-solving through asking probing questions that lead to their learning.

**Lecture method**

Lecture method of teaching is described as a persuasive approach in which students work alone on the same task while being instructed by the teacher (Davis, 1992). In this study, lecture method meant teacher-centered method of teaching used by teachers in which the teacher dominates teaching and learning process, is the source of all knowledge and information and does almost all the talking, while the learners do the listening and only take notes given by the teacher.

**Teaching method**

Teaching method is the application of strategies and ways to manage a learning task so as to facilitate a learning process (Kimweri, 2004). In this study, teaching methods meant strategies teachers use to pass knowledge and skills to their learners.

# CHAPTER TWO

# LITERATURE REVIEW

## 2.1 Introduction

This chapter presents the review of related literature. The review of related literature was done on; the theoretical review, conceptual review, discussion method and academic performance, inquiry-based method and academic performance, and lecture method and academic performance. Finally, the summary of review of related literature is included.

## 2.2 Theoretical review

The study was guided by the Bonwell and Eison, (1991) theory of active learning. Bonwell and Eison, (1991) defined active learning as an instructional method in which learners are involved in the learning process. According to Bonwel and Eison, (1991) active learning is "*anything that involves learners in doing things and thinking about the things they are doing*". According to this theory, learners are supposed to own the responsibility of their learning. To do this, a learner has to play an active role during the lesson. This theory proposes that it is the responsibility of the teacher to devise a teaching strategy that facilitates active learning. Accordingly, active learning correlates with the traditional lecture method which engages learners with activities which entices them to participate in learning while applying knowledge through experience, transfer of skills across context and developing conceptual awareness.

Active learning is centered around learners' activities and engagement while learning. Bonwell and Eison, (1991) suggest that the strategies that cultivate active learning include; problem-based learning, experimental learning, inquiry-based instruction and discovery learning. According to Bowell and Eison, (1991), while teaching, teachers need to put emphasis on active learning

strategies. These include; brief demonstrations, class discussion to increase student engagement and using multiple pauses during the lesson in order to enable learners to reflect on what they are learning and to consolidate their notes. Others include; small group discussions of the subject matter to stimulate creativity, using case studies to engage students in working so that they think about what they are engaged in.

Bonwell and Eison, (1991) theory of active learning de- emphasizes the use of lecture method of teaching which is teacher-centered to present facts. The theory instead calls for learner-centered approaches such as; small group- discussions, debate, learner questioning, think-pair share, role playing, co-operative learning, group projects and learner presentation. Activities that facilitate active learning promote high-order thinking skills which include application of knowledge, analysis and synthesis. The activities engage students into deeper learning and enable students to apply and transfer the knowledge learnt better.

According to Bonwell and Eison, (1991) teachers need to design teaching activities which engage learners to participate in the lesson and also think critically. The aim of active learning is the involvement of learners in their own learning. Active learning strategies should make learners active rather than being passive and only taking directions and notes from their teacher. Learners should engage in activities which enable them to build new knowledge and acquire new scientific skills.

The theory is reinforced by the Piaget, (1958) Constructivist theory of learning which postulates that learning can only occur when the students find solutions to problems which are above their current level of development with the support of their peers or instructors. Piaget says that learners construct knowledge instead of taking it in passively. This theory proposes that students learn

better when they are involved in learning process rather than passively receiving information. This theory views learning as an in-born social process as it is used within a social context because students and teachers work together to construct knowledge. According to the theory, knowledge cannot be directly imparted to students directly. Therefore, teaching is aimed at providing experiences which facilitate the building of knowledge.

Additionally, Bransford et al., (1999) emphasize that people learn through constructing their own knowledge and connect new ideas and experiences to the existing knowledge. This means that learners learn by building on their existing knowledge and experiences. They do this through interactions and explorations. This is in line with the Bonwell and Eison, (1991) theory of Active Learning in which the learner takes an active part in their knowledge acquisition. The essence of all these is that effective learning takes place when learners are at the center of the learning process and are given responsibility. Dover, (2018) postulates that, when learners take responsibility of their learning, they develop advanced skills such as analysis, critical thinking and evaluation of their learning. The two theories therefore call for teaching approaches that foster active teaching.

On the other hand, Chickering and Gamson, (1987) posit that learning does occur only by just observation. They insist that minimum learning occurs when leaners are passive in class. They instead opine that learning can only take place when learners are involved in their learning through talking about what they are learning, writing about it, relating it to past experiences and applying it to their lives. They need to make what they learnt part of themselves through reading, writing, discussing or involving themselves in solving problems. The above argument clearly indicates that learning is not supposed to be a passive process on the part of the learner. This therefore calls for a learner to actively get involved. It is therefore paramount to note that teachers have the responsibility of employing teaching strategies that involve engagement of the learner during the

learning process. It therefore calls for a collective responsibility for both the learner and the teacher.

In another study, Dale, (1969) compliments Bonwell and Eison, (1991) theory by asserting that learners are able to remember; what they read by 10%, what they hear by 20%, what they see by 30%, what they see and hear by 50%, what they say and write by 70%, and what they do as they perform a task by 90%. The use of teaching methods which involve active learning theory make the classroom inclusive. The implication is that learners get directly involved in their learning which encourages them to stay focused on their learning and also gives them greater enthusiasm for their studies. This translates in high academic achievement (Bonwell and Eison, 1991).

**2.3 Conceptual review**

The conceptual framework for this study depicts the relationship between teaching methods and learner's achievement in Chemistry. It is conceptualized that teaching methods have a linear relationship with learner's achievement. This means that learners' achievement in class depends on the teaching methods employed by the teacher. However, this depends on the appropriateness of the teaching methods. Appropriate teaching methods lead to greater learners' achievement which results in better grades, hence good academic performance. On the contrary, poor or inappropriate teaching methods employed by teachers lead to low learners' achievement. This leads to poor grades hence poor academic performance by the learners. In this study, the teaching methods to be investigated include; discussion method, inquiry-based method and lecture method.

It is conceptualized that there is a linear relationship between discussion method and learner's achievement. In the discussion method, there is cooperative learning in the group, learners do peer teaching, learners discuss in their groups and learners actively participate/engage in their groups.

Group-discussion has been discovered to have a linear relationship with learner's academic performance. Rahman, (2011) opines that discussion method fosters student activity and the interaction between one student with other students. This leads to better understanding as there is sharing of ideas.

Inquiry-based learning method as recommended by Dewey, (1933) is the best method for teaching Chemistry. According to Dewey, (1933), inquiry-based learning is a learning process which engages learners through making real-world connections by exploration and high-level questioning. He further describes it as an approach to learning which encourages learners to engage in problem-solving and experiential learning. This method is characterized by learners posing questions**,** learners solving questions**,** the teacher encouraging more free investigation and the teacher asking probing questions. Inquiry-based learning enables students to work with their peers, coordinate, and also learn communication skills. The method also allows students to build their own knowledge leading to a better retention of science concepts and greater engagement in the learning process.

Percival and Ellington, (1988), describes a lecture is a didactic instructional strategy which involves a one-way communication from an active presenter to a passive audience. The lecture method of teaching is characterized by; all instructions coming from the teacher, all information coming from the teacher, the teacher doing all the talking and asking questions and learners only taking notes from the teacher. The lecture method has a linear relationship with learner's achievement. The lectures method has been found to promote only 'surface' learning. This promotes memorization and unsuitable for 'deep' learning which is necessary for promoting understanding and problem-solving skills. Lectures are also seen to be ineffective for teaching

practical skills than demonstrations and laboratory work. This negatively affects the learning of Chemistry.

## 2.4 Review of related literature

This section presents the review of related literature. The section is divided into four sub-sections. The first sub-section presents review of related literature on discussion method and academic performance, the second sub-section presents review of related literature on inquiry-based method and academic performance, the third sub-section presents review of related literature on lecture method and academic performance. Review of related literature on academic performance has also been done.

### 2.4.1 Discussion method and academic performance

Discussion is described as an activity where both written and oral expressions of various points of view are included in a given situation (Cashin, 2011). On the other hand, Brookfield and Preskill, (2005: 6) define discussion as a playful effort and a serious exchange of views and by a group of two or more in order to engage in mutual and reciprocal critiquing. The two authors articulate the goal of group discussion being beneficial to both parties.

A discussion is usually ignited by a probing question which demands the use of previous knowledge on a specific course (Morice, et al., 2015). During peer instruction, the teacher's role is to monitor and correct any misconception. Peer instruction enables learners to obtain problem-solving skills than what they could develop alone (Morice et al., 2015). Peer teaching is so vital in keeping the passive learners engaged thereby advancing multiple approaches to problems, increasing understanding which leads to the creation of a classroom atmosphere which is lovely (Morice, et al., 2015).

According to Amber, (2014), for teachers to incorporate active learning into their classrooms, they need to have problems, activities, discussions and group exercises. This enables learners to apply the knowledge they have learnt to situations in real-life. It is vital to innovate a method which helps their learners. They also need to employ many methods which meet the learners needs of all learners. Any active learning method of teaching helps a teacher to become more effective, which in turn impacts learners in positive direction (Amber, 2014).

According to National Academies of Sciences, Engineering, and Medicine, (2007) as cited by (Aksakalli, 2019), classroom discussion is very important in supporting learning in science. Students need to be encouraged and given guidance to articulate their ideas and identify that explanation rather than grasping facts is the ultimate goal of the scientific undertaking.

The best way of learning science is by actively getting engaged in the practices of science which include; investigations, sharing ideas with peer-peer sharing of ideas, specialized ways of talking and writing, mathematical, mechanical, computer-based modeling and development of representations of phenomena (Aksakalli, 2019). Viadero and Sparks, (2021) encourages teachers to devote some moment to communicate the importance of discussion to their learners. This helps to convey the rationale for discussion and hence deepening their sense of why should engage in active learning and also engage with the course.

The discussion method of teaching has been adopted by teachers for varying reasons. For example; Cashin, (2011) argues that proper discussion assists learner to attain a critical understanding of a topic, appreciation of diversity, self-awareness and capacity for self-critiquing with an informed action. However, some critics such as Brookfield and Perskill, (2005) argue that problems may come up such as some learners dominating the discussion sessions while other students remaining

passive. On the other hand, (Howard, 2015) supports Brookfield and Perskill, (2005) opinion that, the discussion may also include some signs of limitation like students getting off track while a few may dominate during the whole session. According to Bartley and Milner, (2011) as cited by Soysal, (2021) small group discussions improve team work and build skills learners need for their success at work. According to Craven and Hogan, (2001), group-discussion method avails students with a platform which enables them to contribute to their own learning and offers the teacher chance to check on students' understanding of the content. Griffin and Cashin, (1989) opine that, group-discussion approach can be a powerful addition to a lecture. Discussion provides the instructor with valuable feedback about learning. In group-discussion method of teaching, learners discuss in their groups. Group interactions are not only beneficial to the group as a whole, but also to the individual leaners.

In a study by Bartley and Milner, (2011) on student attitude in English classrooms, it was discovered that there is a strong correlation between group work and student attitude in English classrooms. Similarly, studies by Malto, et al., (2018), (Segumpan and Tan, 2018) and Camiling, (2017) on classroom discussion found that many teachers recommended this teaching mothed as they also noticed improvement in academic performance.

In Philippines, studies on the impact of classroom discussion showed a significant increase in learners' performance in Biology (Malto, et al., 2018), Physics (Cagande and Jugar, 2018), and trigonometry (Segumpan and Tan, 2018). Additionally, classroom discussion showed a positive effect on grades beginning with science process skills for basic, junior high school, and college students (Camiling, 2017).

In another study, Suryadi, (2020) found out that group-discussion had a significant effect learning. On the other hand, Clinton and Kelly, (2020) discovered that students had a positive attitude

towards group discussion learning. Suryadi, (2020) studied the impact of small group discussion on speaking skills but not in Chemistry. On the other side, Kelly, (2020) studied students' attitude towards group discussion in a university setting. Though the two researchers' findings agree on the effect discussion on learning, the impact of group discussion on learners' academic achievement in Chemistry in Arua District needs to be studied, hence the need for the researcher to go to the field so as to close that knowledge gap.

Co-operative learning is a teaching strategy which involves the formation of small groups where learners work together to accelerate their learning as well as each other's learning (Johnson and Johnson, 1994). They further argue that co-operative learning requires co-operative conversation and discussion of meaning between different individuals involved in activities in which individuals have something to contribute to and learn from the other individuals. Meanwhile, on the other hand, Kagan, (1989) defines co-operative learning as a teaching strategy which involves small, heterogeneous groups of students working together with the aim of achieving a common goal. The two authors clearly reveal that the sole purpose of co-operative learning is to achieve a common objective of increasing their individual learning. This is clear that learners learn better when organized in groups than individually.

In a study, Rabgay, (2018) found out that co-operative learning positively impacted on students' learning. On the other hand, Molla and Muche, (2018) discovered that learners taught using co-operative learning exceled better than those taught using individual learning. Rabgay, (2018) used the questionnaire on students' opinion on co-operative learning as well as the lesson observation tool for collecting data from the respondents. On the other hand, Molla and Muche, (2018) used the quasi-experimental design for making a comparison on co-operative learning and individual learning. Although the two studies reveal that co-operative learning positively impacts on learning,

the studies were carried out in Asia and Ethiopia respectively. Besides, the two studies were carried in Biology and not in Chemistry. This therefore left a study gap that needed to be investigated, because the situation in Arua District was not known.

Peer teaching is a technique that comprises one or more students teaching other students in a specific subject area thus building on the belief that when one teaches, he or she learns twice (Whitman, 1998). In another study, Ullah et al., (2018) found out that learners who are low achievers performed at the same level with the high achievers after peer tutoring. Moliner and Alegre, (2020) on the other hand, discovered that learners gained concepts after peer tutoring. The findings of the researchers agree on the impact of peer tutoring. However, it is important to note that Ullah et al., (2018) used high achievers as tutors. The use of high achievers as tutors is not representative of the study population because these learners are not at the same level of achievement. The researcher therefore opines that it would be better if learners were randomly selected as tutors and tutees.

Although Ullah et al., (2018) used the experimental pretest-posttest approach, the study was done in Biology in Pakistan but not Chemistry. The situation in Arua District in Uganda is not known. Therefore, this leaves a knowledge gap, which is a reason why the researcher intends to go out and find. However, Beichner and Saul, (2003) and Smith et al., (2011) opined that high-achievement learners benefited more from interactive approaches than low-achieving (weaker) counterparts. They recommended that, teachers needed to consider both categories uniformly while forming peer groups before and after peer discussion.

In another study, Silitonga, (2018) found out that peer tutoring can improve students' results. Ghalley et al., (2019) on the other hand, found out that peer tutoring positively affects learning

science. The two researchers' findings agree that peer tutoring has a positive impact on students' achievement. Though Silitonga, (2018) carried out the study in environmental Chemistry, Ghalley et al., 2019) carried out their study in science. Both studies were done in Asia and not in Arua District. Therefore, there is need to study the situation in Arua District, a reason why the researcher intends to go out in the field.

Student engagement is described as teaching strategy whereby students get fully involved in their learning of tasks and activities (Mark, 2000). He further opines that this involvement does not only directly affect school changes but also brings about advancement in academic performance of learners whose grades were low hence reducing students' levels of discontent and drop-out rates. However, Briggs, (2015) describes student engagement in terms of the level of interest which is shown by learners, how they interact with each other in their course and their willingness to learn. Within the group, learners are able interact and get engaged.

In a similar study, Lei et al., (2018) studied the relationship between student engagement and academic performance. The findings showed that student engagement had a positive effect on student's academic performance. Similarly, Theobald et al., (2020) found out that group interactions that foster active learning narrows the achievement gap for the under-represented students. Though the findings of the two researchers agree, Lei et al., (2018) carried out their study in China and not Arua District. Besides, the study involved a meta-analysis of the previous studies on the relationship between student engagement and academic performance among learners in Grade 1 to Grade 12. On the other hand, though Theobald et al., (2020) carried out research on the impact of active learning science, technology and mathematics, the study was done in a university setting. Therefore, in both cases, their studies leave a knowledge gap for Chemistry in a secondary school setting in Arua District, hence the need for the researcher to investigate.

### 2.4.2 Inquiry-based method and academic performance

Inquiry-based method is described as the attitudes assumed by students when they are finding a solution a task which involves high cognitive participation enabling them to predict, experiment, explain and make decisions. The method provides learners with opportunities to explore their own questions about topics and problems which are science-based (Panjaitan and Siagian, 2020). This model provides an opportunity to interpret data, construct models or develop scientific explanations through a group of integrated activities which include experimenting, reasoning and the integration of scientific knowledge. (Kaçar, et al., 2021) and (Teig, 2021).

Similarly, Ssempala, (2017) describes inquiry-based learning as a learning method whose aim is to direct students to examine scientific issues, problems, and queries grounded in scientific theories, laws and facts. The inquiry method is best for processes and procedures which involve pursuit and discovery. The duty of learners in this method is to follow and find their own solutions and explanations on a scientific topic while the teacher gives guidance and support to help learning (Ssempala, 2017). Inquiry-based learning is the building of knowledge. It involves observing, asking important questions, careful assessment of ideas including other sources of information, planning experiments, evaluation of information already known, carrying out experiments, collecting, analyzing and interpreting data, formulating predictions, drawing conclusions and communicating the findings.

Studies involving Inquiry-Based Learning (IBL), done by the Program for International Student Assessment (PISA), classify three lines of research. The first line describes inquiry in terms of teaching strategy which examines various types of information to explain perceived classroom implementation. The second line is inquiry describes inquiry as a teaching outcome which aims at explaining differences in student inquiry outcomes. The third line describes inquiry as both a

teaching approach which aims at the relationship between inquiry input, process, and output (Teig, 2021). IBL thus develops science through the stages below. The first involves initiating the inquiry process. The second phase involves improving dialogue with the learners. The third phase involves forming discussion groups. The fourth phase involves clarifying any misconceptions which learners have about a material, scientific research procedures and attitudes. The fifth phase involves the use of student's experiences to construct new knowledge (Odegaard,et al., 2015). Inquiry activities include planning, experimenting and producing results (Sutiani, et al., 2021). These stages ensure the development of thematic fields, generate scientific competence, scientific reasoning, scientific practices, attitudes, and skills (Suárez, 2022).

Inquiry-based learning puts learners in the processes involving scientific discovery and makes science relevant in their real-world experiences (Darling-Hammond et al., 2020). Inquiry-based learning is rooted in the philosophy of Dewey, (1938) who believed that for education to start, the learner must be inquisitive. He further opined that learning and researching correspond to each other. Both activities are focus on cognitive processes. Discovery-based learning has many advantages which help develop students. It facilitates active engagement of learners, promotes motivation, autonomy, responsibility, independence, develops creativity as well as problem-solving skills.

Inquiry-based learning is strongly recommended for developing student-directed learning so that students are able to solve real world problems as well as building on their science content knowledge (Tawfik et al., 2020). Studies have shown that the implementation of inquiry-based learning through student-centered learning is strongly effective and beneficial in helping students conceptualize content knowledge and develop problem-solving skills. According to Tawfik et al.

(2020), the use of inquiry-based learning showed positive significant changes among the conceptual knowledge and understanding of students.

In Indonesian, (Amini and Sinaga, 2021) established a low achievement in learners in scientific literacy between 2012 and 2015, and between 2015 and 2018.This means that the students were unable to achieve the skills of explaining phenomena, evaluating and designing investigations, and interpreting data based on scientific evidence. This is clear evidence that the teachers were using other teaching methods other than inquiry-based teaching method.

In a study done by Skelton, et al., (2018), it was discovered that the results of the 6th grade classes' post-test science comprehension mean score in scientific skill development, scientific knowledge and scientific reasoning had risen by 6.35 and the 8th grade classes' post-test science comprehension mean score had risen by 6.05. This means that the use of inquiry-based method was instrumental in bringing about this improvement.

In a study done by Antonio, et al., (2023) in Peru, it was found out that teaching science using the IBL enabled the achievement of learning through scientific reasoning and the use of constructivist instructional strategies. According to Antonio, et al., (2023), the use of the inquiry-based approach enabled the development of research skills and building of scientific knowledge. It was found that this coupled with effective teaching strategies, the approach enables the application of scientific theories with real situations, thereby making science education more interesting. However, this study was done in Peru. This therefore left a knowledge gap in Arua District which needed to be closed.

In a meta -analysis study, Batdi et al. (2018), found out that inquiry-based learning had a positive impact on learner's achievement. The study recommended the use of inquiry-based learning as an

alternative method which can meet students' needs in technological era. Though the study recommended inquiry-based learning method to be used as an alternative teaching method, it was an analysis of previous studies in Turkey. The current situation is not known especially in Arua. In another study in Indonesia by Tieg, (2021), it was discovered that teachers mostly used was inquiry method of instruction. This meta-analysis was done in Indonesia and not in Arua District hence the need to close the knowledge gap in Arua District.

In another study, Mupira and Ramnarain, (2018) found out that inquiry-based learning increased learners' mastery of goal orientation. The study concluded that inquiry-based learning increases motivation of learners. On the other hand, Chileya and Shumba, (2020) found that inquiry-based learning had a positive contribution towards learners' achievement. The findings of the two studies concur that inquiry-based learning is beneficial. Though the studies agree on the impact of inquiry-based learning, they were done Ghana and Zambia respectively. The situation in Arua is not known hence the need for a study.

In another study, Issaka, (2018) discovered that inquiry-based learning increased learners' retention of concepts. Meanwhile, Zhao et al., (2021) learners taught using inquiry-based teaching achieved more concepts. Laksana, et al. (2019) found out that inquiry-based teaching increased concept understanding. The studies agree that concept development and retention is key to learning. However, a study needs to be done in Arua. On the other hand, Aulia et al., (2018) discovered that inquiry-based learning is effective at improving student's science literacy skills. The studies were done in China and Indonesia, hence a need for a study in Arua.

### 2.4.3 Lecture method and academic performance

According to Abdullahi, (1982), the lecture method is a method of teaching which puts emphasis on “talk-and-chalk” during the teaching of science subjects. He further notes that teacher verbally present over 80% of ideas, scientific information, concepts, facts and generalizations to students. He concludes that, in the lecture method as the students are either passive or slightly involved in the lesson, the teacher dominates most of the activities. On the other hand, Olarenwaju, (1994) views lecture method as a purely teacher -centered approach where the teacher does not give learners opportunities to ask questions and does not get feedback from his learners. In this case, the teacher talks as he writes notes on the chalkboard. The students only listen and copy notes.

As a traditional learning method, the lecture method is a strategy centered around the teacher. Information is given by the teacher or got from resources such as textbooks and lectures notes (Khalaf, 2018). During the use of this traditional learning strategy, the monitoring of students’ achievement and progress does not necessarily count as an important aspect of education and curriculum but rather aims at the ability of learners to answer knowledge-based questions. This is achieved through standardized tests but does not show the ability for students to make stronger, deeper, and personal connections to the content (Khalaf, 2018).

Because the lecture method is teacher-centered, it is the teacher who has the authority classroom activities. As a result, the classroom is often orderly, and the learners are always quiet. Some studies indicate that the advantage of the lecture method lies in its ability to allows students to learn on their own. As a result, the learners become more independent and learn to decide on their own. Additionally, as the teacher designs, directs, and conducts all classroom activities, it minimizes the chances of the learners missing any vital material or content (Anuradha, 2020). However, this method is only good for the above-average students who benefit more from this

form of teaching. The below-average students however may be disadvantaged in both content and skill. Korkor, et al., (2018) observes that meaningful learning is the climax of all science experiences. To achieve this, teaching needs to sufficiently address students' interest, needs, aspirations and the importance of what they learn to their daily lived experiences. They further opine that learners should have the ability to transfer what they have learnt at school to solve problems which they encounter at home.

A study carried out in Nigeria by Akinmade and Chollom, (2013) found out that most secondary school students were at the concrete operational level of cognitive development. Therefore, the lecture method of instruction could be detrimental to them. They opine that the lecture method only makes more sense to learners who can make abstract reasoning. They further suggest the lecture method would be good if science teachers could sufficiently enrich it, it can be of benefit to secondary school students.

Reports from SCIENCE DAILY, (2018) indicate that the lecture method still dominates up to 55% of Science, Technology, Engineering and Mathematics (STEM) classroom interactions in much of American schools. Covill, (2011) as cited by Korkor, et al., (2018) reported that students' perceptions about the lecture method differed greatly from those of educators. Though the students claimed that they learnt a lot as they engaged in the learning process, independent thinking and problem-solving. Contrary, the teachers believe that the lecture method is ineffective, compared to active learning. They concluded that learning by lecture method is relatively transient and superficial.

In a study by Jaschik, (2018), it was reported that lectures remained dominant despite repeated findings questioning their effectiveness in STEM undergraduate courses. It was observed that

instructors were reorganizing their courses to focus on active learning hence moving away from the lecture method to a more student-centered approach.

According to Abdullahi, (1982), the lecture method does not promote academic performance in science. On the hand, Kuar, (2011), observes that the lecture method of teaching that is frequently criticized much as it is still often used to teach organized bodies of knowledge and has continued to remain a primary form instruction at all levels especially in colleges and universities. Kuar, (2011) observes that, the lecture method continues to remain popular due to a number of reasons. These include; efficiency, flexibility and can be adapted to a wide range of subjects.

In a study done by Zakirman, (2018), it was found out that the lecture method is still the most used method of teaching science learning. Djudin, (2018) in another study found out that there is a significant difference of student's satisfaction rate with lecturers' academic service and academic achievement in terms of lecture method and direct instruction model. The study also found out that there is a significant effect of the lecture method on the rate of student satisfaction and on students' academic achievement. Zakirman, (2018) did the study in a secondary school setting while Djudin, (2018) in a university setting. The findings of Djudin, (2018) are because the lecture method is commonly used method of teaching. The data collected for the study was about students' opinion about the method, therefore the real impact of the method is not known.

In another study, Ameh and Dantani, (2012) found out that students taught using the lecture method had lower scores than their counterparts taught using the demonstration method. In another study, Omwirhiren and Ibrahim, (2016) concluded that the formal style of learning in a lecture environment does not prove to be effective. From the two studies, though the lecture method is the most used method of teaching, it has a negative impact on learning.

### 2.4.4 Academic performance

Academic performance is defined as the knowledge and skills gained and is shown by marks scored from an assessment (Narad and Abdullah, 2016). Wamala, (2013) also defines academic performance as the measurement of a learner's achievement in the various academic subjects. Geisinger, (2014) states that, academic performance is determined by the results of an assessment of the learner's academic proficiency. Additionally, Wamala, (2013) observes that teachers and education officials determine achievement through classroom performance, standardized test results and graduation rates. This is done by considering the Grade Point Average (GPA). According to Wamala, (2013), using standardized achievement tests to indicate academic achievement is very important since it gives a better rating of academic achievement than the grades

According to Linn and Gronlund, (2015), academic achievement measured wholly basing on students' age, students' previous experience, and the students' capacity in relation to social and education skills. In order to measure academic achievement, teachers employ different types of assessment. Similarly, Nyagosia, (2011) observes students' academic performance is determined by; class assignments, home-work assignments, tests, examinations, class participation and participation in co-curricular activities. However, this study focused on the results from assessment of learners as the determinant of academic performance.

According to Nyagosia, (2011), it is the pressure put school administrators and teaches by parents and other stakeholders to improve on academic performance which has helped schools to innovate advanced strategies. The include; promotion of extra-classes for students, introduction of effective instructional strategies and teaching-learning methods, use of technology, reward of students for

their good performance which motivates them to work hard especially when they get low grades. He further opines that, if teachers implement the strategies aimed at rewarding good performance, learners would be motivated to study and thereby improving their academic performance. However, this study aimed at establishing the influence of teaching methods on academic performance.

In the United States, one of the means through which academic performance is measured is by the use of standardized assessments or Grade Point Average. The standardized assessments or Grade Point Average has been formulated for selection purposes. For instance, the Scholastic Assessment Test is used to decide whether a learner should continue their education in a university. The implication is that, academic performance determines whether a learner can proceed to a higher institution of learning or not based on the educational achievement. Besides, Myrberg and Monica, (2021), opine that the wealth and prosperity of a nation is brought about by the academic achievement of learners.

Students who are successful in their academics tend to have a higher self-esteem and self-confidence, and are less likely to engage in abuse of substance. However, a study about graduation rates in higher learning institutions revealed an increase in the number of students who were not graduating on time. The suggestion was that these students were not performing well in their studies (Razak, et at., 2019).

### 2.5 Summary of literature review

Discussion method has a linear relationship with learner's academic performance. In all the studies carried out on the relationship between discussion method of teaching and learner's academic performance, the studies were done in different study areas such as speaking skills, students'

attitude and Biology but not in Chemistry. The studies were also done in a university setting and not in a secondary school setting. Besides that, they were done in different geographical locations such as Lei, et al., (2018) in China and Ullah, et al., (2018) in Pakistan, but not in Arua District in Uganda. Some of the methodologies used include quasi-experimental by Molla and Muche, (2018) and meta- analysis by (Lei et al., 2018). This therefore left a gap in the case of Chemistry in a secondary school setting in Arua District in Uganda which needed to be investigated.

Studies on the relationship between inquiry-based learning and learner's academic performance were done in science literacy skills in general but not in Chemistry in particular. The studies were also done in different geographical locations such as Turkey, Ghana, Zambia, China and Indonesia but not in Arua District. Besides, the methodology used was a meta-analysis and not observation as the researcher intended to use. This therefore called for a study to be done in Arua District so as to close the knowledge gap.

The influence of the lecture method is negative as discovered in the review of related literature above. Thought the studies were carried out in both a university and secondary school setting by collecting data from students on the opinion, they were not done in Arua District. Therefore, this left a knowledge gap on the situation in Arua District which required filling hence the reason for the study.

In summary, the literature above reviews variables relating to classroom discussion, inquiry-based learning and lecture method in relation to science education as a whole. Most of the authors conducted their studies outside Uganda thus making their finding less relevant for teaching and Chemistry in Arua District in Uganda.

It can be concluded that teaching methods influence learner's academic performance. There is a relationship between each teaching method and learner's academic achievement. Therefore, there was a need to investigate which teaching method is being used by teachers, as identified in the related literature review. This helped to inform the study so as to draw conclusions about the persistent low scores in Chemistry in selected Universal Secondary Education schools in Arua

# CHAPTER THREE

# METHODOLOGY

## 3.1 Introduction

The chapter presents: the research design, study population, sample size and selection, sampling techniques and procedure, data collection method, instruments for data collection, data quality control, procedure for data collection. data analysis, measurement of variables and the ethical considerations.

## 3.2 Research Design

The study used the correlational cross-sectional survey design to collect data. A correlational research design was used to establish the relationship between teaching methods and learner's academic performance (Mugenda and Mugenda, 1999). Similarly, a cross-sectional design was used for collecting data from respondents over a short period of time (from 2017 to 2022). The purpose of this design was to gain insight and describe what the respondents' experience on ground was (Mugenda and Mugenda, 1999). The design was also used to enable the researcher collect data from a large target population.

The approach that was used for this study was both quantitative and qualitative methods. The method enabled the researcher to quantify and understand the meanings of statistical data that arose from the study (Mugenda and Mugenda, 1999). The qualitative approach enabled the researcher in soliciting information that was in textual form (Mugenda and Mugenda, 1999). Combining the quantitative and qualitative information helped the researcher to interpret of the findings that arose from the study.

### 3.3 Study population

The study population was 1810 which comprised both Advanced level and Ordinary level learners and Chemistry teachers. The two categories were used because; the teachers are the implementers of the teaching methods while learners are the direct beneficiaries of the teaching methods used by the teachers. The two categories were also used to avoid bias that would have arisen from collecting data from only category of respondent.

### 3.4 Sample size and selection

The sample size was 327 respondents of which 10 were teachers and 317 learners. The estimated sample size was got with reference to the Krejcie and Morgan, (1970) table, who recommend that a sample size 327 is representative enough of the target population of 1810. The sample size was got from the following schools: Anyavu Secondary School, Logiri Girls Secondary School and Vurra Secondary School.

### 3.5 Sampling techniques and procedure

The teachers who were used for lesson observation were selected using purposive technique. Teachers were selected purposively because of their knowledge about the various teaching methods that are used to teach Chemistry. The target population, sample size, sampling techniques and the data collection method are presented in Table 3.1.

**Table 3**

*Target Population, Sample Size, Sampling Technique and Data Collection Method*

| Population | Target population | Sample size | Sampling technique | Data collection method |
|---|---|---|---|---|
| Teachers | 10 | 10 | Purposive | Observation |
| Learners | 1800 | 317 | Simple random | Questionnaire |
| Total | 1810 | 327 | | |

**Source:** *Adopted and guided by Krejcie and Morgan, (1970) table for sample determination*

Purposive sampling technique was employed to select the samples of teachers as respondents for the study. This is because they have more knowledge on the various teaching methods, being the vey users of the methods. This follows the recommendation of Amin, (2005) who urges that such people are knowledgeable and hence good for data collection.

In order to select respondents among learners, stratified sampling was used to get representative samples of both female and male learners. Then, simple random sampling was used so that every learner gets a chance of being selected. This helped to eliminate any biases and hence give a representative sample for the study as recommended by (Creswell, 2018).

### 3.6 Data collection method

The study employed two data collection methods due to the nature of the research question. These were: questionnaire and observation. The questionnaire was used so as to get leaners experiences while being taught by their Chemistry teachers while observation was used to enable the researcher get first-hand information about the actual teaching method being used at the time of teaching. The questionnaire was administered on the learners while the observation was used on the teachers as a methodological triangulation (Amin, 2005).

### 3.6.1 Questionnaire

Because that the learners form the largest sample size for this study, the questionnaire was used to solicit responses from each of them about the methods used by their teachers. They received the questionnaire individually and filled them individually as recommended by Amin, (2005). The use of the questionnaire provided some degree of anonymity of the respondent to avoid bias (Amin, 2005).

### 3.6.2 Observation

The researcher carried out a non-participant observation of the teachers as they taught in class. As the teacher taught, the researcher observed the activities in class which represent the various teaching methods and ticked them appropriately as given in the lesson observation check-list. This helped the researcher to pursue additional information about their actual teaching method in class as recommended by (Creswell, 2009).

## 3.7 Instruments for data collection

The researcher used two types of instruments whose development was guided by the study objectives, conceptual framework and literature review. These are; structured questionnaire and observation guide.

### 3.7.1 Structured questionnaire

The structured questionnaire containing closed-questions was developed by the researcher. This was used because of the number of respondents who formed the largest sample size, its cost-effectiveness, less time-consuming and the nature of the topic. Therefore, the data collected using

this tool was quantitative (Kothari, 2004). A set of items consisting of five sections was administered to the learners. Section A consisted of items about the background, sections B to D consisted of items about the independent variable (teaching methods) while section E consisted of items about the dependent variable (academic performance). Section A solicited information about the respondent's background. Section B solicited information on discussion method of teaching, Section C solicited information about inquiry-based method of teaching. Section D solicited information about lecture method of teaching while section E solicited information about learner's academic performance.

### 3.7.2 Observation guide

This had activities for the three teaching methods as outlined in the conceptual diagram. The purpose of this tool was to find out which actual method of teaching is used by the teacher while teaching in class (Gorman and Clayton, 2005). The activities indicating the various teaching methods were: the teacher organizes all learners in groups, the teacher gives work to learners in groups, the teacher supervises groups' activities, learners discuss in their groups before presenting their work to the class, learners argue among themselves within the group before they finally agree on common terms, learners actively participate in their groups, learners interact among themselves, learners do peer teaching in their respective groups, after discussion, groups present their work to the rest of the class, the teacher harmonizes learners' presentations at the end of the lesson, the teacher gives learners the opportunity to ask questions, the teacher gives learners the opportunity to ask questions, the teacher asks probing questions, the teacher attends to learners individually in class, the teacher encourages learners to freely think and carry out investigation, learners are given the opportunity to explore, learners go to the laboratory to carry out their own experiments, the teacher is the source of all knowledge, the teacher gives learners all the notes during the lesson,

the teacher asks all the questions during the lesson, the teacher answers any question raised by learners instead of requesting fellow learners to answer the question, learners only listen and take notes from the teacher, the teacher presents the subject matter at his/her own speed, the teacher does not check on learners' progress during the lesson and finally the teacher covers a huge amount of work within the lesson than what learners can absorb.

The researcher ticked the corresponding activity done in class as observed by the researcher. This informed the study of the actual teaching method used by the teacher. This tool was adopted because it was easy to use and had a high accuracy in soliciting information. This enabled the researcher to get information about the actual teaching method used by the teachers as recommended by (Creswell, 2009). Therefore, data collected using this tool was qualitative.

### 3.8 Data Quality Control

Control of data quality was determined using validity and reliability. To get valid and reliable data, the researcher ensured that the two met statistical requirements.

#### 3.8.1 Validity

Accuracy of data was guaranteed by the use of relevant tools. Criterion validity and face validity of the tools was determined by rating by the different research experts. The tools were rated by different research experts after which they were subjected to rating using the Content Validity Index (CVI) computation, as recommended by Amin, (2005) using the formula below;

$$\text{CVI} = \frac{\text{Number of items rated as relevant}}{\text{Total number of items in the tool}}$$

The number of items in the questionnaire which were rated relevant was 61 out of the total number of items which was 84. Therefore, applying the formula CVI $= \frac{61}{84}$ =.726, the CVI value obtained

was greater than the recommended 0.7 (Amin, 2005). Hence, the questionnaire was considered valid for data collection.

The number of items in the observation check-list which were rated relevant was 36 out of the total number of items which was 50. After applying the formula CVI $= \frac{36}{50}$ =.720, a CVI value got was greater than the recommended 0.7 (Amin, 2005). Hence, the lesson observation checklist was considered valid for data collection.

### 3.8.2 Reliability

The tools were piloted in three similar schools to find out if similar results are generated. This helped to ensure consistency, dependability and their ability to solicit responses that are appropriate for the objectives of the study. The final reliability of the tools was be obtained by subjecting the tools to a Cronbach Alpha Index. A value of alpha of 0.719 was obtained. Because the Cronbach Alpha was greater than 0.7, as recommended by Amin, (2005), the items were considered dependable for data collection.

## 3.9 Procedure for Data Collection

The researcher got a letter of introduction from the University and permission letters from schools before collecting data. The researcher was introduced to the Chemistry teachers who were used in the study including the purpose of the study. While in class, the researcher was introduced to the learners before each lesson started. The researcher sat at the back of the class for the entire duration of the lesson (80 minutes) while observing and ticking the activities in the observation check-list as they occurred. For the questionnaire, the researcher was introduced to the learners in their respective classes after which randomly sampled out twenty (20) learners per class were randomly

sampled out for the study. The questionnaires were administered to the respondents by the researcher who collected them immediately after they were filled. Once collected, the raw data was coded and analyzed so as to draw meaningful conclusions (Amin, 2005).

### 3.10 Data analysis

After collecting the questionnaires, the researcher removed unanswered questionnaires as well as outliers. The researcher then used average for the answered items (Amin, 2005).

#### 3.10.1 Quantitative data analysis

The collected data was analyzed using both descriptive statistics and inferential statistics (Creswell, 2014).

##### 3.10.1.1 Descriptive statistics

To investigate the relationship between the independent and dependent variables, the researcher used descriptive statistics to analyze data collected using the questionnaire and observation for each objective. The data was described using frequencies, percentages and means to show the distribution of the respondents on each of the constructs of the independent variable and the dependent variable (Creswell, 2018).

##### 3.10.1.2 Inferential statistics

To test the hypotheses, the researcher employed Pearson correlation in the SPSS version 2022 package to determine the strength of the correlation of the teaching method associated with the academic performance. A regression analysis was used to test the hypotheses (Creswell, 2014).

### 3.10.2 Qualitative data analysis

This involved thematic analysis which was used to organize qualitative data into meaningful sentences. The recurrent themes which emerged from the lesson observation checklist were presented.

### 3.11 Measurement of variables

The items in the questionnaire about the variables were rated using a five- scale as indicated on the Likert Scale (Likert, 1932). The Likert scale was used in rating the items in the questionnaire and they were scored as follow; 5 for Strongly Agree (SA), 4 for Agree (A), 3 for Not Sure (NS), 2 for Disagree(D), and 1 for Strongly Disagree (SD). This was on all the activities in Section B of the questionnaire (Group-discussion method of teaching), Section C (Inquiry-based method of teaching), Section D (Lecture method of teaching) and Section E (Academic performance) as shown in Appendix VI. The respondent chose only one alternative out of the five. The purpose of this was to enable the respondents (learners) express their perception about how much they agreed or disagreed with the activities done in class by their teachers. The selected set of activities was to inform the study about the actual teaching method used by teachers while delivering lessons. The items in the observation guide were formulated to capture the activities of the teachers in the class while delivering their lessons. These were selected and ticked as observed by the researcher while observing the lesson. They were useful in drawing a conclusion about the actual method used by the teacher while teaching.

### 3.12 Ethical considerations

The ethical issues that were considered for this study include the following. Being one of the third parties in this study, the school authorities were informed in advanced about the intended study in

their school as recommended by (Amin, 2005). By this, the researcher requested for permission from the school authorities to carry out the survey in their schools. This was backed-up by the introduction letter from the University as per Muni University research guidelines ,2023. The respondents (learners) were informed in advanced about the purpose of the survey before they committed themselves in giving responses to the items in the questionnaire (Amin, 2005). The other respondents (teachers) were also informed in advance about the purpose of the survey before their lessons were observed by the researcher (Amin, 2005). The school authorities were informed of their right to stop the researcher from using the school for carrying out the study if they felt it unnecessary. The first category of respondents (learners) was informed of their right to withdraw from participating in the study in case they felt that they couldn't continue participating (Mugenda and Mugenda, 1999). The second category of respondents (teachers) was also informed of their right to stop the researcher from observing their lessons if they felt it unnecessary. Finally, the first category of respondents (learners) was assured that the information obtained from them would be treated with the utmost confidentiality it deserved. The second category of respondents (teachers) was also assured that the information obtained from their observation in class would be treated with the utmost confidentiality it deserved (Amin, 2005).

# CHAPTER FOUR

# DATA PRESENTATION, ANALYSIS AND INTERPRETATION

## 4.1 Introduction

This chapter presents, analyses and interprets the findings. The chapter presents finding on; the response rate of the respondents, background information of the respondents, analysis of group-discussion method and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District, analysis of inquiry-based method and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District, analysis results of lecture method and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District and finally, the relationship between the combined teaching methods and learners' academic performance.

## 4.2 Response Rate

In research, response rate refers to the number of respondents who responded to the survey over by the number of respondents in the sampled population. The result is expressed in percentage. Dillman, 2000; Bailey, 1987; and Babbie, (1978), as cited Hager et al., (2003) by opine that, a low response rate results in sampling bias while a high response rate eliminates sampling bias. Before analyzing the data, the researcher determined the response rate of the questionnaires and the lesson observation. This was done using the formula below;

$$\text{Response rate} = \frac{\text{Number of questionnaires returned}}{\text{Total number of questionnaires disbursed}}$$

The response rate of respondents for this study is presented in Table 4.1.

**Table 4.1**

*Response Rate*

| Category of population | Target population | Sampled size | Response rate | Percentage |
|---|---|---|---|---|
| Teachers | 10 | 10 | 10 | 100 |
| Learners | 1800 | 317 | 252 | 79.5 |
| Total | 1810 | 327 | 262 | 80.1 |

**Source:** *Field data, (2023)*

From the study population of 1810, using the Krejchie and Morgan, (1970) table as recommended by Amin, (2005), the researcher sampled out 327 respondents to participate in the study. Out of the 327 sample population, 262 responded. This gave a response rate of 80.1%. This rate is well above the recommended 70% response rate (Amin, 2005). Therefore, the results were considered respresentative of the target population.

### 4.3 Background information results

In order to obtain clear and objective information, the researcher begun by getting relevant background information of the respondents (learners). The responses from the learners included; class in which the learner was, the gender of each learner, the age bracket of the individual learners and the number of years of studying each learner had spent in the school. Table 4.2 presents the distribution by class of the respondents.

**Table 4.2**

*Class of the Respondents*

| Class of respondent | Frequency | Percentage |
|---|---|---|
| S.1 | 50 | 19.8 |
| S.2 | 69 | 27.4 |
| S.3 | 65 | 25.8 |
| S.4 | 48 | 19.0 |
| S.5 | 10 | 4.0 |
| S.6 | 10 | 4.0 |
| Total | 252 | 100.0 |

**Source**: *Field data, (2023)*

Table 4.2 shows that the respondents were sampled from all the classes. However, the number of respondents from classes S.5 and S.6 were lower than the respondents from other classes. This implies that few of the learners took Chemistry at high school in the schools from which the study was conducted. Never-the-less, the implication is that, the views of all learners contributed significantly to the findings of the study. Table 4.3 presents the distribution by gender of the respondents.

**Table 4.3**

*Gender of the Respondents*

| Gender | Frequency | Percentage |
|---|---|---|
| Male | 114 | 45.2 |
| Female | 138 | 54.8 |
| Total | 252 | 100.0 |

**Source:** *Field data, (2023)*

Table 4.3 shows that more of the respondents (54.8%) were females. However, a significant number of males (45.2%) also participated in the study. This implies that the views of both genders significantly contributed to the study. Table 4.4 presents the distribution by age of the respondents.

**Table 4.4**

*Age Bracket of the Respondents*

| Age bracket | Frequency | Percentage |
|---|---|---|
| 10-15 years | 29 | 11.5 |
| 16-20 years | 204 | 81.0 |
| 21-25 years | 16 | 6.3 |
| Above 25 years | 3 | 1.2 |
| Total | 252 | 100.0 |

**Source:** *Field data, (2023)*

Table 4.4 shows that most of the respondents (81.0%) were in the age-bracket of 16-20 years. This implies that they had a good knowledge of the various activities that take place in their respective

classes during Chemistry lessons. However, views of respondents from other age-brackets also contributed significantly to the study. Table 4.5 presents the distribution by duration of the respondents in their respective schools.

**Table 4.5**

*Number of Years of Study of the Respondents in the School*

| Number of years of study | Frequency | Percentage |
|---|---|---|
| Less than one year | 73 | 29.0 |
| 1-3 years | 135 | 53.5 |
| 4-6 years | 41 | 16.3 |
| Above 5 years | 3 | 1.2 |
| Total | 252 | 100.0 |

**Source:** *Field data, (2023)*

Table 4.5 shows that most of the respondents (53.6%) had spent between 1-3 years. This implies that they have enough experience in identifying the activities that take place in class during Chemistry lessons. However, it should be noted that the views of respondents from other categories of number of years of study in the school also contributed significantly to the study.

### 4.4 Findings on teaching methods and learners' academic performance in Chemistry

In order to establish the relationship between teaching methods and learners' academic performance, there was need to first find out results on each variable separately using descriptive statistics. This involved the use of frequencies, percentages and mean because the data used was ordinal. The following sub-section presents findings about academic performance.

#### 4.4.1 Descriptive statistics on academic performance

Respondents (learners) were subjected to a questionnaire which had 9 items were based on a five-point Likert scale. The learners responded by indicating their agreement on the five-point Likert scale. In all the findings, learners who disagreed and those who strongly disagreed were grouped into one category of learners who disagreed while learners who agreed and those who strongly

agreed were grouped into one category of learners who agreed. The findings about performance in Chemistry are presented in Table 4.6.

**Table 4.6**

*Findings on performance in Chemistry*

| | Items | SD | D | NS | A | SA | Total | Mean |
|---|---|---|---|---|---|---|---|---|
| 1 | I understand all the Chemistry topics. | 55 (21.8%) | 63 (25.0%) | 86 (34.1%) | 34 (13.5%) | 14 (5.6%) | 252 (100%) | 2.56 |
| 2 | I can do all mathematical calculations in Chemistry. | 69 (27.4%) | 67 (26.6%) | 74 (29.4%) | 29 (11.5%) | 13 (5.2%) | 252 (100%) | 2.40 |
| 3 | I can apply the knowledge got from Chemistry to solve a problem in my environment. | 9 (3.6%) | 18 (7.1%) | 22 (8.7%) | 123 (48.8%) | 80 31.7%) | 252 (100%) | 3.98 |
| 4 | I can handle and manipulate all the apparatus used during Chemistry practicals. | 22 (8.7%) | 44 (17.5%) | 52 (20.6%) | 89 (35.3%) | 45 (17.9%) | 252 (100%) | 3.36 |
| 5 | I can make and record observations during Chemistry practicals. | 14 (5.6%) | 20 (7.9%) | 46 (18.3%) | 106 (42.1%) | 66 (26.2%) | 252 (100%) | 3.75 |
| 6 | I can interpret experimental observations and draw conclusions from the observations. | 6 (2.4%) | 10 (4.0%) | 29 (11.5%) | 100 (39.7%) | 107 (42.5%) | 252 (100%) | 3.28 |
| 7 | I can draw a diagram to show any apparatus used in the Chemistry laboratory. | 6 (2.4%) | 10 (4.0%) | 29 (11.5%) | 100 (39.7%) | 107 (42.5%) | 252 (100%) | 4.16 |
| 8 | I can draw and label all the diagrams to show the preparation of any gas. | 26 (13.1%) | 36 (19.8%) | 80 (32.5%) | 67 (21.8%) | 43 (12.7%) | 252 (100%) | 3.26 |
| 9 | I can draw and label all the diagrams to show any chemical process. | 33 (13.1%) | 50 (19.8%) | 82 (32.5%) | 55 (21.8%) | 32 (12.7%) | 252 (100%) | 3.01 |
| | **Aggregate mean** | | | | | | | **3.307** |

**Source:** *Field data, (2023)*

Findings from Table 4.6 show that most of the learners disagreed on item 1 (that is, 21.8% and 25.0% for strongly disagreeing and disagreeing respectively). Those who were not sure accounted for a greater percentage of the respondents (34.1%). However, those who agreed on item 1 were

minimal (13.5% and 5.6% for agreeing and strongly agreeing respectively). From the comparisons, it can be seen that majority of the respondents showed that they did not understand all the topics. Those who could not understand all the Chemistry topics accounted for 46.8% compared to those who understood all the topics (19.1%).

In the same vein, findings show that most of the learners disagreed on item 2 (27.4% and 26.6%). Those who were not sure were 29.4% while those who agreed were 11.5% and 5.2%. From the comparisons, it can be seen that majority of the learners either disagreed or were not sure on item 2. Those who disagreed with the item accounted for 54.0% while those who agreed were only 16.7%. On the other hand, a comparison of the findings about item 3 shows that most of the learners agreed with item 3 (48.8% and 31.7%). This totals up to 80.5%. Those who disagreed were 3.6% and 7.1% while those who were not sure were 8.7%.

Most of the learners agreed with item 4 (35.3% and 17.9%) while those who were not sure accounted for 20.6%. Those who disagreed with the item were fewer than those who agreed and accounted for 8.7% and 17.5%. For item 5, more than half of the learners (42.1% and 26.2%) agreed that they could make and record observations during Chemistry practicals. Those who disagreed or were not sure were fewer (from 5.6% to 18.3%).

A comparison of the findings on item 6 show that more than half of the learners showed that they could interpret experimental observations and draw conclusions from the observations compared to the 13.5% who could not. Those who disagreed or were not sure ranged from 2.4% to 11.5%. For item 7, learners who concurred that can draw a diagram to show any apparatus used in the Chemistry laboratory (39.7% and 42.5%) were more than those who either disagreed (2.4% and 4.0%) or were not sure (11.5%). For items 8 and 9, those who agreed with the items accounted for

21.8% and 12.7% which was almost similar to those who were not sure (32.5%). Learners who disagreed with the same items accounted for 13.1% and 19.8%. The aggregate mean value of 3.307 for Academic performance indicates that learners were not sure of their performance.

### 4.4.2 Group-discussion method of teaching and learners' academic performance

#### 4.4.2.1 Descriptive statistical results of group-discussion method and learners' academic performance

In order to find the relationship between group-discussion method and learners' academic performance, findings on learners' response on the items under group discussion method were described using frequencies and percentages as shown in Table 4.7.

**Table 4.7**

*Findings about Group -Discussion Method of Teaching*

| | Items | SD | D | NS | A | SA | Total | Mean |
|---|---|---|---|---|---|---|---|---|
| 1 | Before the Chemistry lesson begins, teacher organizes all learners in my class in groups. | 20 (7.9%) | 30 (11.9%) | 10 (4.0%) | 86 ((34.1%) | 106 (42.1%) | 252 (100%) | 3.90 |
| 2 | The Chemistry teacher gives work to learners in their groups. | 17 (6.7%) | 21 (8.3%) | 9 (3.6%) | 88 (34.9%) | 117 (46.4%) | 252 (100%) | 4.06 |
| 3 | The Chemistry teacher supervises my group's activities. | 16 (6.3%) | 32 (12.7%) | 16 (6.3%) | 89 (35.3%) | 99 (39.3%) | 252 (100%) | 3.88 |
| 4 | During the Chemistry lesson, learners in my group argue among themselves before they finally agree on common terms. | 22 (8.7%) | 20 (7.9%) | 23 (9.1%) | 77 (30.6%) | 110 (43.7%) | 252 (100%) | 3.92 |
| 5 | During the Chemistry lesson, the learners in my group discuss before presenting the work to the class. | 10 (4.0%) | 13 (5.2%) | 12 (4.8%) | 74 (29.4%) | 143 (56.7%) | 252 (100%) | 4.30 |

| | *Findings about Group -Discussion Method of Teaching cont.……* | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 6 | During the Chemistry lesson, I actively participate in my group. | 7 (2.8%) | 20 (7.9%) | 15 (6.0%) | 83 (32.9%) | 127 (50.4%) | 252 (100%) | 4.20 |
| 7 | During the Chemistry lesson, I interact with other learners in my group. | 19 (7.5%) | 21 (8.3%) | 22 (8.7%) | 90 (35.7%) | 100 (39.7%) | 252 (100%) | 3.92 |
| 8 | During the Chemistry lesson, learners in my group teach themselves. | 22 (8.7%) | 33 (13.1%) | 24 (9.5%) | 84 (33.3%) | 89 (35.3%) | 252 (100%) | 3.73 |
| 9 | After discussion, my group presents its work to the whole class. | 12 (4.8%) | 19 (7.5%) | 10 (4.0%) | 58 (23.0%) | 153 (60.7%) | 252 (100%) | 4.27 |
| 10 | Towards the end of the Chemistry lesson, the teacher harmonizes all the groups' presentations. | 19 (7.5%) | 18 (7.1%) | 19 (7.5%) | 82 (32.5%) | 114 (45.2) | 252 (100%) | 4.01 |
| | **Aggregate Mean** | | | | | | | **4.407** |

**Source**: *Field data, (2023)*

Before the findings about group-discussion method are presented, learners who disagreed and those who strongly disagreed were grouped into one category of learners who disagreed while learners who agreed and those who strongly agreed were grouped into one category learners who agreed. Table 4.7 presents the findings of learners' responses to the items under group-discussion method. It can be seen that most of the learners agreed with item 1 (34.1% and 42.1%) compared with those who were either not sure (4.0%) or those who disagreed with the item (7.9% to 11.9%). It is therefore important to note that learners concurred with the item since those who agreed with the item were more than those who disagreed.

For item 2, findings show that more than half of the learners agreed with the item. This ranged from 34.9% to 46.4%. Those who were not sure were only 3.6%. Learners who disagreed with the item ranged from 6.7% to 8.3%. It can be seen that most of the learners concurred with the item.

For item 3, it can be seen that learners who concurred with the item ranged from 35.3% to 39.3%. Those who were not sure were only 6.3% while those who disagreed with the item ranged from

6.3% to 12.7%. This implies that most of the learners (78.12%) with an aggregate mean value of 4.407 agreed that their Chemistry teachers used group-discussion method while teaching compared to the 15.53% who disagreed. Those who were not aware of the method being used were 6.35%.

Findings from lesson observation indicate that*;*

*Teachers organized all learners in groups, gave work to learners in the groups and supervised the group activities. Learners discussed in their groups before they presented their work to the rest of the class, argued among themselves within the group, actively participated in their groups, interacted among themselves, did peer teaching in their respective groups and presented their work to the whole the class. The teachers harmonized learners' presentations.*

As observed, these activities are indicators of group-discussion method of teaching. This implies that the teachers were using group-discussion method of teaching. This concurs with the findings in Table 4.7.

#### 4.4.2.2 Inferential statistical results on group-discussion method and learners' academic performance

The first hypothesis: **"*There is a relationship between discussion method of teaching and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District"*** was tested. This was done using Pearson's correlation coefficient (*r*) to determine the strength of the relationship between group-discussion method and learners' academic performance in selected Universal Secondary Education schools in Arua District. The coefficient of determination (p) was used to show the level of significancy that group-discussion has on learners' academic performance by comparing it to the critical level (0.05). The test results of analysis for the first hypothesis are presented in Table 4.8.

**Table 4.8**

*Correlation and Coefficient of Determination on Group-Discussion Method and Academic Performance*

| | Group-discussion method |
|---|---|
| Academic performance | $r = .048$<br>$r^2 = .002$<br>$p = .449$<br>$n = 252$ |

**Source**: *Field data, (2023)*

Table 4.8 shows that there was a very weak positive correlation (*r=.048)* between group-discussion method of teaching and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District. A coefficient of determination value of $r^2 = .002$ expressed as a percentage to determine the variance in academic performance due to group-discussion method showed that group-discussion method accounted for 0.2% variance in academic performance. A value of *p=.449* which is greater than the recommended critical significance of .05 is not statistically significant and therefore the alternative hypothesis was rejected. Because of this, the hypothesis **"*There is a relationship between discussion method of teaching and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District*"** was rejected. Therefore, it was concluded that group-discussion method of teaching did not have a relationship with learners' academic performance in Chemistry in selected Universal secondary education schools in Arua District.

### 4.4.3 Inquiry-base method of teaching and learners' academic performance

#### 4.4.3.1 Descriptive statistical results of inquiry-based method and learners' academic performance

In order to find the relationship between inquiry-based method and learners' academic performance, findings on learners' response on the items under inquiry-based method were described using frequencies and percentages as shown in the Table 4.9.

**Table 4.9**

*Findings about Inquiry-Based Method of Teaching*

| | Items | SD | D | NS | A | SA | Total | Mean |
|---|---|---|---|---|---|---|---|---|
| 1 | During the Chemistry lesson, I am given the opportunity by teacher to ask questions. | 4 (1.6%) | 4 (1.6%) | 6 (2.4%) | 86 (34.1%) | 152 (60.3%) | 252 (100%) | 4.50 |
| 2 | During the Chemistry lesson, the teacher gives questions that require me to search for answers and solve. | 11 (4.4%) | 14 (5.6%) | 8 (3.2%) | 107 (42.5%) | 112 (44.4%) | 252 (100%) | 4.17 |
| 3 | During the Chemistry lesson, the teacher asks questions that require wide knowledge about the subject matter being taught. | 11 (4.4%) | 13 (5.2%) | 28 (11.1%) | 90 (35.7%) | 110 (43.7%) | 252 (100%) | 4.09 |
| 4 | The teacher attends to me individually during the Chemistry lesson. | 65 (25.8%) | 65 (25.8%) | 49 (19.4%) | 44 (17.5%) | 29 (11.5%) | 252 (100%) | 2.63 |
| 5 | The Chemistry teacher encourages me to freely think and carry out investigations. | 22 (8.7%) | 23 (9.1%) | 21 (8.3%) | 96 (38.1%) | 90 (35.7%) | 252 (100%) | 3.83 |
| 6 | I go to the Chemistry laboratory to carry out my own experiments. | 64 (25.4%) | 61 (24.2%) | 41 (16.3%) | 42 (16.7%0 | 44 (17.5%) | 252 (100%) | 2.77 |
| 7 | I convince other students to search for more information in Chemistry. | 21 (8.3%) | 24 (9.5%) | 36 (14.3%) | 98 (38.8%) | 73 (29.0%) | 252 (100%) | 3.71 |
| | **Aggregate Mean** | | | | | | | **3.67** |

**Source**: *Field data, (2023)*

Before presented about the findings of learners' perception about inquiry-based method are presented, learners who disagreed and those who strongly disagreed were grouped into one category of learners who disagreed while learners who agreed and those who strongly agreed were grouped into one category learners who agreed. A comparison of the findings from Table 4.9 shows that most of the learners agreed with items; 1, 2, 3, 5 and 7 while others disagreed with items 4 and 6. Learners who agreed with the items 1, 2, 3, 5 and 7 were more in percentage than

those who either disagreed or were not sure with the items. The percentage of learners who agreed or strongly agreed with the item1 ranged from 34.1% to 60.3%. Those who were not sure were only 2.4%. Learners who disagreed with the item were only 1.6%. Therefore, it can be seen that most of the learners concurred that they are given the opportunity to ask questions during the Chemistry lesson. Learners who agreed with item 2 were more (42.5% and 44.4%) than those who either disagreed (4.4% to 5.6%) or were not sure (3.2%). A comparison of the findings of learners' response on item 3 indicates that over half of the learners agreed that during the Chemistry lesson, the teacher asks questions that require wide knowledge about the subject matter being taught. The percentage of their responses ranged from 35.7% to 43.7%. Those who were not sure were 11.1% while those who disagreed with the item ranged from 4.4% to 5.2%. For item 4, it can be seen that more than half of the learners disagreed with the item (66.0%, that is, 25.8% and 25.8%). This is more than those who were either not sure (19.4%) or those who agreed (17.5% and 11.5%). Most of the learners agreed with items 5 and 7 but disagreed with item 6. Those who agreed with item 5 were 38.1% and 35.7%. Those who were not sure were 8.3% while those who disagreed with the item ranged from 8.7% to 9.1%. Learners who disagreed with item 6 were more than those who either agreed or were not sure with the item. Those who disagreed ranged from 24.2% to 25.4%. This is more than those who were not sure (16.3%) and those who agreed (16.7% to 17.5%). Furthermore, it can be seen that learners who agreed with item 7 (from 29.0% to 38.8%) were more than those who either disagreed (8.3% to 9.5%) or were not sure (14.3%). Most of the learners (66.49%) indicated that their Chemistry teachers used inquiry-based method while teaching compared to those who disagreed (22.80%) with the method. Those who were not aware of the method being used were 10.71%. The aggregate mean value 3.67 implies that learners agreed that their teachers used inquiry-based method of teaching.

Findings from lesson observation indicate that;

*Teachers gave opportunities to the learners to ask questions during the lesson and learners were given questions to solve on individual basis. The teachers would be seen attending to learners individually. Teachers also gave learners the opportunity to explore more about the content taught.*

These activities indicate inquiry-based learning. This implies that the teachers were using inquiry-based method of teaching. These findings are in agreement with the findings in Table 4.9.

#### 4.4.3.2 Inferential statistical results on inquiry-based method and learners' academic performance

The second hypothesis: ***There is a relationship between Inquiry-based method of teaching and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District,*** was tested using Pearson's correlation coefficient (*r*) to determine the strength of the relationship between inquiry-based method and learners' academic performance in selected Universal Secondary Education schools in Arua District. The coefficient of determination (*p*) was used to show the level of significancy that inquiry-based method has on learners' academic performance by comparing it to the critical level (0.05). Table 4.10 presents the test results of analysis for the second hypothesis.

**Table 4.10**

*Correlation and Coefficient of Determination on Inquiry-Based Method and Academic Performance*

| | Inquiry-based method |
|---|---|
| Academic performance | $r = .314$<br>$r^2 = .099$<br>$p = .000$<br>$n = 252$ |

**Source**: *Field data, (2023)*

Table 4.10 shows that there was a weak positive correlation (*r=.314)* between inquiry-based method of teaching and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District. A coefficient of determination value of $r^2 = .099$ expressed as a percentage to determine the variance in academic performance due to inquiry-based method showed that inquiry-based method accounted for 9.9% variance in academic performance. A value of *p=.000* which is less than the recommended critical significance of .05 is considered significant. Thus, the hypothesis **"*There is a relationship between inquiry-based of teaching and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District"*** was accepted. It was therefore concluded that inquiry-based method of teaching had a relationship with learners' academic performance in Chemistry in selected Universal secondary education schools in Arua District.

### 4.4.4 Lecture method of teaching and learners' academic performance

#### 4.4.4.1 Descriptive statistical results of lecture method and learners' academic performance

In order to find the relationship between lecture method and learners' academic performance, findings on learners' response on the items under lecture method were described using frequencies and percentages as shown in the Table 4.11.

**Table 4.11**

*Findings about Lecture Method of Teaching*

| | Items | SD | D | NS | A | SA | Total | Mean |
|---|---|---|---|---|---|---|---|---|
| 1 | During the Chemistry lesson, all information about the topic to be studied comes from the teacher. | 41 (16.3%) | 27 (10.7%) | 25 (9.9%) | 67 (26.6%) | 92 (36.6%) | 252 (100%) | 3.56 |
| 2 | The Chemistry teacher gives me all the notes during the lesson. | 77 (30.6%) | 61 24.2%) | 36 (14.3%) | 43 (17.1%) | 35 (13.9%) | 252 (100%) | 2.60 |

*Findings about Lecture Method of Teaching cont.……..*

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 3 | All the questions during the Chemistry lesson are asked by the teacher. | 74 (29.4%) | 86 34.1%) | 45 (17.9%) | 28 (11.1%) | 19 (7.5%) | 252 (100%) | 2.33 |
| 4 | The teacher does not give opportunities to learners to answers any question raised by their fellow learners but instead answers them. | 128 (50.8%) | 59 (23.4%) | 34 (13.5%) | 22 (8.7%) | 9 (3.6%) | 252 (100%) | 1.91 |
| 5 | During the Chemistry lesson, I only listen and take notes from the teacher. | 70 (27.8%) | 67 (26.6%) | 26 (10.3%) | 53 (21.0%) | 36 (14.3%) | 252 (100%) | 2.67 |
| 6 | I am not given chance to ask questions during the Chemistry lesson. | 143 (56.7%) | 59 (23.4%) | 23 (9.1%) | 13 (5.2%) | 14 (5.6%) | 252 (100%) | 1.79 |
| 7 | During the Chemistry lesson, the teacher does not attend to me individually in class to find out what I have not understood. | 84 (33.3%) | 55 (21.8%) | 24 (9.5%) | 50 (19.8%) | 39 (15.5%) | 252 (100%) | 2.62 |
| 8 | During the Chemistry lesson, the teacher teaches the subject very fast. | 95 (37.7%) | 73 (29.0%) | 31 (1.3%) | 28 (11.1%) | 25 (9.9%) | 252 (100%) | 2.27 |
| 9 | The teacher covers a lot of work than I can understand within the Chemistry lesson. | 80 (31.7%) | 61 (24.2) | 38 (15.1%) | 36 (14.3%) | 37 (14.7%) | 252 (100%) | 2.56 |
| | **Aggregate Mean** | | | | | | | **2.48** |

**Source**: *Field data, (2023)*

In order to present the findings about learners' perception about lecture method, learners who disagreed and those who strongly disagreed were grouped into one category of learners who disagreed while learners who agreed and those who strongly agreed were grouped into one category learners who agreed. Table 4.11 shows findings of learners' responses on items under lecture method of teaching. It can be seen that most of the learners agreed with item 1 but disagreed with items; 2, 3, 4, 5, 6, 7 and 8. Learners who agreed with item 1 ranged from 26.6% to 36.6%. This was more than those either disagreed (10.7% to 16.3%) or were not sure (9.9%). Learners who disagreed with items; 2, 3, 4, 5, 6, 7 and 8 were more than those who either agreed or were

not sure. Those who disagreed with the items ranged from 21.3% to 56.7%. For item 2, learners who disagreed ranged from 24.2% to 30.6% while those who agreed ranged from 13.9% to 17.1%. For item 3, learners who disagreed with the item ranged from 29.4% to 34.1%. Learners who disagreed with item 4 ranged from 23.4% to 50.8% while those agreed ranged from 3.6% to 8.7% and those who were not sure were 13.5%. For item 5, learners who disagreed with the item ranged from 26.6% to 27.8% while those who agreed ranged from 14.3% to 21.0% and those who were not sure were 10.3%. Learners who disagreed with item 6 ranged from 23.4% to 56.7% while those agreed ranged from 5.2% to 5.6% and those who were not sure were 9.1%. For item 7, learners who disagreed with the item ranged from 21.8% to 33.3% while those who agreed ranged from 15.5% to 19.8% and those who were not sure were 9.5%. Learners who disagreed with item 8 ranged from 29.0% to 37.7% while those agreed ranged from 9.9% to 11.1% and those who were not sure were 1.3%. For item 9, learners who disagreed with the item ranged from 24.2% to 31.7% while those who agreed ranged from 14.3% to 14.7% and those who were not sure were 15.1%. The implication is that most of the learners (60.29%) with an aggregate mean value of 2.48 disagreed with the use of lecture method of teaching by their Chemistry teachers compared to those who agreed (28.5%). Those who were not aware of the teaching method were 11.21%.

Findings from lesson observation in some schools indicate the following activities;

*All information and notes came from the teacher, most of the questions during the lesson were asked by the teacher and learners mainly listened to the teacher which was interjected with taking notes from the teacher. Additionally, no teacher checked on learner's progress and teachers would be seen teacher a lot of content.*

This is an indication of a lecture method. The implies that some teachers used lecture method of teaching. However, these findings disagree with the conclusive findings of Table 4.11. The use of the lecture method was observed in advanced classes of Senior five and Senior six hence the variation in the findings. Teachers in these classes could have preferred to use this method so to increase their coverage of the syllabus within a short period of time given that these classes are semi-candidates and candidates respectively.

#### 4.4.4.2 Inferential statistical results on lecture method and learners' academic performance

The third hypothesis**: *There is a relationship between lecture method of teaching and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District"*** was tested. This was done using Pearson's correlation coefficient (r) to determine the strength of the relationship between lecture method and learners' academic performance in selected Universal Secondary Education schools in Arua District. The coefficient of determination (p) was used to show the level of significancy that lecture method has on learners' academic performance by comparing it to the critical level (0.05). Table 4.12 presents the test results of analysis for the third hypothesis.

**Table 4.12**

*Correlation and Coefficient of Determination on Lecture Method and Academic Performance*

| | Lecture method |
|---|---|
| Academic performance | $r = .060$<br>$r^2 = .004$<br>$p = .344$<br>$n = 252$ |

**Source**: *Field data, (2023)*

Table 4.12 shows that there was a very weak positive correlation (*r=.060)* between lecture method of teaching and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District. This implied that learners' academic performance in Chemistry was not affected by lecture method of teaching. A coefficient of determination value of $r^2 = .004$ expressed as a percentage to determine the variance in academic performance due to lecture method showed that lecture method accounted for 0.4% variance in academic performance. A value of $p = .344$ which is greater than the recommended critical significance of .05 is considered insignificant. Thus, the **hypothesis "*There is a relationship between lecture of teaching and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District*"** was rejected. It was therefore concluded that lecture method of teaching had no relationship with learners' academic performance in Chemistry in selected Universal secondary education schools in Arua District.

### 4.5 Relationship between teaching method and learners' academic performance

In order to determine the relationship between teaching method (the independent variable) and learners' academic performance (dependent variable), a combined regression analysis was conducted. The findings are presented in Table 4.13.

**Table 4.13**

*Relationship between Teaching Methods and Learners' Academic Performance*

| **Model Summary** | | | | | |
|---|---|---|---|---|---|
| **R** | R Square | Adjusted R square | | Std Error of the Estimate | |
| **.325** | .106 | .095 | | 5.39828 | |
| **ANOVA** | | | | | |
| | Sum of squares | df | Mean Square | F | Sig. |
| **Regression** | 853.155 | 3 | 284.385 | 9.759 | .000 |
| **Residual** | 7227.079 | 248 | 29.141 | | |
| **Total** | 8080.234 | 251 | | | |

*Relationship between Teaching Methods and Learners' Academic Performance cont……..*

| Coefficients | | | | | |
|---|---|---|---|---|---|
| | Unstandardized Coefficient | | Standardized Coefficient | t | Sig. |
| | B | Standard Error | Beta | | |
| **(Constant)** | 25.987 | 2.654 | | 9.794 | .000 |
| **Group-discussion method** | -.016 | .43 | -.024 | -.376 | .707 |
| **Inquiry-base method** | .385 | .074 | .325 | 5.232 | .000 |
| **Lecture method** | .065 | .52 | .076 | 1.248 | .213 |

**Source**: *Field data, (2023)*

The findings in Table 4.13 show a moderate linear relationship (Multiple R=.325) between dimensions of group-discussion method of teaching, inquiry-based method of teaching and lecture method of teaching on learners' academic performance. The adjusted R Square (.095) that the dimensions of group-discussion method of teaching, inquiry-based method of teaching and lecture method of teaching accounted for 9.5% variance in academic performance.

The findings above were subjected to ANOVA test in order to accept or reject them. Results from the t-test indicate a degree of freedom of 5 at 251 (df = 5, 251), F = 9.759 had a significant value of .000 which was less than the critical significance of .05. This indicated that the findings met the acceptable error hence confidence in the findings.

From Table 4.13, the combined effect of group-discussion method of teaching, inquiry-based method of teaching and lecture method of teaching accounted for 9.5% variance in learners' academic performance. There was need to find out which dimensions affected academic performance most. As shown in Table 4.10, it was only inquiry-based method of teaching which

had a significant effect (*p=.000)* on learners' academic performance in selected Universal Secondary Education schools in Arua District. Group- discussion method of teaching (*p=.707)* as shown in Table 4.8 and lecture method of teaching (*p=.213)* as shown in Table 4.12 did not significantly affect learners' academic performance in selected Universal secondary education schools in Arua District.

# CHAPTER FIVE

# SUMMARY, DISCUSSION, CONCLUSION AND RECOMMENDATION

## 5.1 Introduction

This chapter presents; the summary of findings, discussions, conclusions, recommendations, contribution of the study and finally, areas for further study.

## 5.2 Summary of findings and discussion

### 5.2.1 Group-discussion method of teaching and learners' academic performance

The findings in Table 4.8 show that there was a very weak positive correlation (*r=.048)* between group-discussion method of teaching and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District. Group-discussion method accounted for 0.2% variance in academic performance with *p=.449*. It was thus concluded that group-discussion method of teaching did not significantly affect learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District.

The first objective of this study was to establish the relationship between group-discussion method of teaching and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District. The study found out that group-discussion method of teaching did not significantly affect learners' academic performance in selected Universal Secondary Education schools in Arua District. The findings indicate that therefore was no relationship between group-discussion method and learners' academic performance in Chemistry. This could be an indicator that, though the learners were put into small group by the teacher, there was no learning taking place within those groups, which is reflected in the learners' academic performance.

The findings of this study disagree with the findings of (Malto, et al., 2018; Segumpan and Tan, 2018; and Camiling, 2017). Whereas the studies by Malto, et al., (2018); Segumpan and Tan, (2018) and Camiling, 2017) showed an improvement on in academic achievement, the findings of this study reveal that there was no relationship between group-discussion and learners' academic achievement. This difference could be as a result of the above studies being conducted on the effects of classroom inquiry-based learning in different subjects. The study by Cagande and Jugar, (2018) was done in Physics. The study by Malto, et al., (2018) was done in Biology. while the study by Segumpan and Tan, (2018) was done in trigonometry but not in Chemistry unlike this study. Besides, the studies were done in Philippines and not in Uganda.

According to Vygotsky, (1962) theory of social learning, as cited by Kalina and Powell, (2009), learners can gain knowledge and concepts through peer-to-peer learning. He further views social learning as an avenue where knowledge could be shared and misconceptions clarified. In addition, Hollander, (2002) opines that through these small group-discussions, human reasoning and can be facilitated. This implies that, a learner can transfer the knowledge he or she has acquired from the group to answer any examination question that may be presented to him or her. In light of all these, learning takes place within the group. From the findings, it can be seen that though the learners were grouped by the teacher, there could be a possibility that individual learning by the learners did not take place within those groups. On the, even if learning took place, it is possible that the learners were unable to apply the knowledge obtained to solve examination tasks. Although Vygotsky, (1962) theory of social learning, observes that learners gain knowledge and concepts through peer-to-peer learning, the cognitive learning theory by Bandura, (1986) explains that an individual's mental processes are affected by both internal and external factors while supplementing learning. According to Bandura, (1986), any delays and difficulties in learning are

noted when cognitive processes are not working as expected. The mental processes include; categorization, observation, attention and retrieval from long-term memory. This implies that group-discussion method of teaching did not lead to academic achievement but rather, it is the learner's cognitive ability that leads to learning regardless of the teaching methods used by the teacher.

### 5.2.2 Inquiry-base method of teaching and learners' academic performance

The findings in Table 4.10 show that there was a weak positive correlation (*r=.314)* between inquiry-based method of teaching and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District. Inquiry-based method accounted for 9.9% variance in academic performance with *p=.000*. It was thus concluded that inquiry-based method of teaching significantly affected learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District.

The second objective of this study was to establish the relationship between inquiry-based method of teaching and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District. The study found out that inquiry-based method of teaching significantly affected learners' academic performance in selected Universal Secondary Education schools in Arua District. The findings indicate that there was a relationship between inquiry-based method of teaching and learners' academic performance in Chemistry. Inquiry-based method of teaching affected academic performance by 9.9%. This implies that for every unit increase in the use of inquiry-based method, there is a 9.9% increase in academic performance. This is an indicator that learning took place which is reflected in the learners' academic performance.

The findings of this study agree with the previous studies of (Antonio, et al., 2023; Zhao et al., 2021; Chileya and Shumba, 2020; Laksana, et al. 2019; Aulia et al., 2018; Batdi et al. 2018; Issaka,

2018; Mupira and Ramnarain, 2018; and Skelton, et al., 2018). All their studies indicate that inquiry-based method of teaching had a positive impact on the academic achievement of learners. Though the findings of this study agree with the findings of the above studies, it important to note that the above studies were carried out in different geographical locations and in different subject areas while this study aimed at investigating the relationship between inquiry-based method of teaching in learners' academic performance in Chemistry in Arua District. Therefore, it is not concrete enough to conclude that inquiry-based method of teaching leads to improved academic performance.

The findings of this study agree with the Bonwell and Eison, (1991) theory of active learning which postulates that learners ascend from remembering and understanding to analyzing and creating knowledge. Bonwell and Eison, (1991) maintains that inquiry-based teaching method encourages critical thinking, improves problem-solving skills helps learners understand complex topics and connects learning to the real world. This implies that whenever this method was used, individual learning took place and hence the relationship between inquiry-based method and learners' academic performance.

### 5.2.3 Lecture method of teaching and learners' academic performance

The findings in Table 4.12 show that there was a very weak positive correlation (*r=.060)* between Lecture method of teaching and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District. Lecture method accounted for 0.4% variance in academic performance with *p=.344.* It was thus concluded that Lecture method of teaching did not significantly affect learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District.

The third objective of this study aimed at establishing the relationship between lecture method of teaching and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District. The study found out that lecture method of teaching did not significantly affect learners' academic performance in selected Universal Secondary Education schools in Arua District. The findings indicate that therefore was no relationship between lecture method of teaching and learners' academic performance in Chemistry. This could be an indicator that, whenever the method was used or not, either learning took place or did not take place.

The findings of this study do not concur with previous studies by Ameh and Dantani, (2012) and Omwirhiren and Ibrahim, (2016). Whereas the findings of this study indicate that lecture method of teaching did not affect learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District, the previous studies by Ameh and Dantani, (2012) and Omwirhiren and Ibrahim, (2016) found out that the lecture method of teaching had a negative impact on learners' academic achievement. The variation in the findings could be attributed to the different methods used during the studies. Although Ameh and Dantani, (2012) used the experimental method in which learners were subjected to pre-test and post-test, this study collected data on learners' perceptions about the lecture method and their academic performance. Therefore, the real impact of the lecture method of teaching on learners' academic performance in Chemistry in the study by Ameh and Dantani, (2012) cannot be used to conclude the effect of the lecture method on learners' academic performance in Chemistry in the selected Universal Secondary Education schools in Arua District as done by this study.

The findings of this study could be as a result of the learners' ability to blend new knowledge with the old one. This therefore conforms to the Ausubel, (1968) theory of learning which suggests that meaningful learning occurs when learners are able to make sense of and integrate new information

into the existing structures. This implies that regardless of the method of teaching used, as long as learners are able to integrate new information into the existing one, learning will take place.

## 5.3 Conclusions

### 5.3.1 Group-discussion method of teaching and learners' academic performance

This study aimed at establishing the relationship between group-discussion method of teaching and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District. Basing on the study findings, it is concluded that the use of group-discussion method of teaching does not significantly affect learners' academic performance in Chemistry in the selected Universal Secondary Education schools in Arua District. This implies that whether teachers use the method or not, learners' academic performance in Chemistry in not affected.

### 5.3.2 Inquiry-base method of teaching and learners' academic performance

This study focused on establishing the relationship between inquiry-based method of teaching and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District. It was found out that inquiry-based method of teaching significantly affected learners' academic performance in Chemistry in the selected Universal Secondary Education schools in Arua District. Basing on the study findings, it can be concluded that the use of inquiry-based method of teaching significantly affects learners' academic performance in Chemistry in the selected Universal Secondary Education schools in Arua District. This implies that teachers need to use the method in order to cause a positive change on learners' academic performance in Chemistry.

### 5.3.3 Lecture method of teaching and learners' academic performance

This study aimed at establishing the relationship between lecture method of teaching and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District. Basing on the findings of the study, it is logical to conclude that the use of the lecture method of teaching does not necessarily affect learners' academic performance in Chemistry in the selected Universal Secondary Education schools in Arua District. This implies that whether the method is used by the teachers or not, learners' academic performance in Chemistry in not affected.

## 5.4 Recommendations

### 5.4.1 Group-discussion method of teaching and learners' academic performance

This study established that group-discussion method of teaching did not significantly affect learner's academic performance in Chemistry in selected Universal Secondary Education schools in Arua District. Group-discussion method of teaching affected learners' academic performance by 0.2%. This implies that the use of group-discussion method does not necessarily affect learners' academic performance in Chemistry.

This study therefore recommends that, the Chemistry teachers should use the method only in circumstances when the teacher wants to get ideas from learners, when dealing with learning tasks that require flow of information from the teacher to the learners and from learners to the teachers.

### 5.4.2 Inquiry-base method of teaching and learners' academic performance

This study established that inquiry-based teaching method had a positive effect on learners' academic performance in Chemistry in selected Universal Secondary education schools in Arua

District. Inquiry-based method of teaching affected learners' academic performance by 9.9%. This implies that a unit increase in the use inquiry-based method of teaching led in 9.9% increase in learners' academic performance.

The findings of this study therefore recommend the use inquiry-based method of teaching Chemistry in Universal Secondary Education schools in Arua District. This can be done by the teacher through activities such as giving learners the opportunity to ask questions in class, encouraging leaners to think freely and carry out investigations, guiding learners to carry out experiments to further their knowledge in the subject area and guiding learners to discover more facts about the subject matter. If learners are given the opportunity to find information by themselves, their ability to recall such information and thus is application enhanced.

This also recommends that school administrators should encourage teachers especially Chemistry teachers to concentrate on the use of inquiry-based method of teaching since this study has found out that there is a relationship between the teaching method and learners' academic performance.

Furthermore, the Ministry of Education and Sports needs to organize refresher courses to science teachers especially Chemistry teachers on the use of inquiry-based method of teaching more especially during the implementation of the new lower secondary curriculum.

### 5.4.3 Lecture method of teaching and learners' academic performance

The study found out that lecture method of teaching did not significantly affect learner's academic performance in Chemistry in selected Universal Secondary Education schools in Arua District. Lecture method accounted for only 0.4% variance in academic performance. This thus implies that whether the method is used or not, learners' academic performance in Chemistry is not affected.

This study therefore recommends that the Chemistry teachers should continue using the lecture method of teaching but to a lesser extent. Teachers should use the method in instances such as; when the background information of what learners are expected to learn is not available or inaccessible to the learners, when time is limited and cannot allow the teacher to accomplish all the learning tasks given, when a change in pace is needed among others.

### 5.5 Contribution of the study

In the first place, the study has added to the body of existing knowledge through the findings of the study on how group-discussion method of teaching, inquiry-based method of teaching and how lecture method of teaching affect learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District.

Secondly, the study has also proved the theory of active learning which informed the study. From study findings, it has been proved that active learning activities such as inquiry-based learning positively impact on learners' academic performance. Although the study findings were only specific to Universal Secondary Education schools, similar studies can be extended to Universal Secondary Education schools in other districts.

### 5.6 Limitation of the study

This study aimed at finding the relationship between teaching methods only and learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District. This therefore limited the study's scope to only Universal Secondary Education schools in Arua District. Furthermore, the study only limited itself to Chemistry. Besides, the study also limited itself to only pedagogical practices of the teacher. Therefore, the findings from the study cannot be generalized to all secondary schools in Arua District in particular and Uganda in general.

## 5.7 Areas for further study

This study sought to find out how group-discussion method of teaching, inquiry-based method of teaching and lecture method of teaching affect learners' academic performance in Chemistry in selected Universal Secondary Education schools in Arua District. However, due to factors such as difference in previous academic performance of learners in their respective primary schools, and the economic status of parents, the study cannot be generalized to all secondary schools (both private and government-aided) in Arua district in particular and Uganda in general. This study therefore recommends the following:

Similar studies need to be carried out on establishing how the same teaching methods affect learners' academic performance in Chemistry in all secondary schools in Arua District in particular and Uganda in general.

The study also recommends more studies need to be done on how other teaching methods other than group-discussion method of teaching, inquiry-based method of teaching and lecture method of teaching affect learners' academic performance in Chemistry in Arua District. The same studies can as well be done in others secondary schools in other districts in Uganda.

There is also need to conduct similar studies in other science subjects other than Chemistry, such as Biology, Physics and Mathematics in Arua District in particular and Uganda in general.

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## APPENDIX I: INTRODUCTION LETTER FROM THE UNIVERSITY

MUNI UNIVERSITY

P. O. BOX 725, ARUA

**Faculty of Education**

Date 19th-JUNE-2023

TO WHOM IT MAY CONCERN

Dear Sir/Madam

RE: INTRODUCTORY LETTER OF EZAKU RICHARD -2021/U/MED/00409

This is to introduce the above named student of Muni University who is pursuing a degree in Master of Education in Educational Planning and Management.
As part of the requirements for the award of a Masters Degree, the student is required to undertake research in an area of interest and submit a report. His/Her research proposal was approved by the Faculty and is now ready to proceed and collect data. The research topic is TEACHING METHODS AND LEARNER'S ACADEMIC PERFORMANCE IN CHEMISTRY IN SELECTED UNIVERSAL SECONDARY EDUCATION SCHOOLS IN ARUA DISTRICT UGANDA

The purpose of this letter is to kindly request you to accord him/her the necessary assistance.

Yours Sincerely,

Joyce Bukirwa Rebecca(PhD)
**Dean Faculty of Education**
Muni Univesity

## APPENDIX II: INTRODUCTION LETTER TO SCHOOL I

MUNI UNIVERSITY
P. O. BOX 725, ARUA

**Faculty of Education**

Date 19th - JUNE - 2023

Perused and given a go ahead

HEADTEACHER
20 JUN 2023
LOGIRI GIRLS' SECONDARY SCHOOL

TO WHOM IT MAY CONCERN

Dear Sir/Madam

RE: INTRODUCTORY LETTER OF EZAKU RICHARD -2021/U/MED/00409

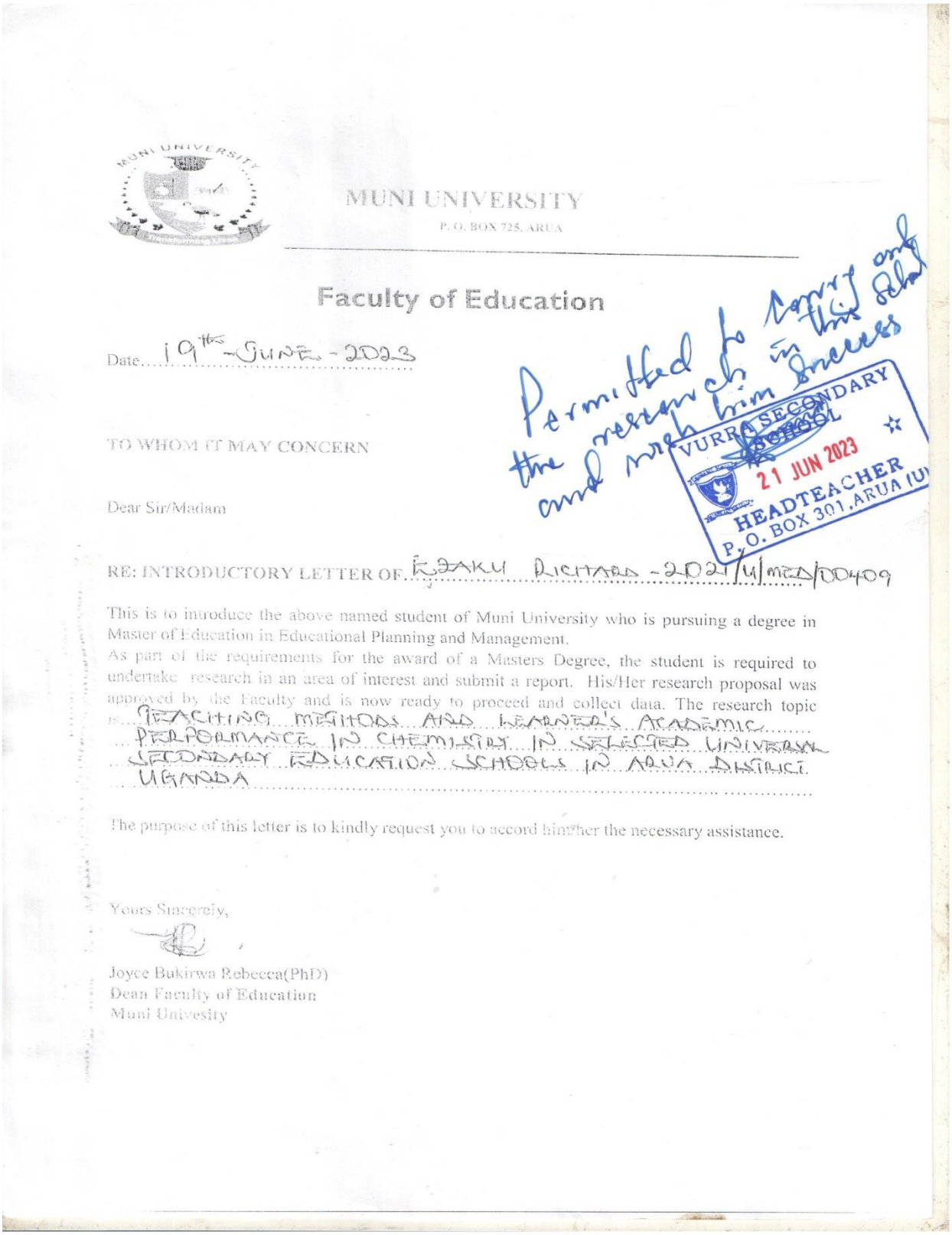
This is to introduce the above named student of Muni University who is pursuing a degree in Master of Education in Educational Planning and Management.
As part of the requirements for the award of a Masters Degree, the student is required to undertake research in an area of interest and submit a report. His/Her research proposal was approved by the Faculty and is now ready to proceed and collect data. The research topic is TEACHING METHODS AND LEARNER'S ACADEMIC PERFORMANCE IN CHEMISTRY IN SELECTED UNIVERSAL SECONDARY EDUCATION SCHOOLS IN ARUA DISTRICT UGANDA

The purpose of this letter is to kindly request you to accord him/her the necessary assistance.

Yours Sincerely,

Joyce Bukirwa Rebecca(PhD)
Dean Faculty of Education
Muni University

## APPENDIX III: INTRODUCTION LETTER TO SCHOOL II



MUNI UNIVERSITY

P. O. BOX 725, ARUA

**Faculty of Education**

Date 19th - JUNE - 2023

Permitted to carry out the research in this School and wish him success

VURRA SECONDARY SCHOOL
21 JUN 2023
HEADTEACHER
P. O. BOX 301, ARUA (U)

TO WHOM IT MAY CONCERN

Dear Sir/Madam

RE: INTRODUCTORY LETTER OF EZAKU RICHARD - 2021/U/MED/00409

This is to introduce the above named student of Muni University who is pursuing a degree in Master of Education in Educational Planning and Management.

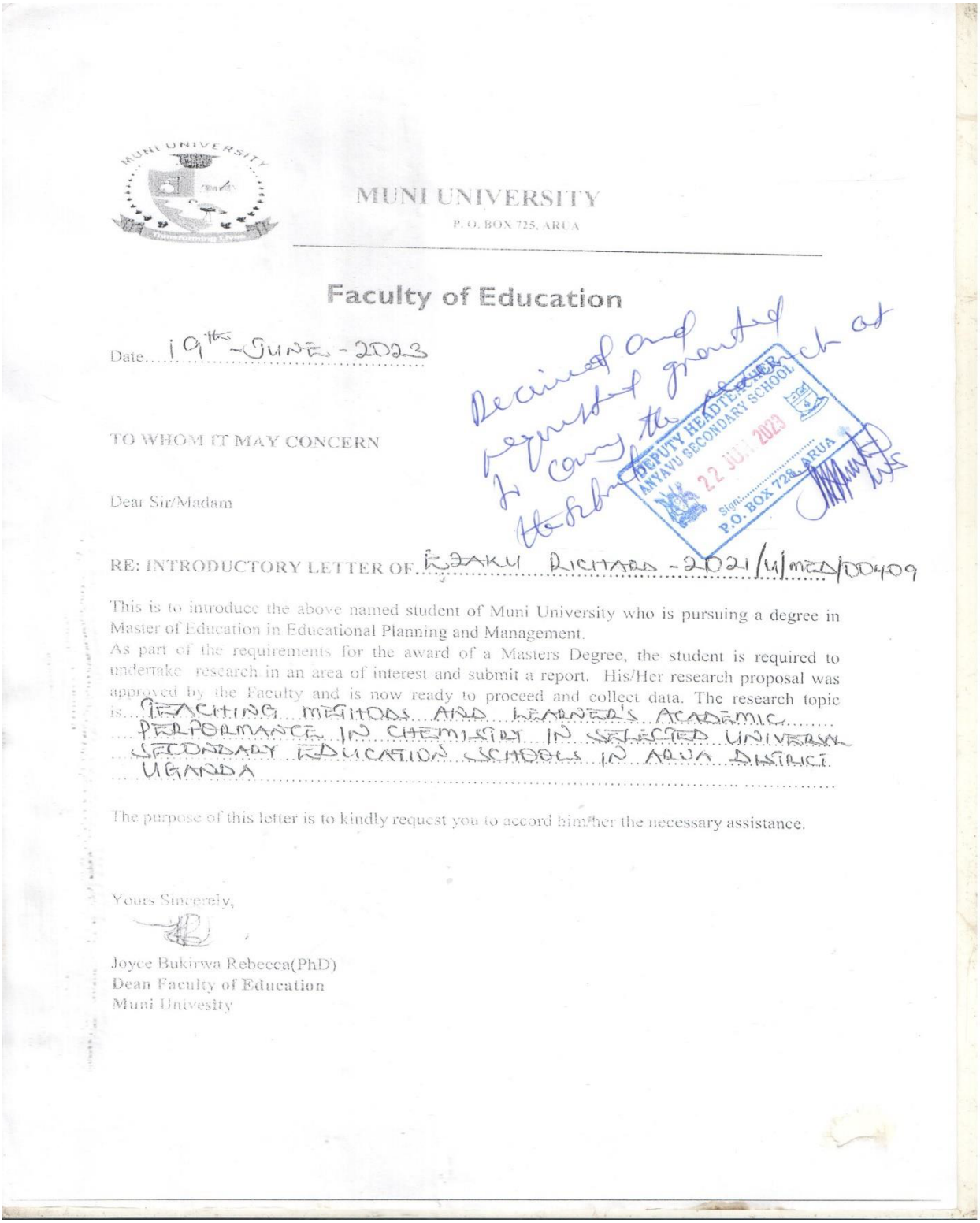
As part of the requirements for the award of a Masters Degree, the student is required to undertake research in an area of interest and submit a report. His/Her research proposal was approved by the Faculty and is now ready to proceed and collect data. The research topic is TEACHING METHODS AND LEARNER'S ACADEMIC PERFORMANCE IN CHEMISTRY IN SELECTED UNIVERSAL SECONDARY EDUCATION SCHOOLS IN ARUA DISTRICT UGANDA

The purpose of this letter is to kindly request you to accord him/her the necessary assistance.

Yours Sincerely,

Joyce Bukirwa Rebecca(PhD)
Dean Faculty of Education
Muni Univesity

## APPENDIX IV: INTRODUCTION LETTER TO SCHOOL III



MUNI UNIVERSITY

P. O. BOX 725, ARUA

**Faculty of Education**

Date 19th - JUNE - 2023

Received and requested granted to carry the research at the school

DEPUTY HEADTEACHER
ANYAVU SECONDARY SCHOOL
22 JUN 2023
Sign.....
P.O. BOX 728, ARUA

TO WHOM IT MAY CONCERN

Dear Sir/Madam

RE: INTRODUCTORY LETTER OF EZAKU RICHARD - 2021/U/MED/00409

This is to introduce the above named student of Muni University who is pursuing a degree in Master of Education in Educational Planning and Management.

As part of the requirements for the award of a Masters Degree, the student is required to undertake research in an area of interest and submit a report. His/Her research proposal was approved by the Faculty and is now ready to proceed and collect data. The research topic is TEACHING METHODS AND LEARNER'S ACADEMIC PERFORMANCE IN CHEMISTRY IN SELECTED UNIVERSAL SECONDARY EDUCATION SCHOOLS IN ARUA DISTRICT UGANDA

The purpose of this letter is to kindly request you to accord him/her the necessary assistance.

Yours Sincerely,

Joyce Bukirwa Rebecca(PhD)
Dean Faculty of Education
Muni Univesity

## APPENDIX V: TABLE OF SAMPLE DETERMINATION

| *N* | *S* | *N* | *S* | *N* | *S* |
|---|---|---|---|---|---|
| 10 | 10 | 220 | 140 | 1200 | 291 |
| 15 | 14 | 230 | 144 | 1300 | 297 |
| 20 | 19 | 240 | 148 | 1400 | 302 |
| 25 | 24 | 250 | 152 | 1500 | 306 |
| 30 | 28 | 260 | 155 | 1600 | 310 |
| 35 | 32 | 270 | 159 | 1700 | 313 |
| 40 | 36 | 280 | 162 | 1800 | 317 |
| 45 | 40 | 290 | 165 | 1900 | 320 |
| 50 | 44 | 300 | 169 | 2000 | 322 |
| 55 | 48 | 320 | 175 | 2200 | 327 |
| 60 | 52 | 340 | 181 | 2400 | 331 |
| 65 | 56 | 360 | 186 | 2600 | 335 |
| 70 | 59 | 380 | 191 | 2800 | 338 |
| 75 | 63 | 400 | 196 | 3000 | 341 |
| 80 | 66 | 420 | 201 | 3500 | 346 |
| 85 | 70 | 440 | 205 | 4000 | 351 |
| 90 | 73 | 460 | 210 | 4500 | 354 |
| 95 | 76 | 480 | 214 | 5000 | 357 |
| 100 | 80 | 500 | 217 | 6000 | 361 |
| 110 | 86 | 550 | 226 | 7000 | 364 |
| 120 | 92 | 600 | 234 | 8000 | 367 |
| 130 | 97 | 650 | 242 | 9000 | 368 |
| 140 | 103 | 700 | 248 | 10000 | 370 |
| 150 | 108 | 750 | 254 | 15000 | 375 |
| 160 | 113 | 800 | 260 | 20000 | 377 |
| 170 | 118 | 850 | 265 | 30000 | 379 |
| 180 | 123 | 900 | 269 | 40000 | 380 |
| 190 | 127 | 950 | 274 | 50000 | 381 |
| 200 | 132 | 1000 | 278 | 75000 | 382 |
| 210 | 136 | 1100 | 285 | 1000000 | 384 |

Note.—*N* is population size. *S* is sample size.

Source: Krejcie & Morgan, 1970

## APPENDIX VI: QUESTIONNAIRE FOR LEARNERS

**Dear respondent,**

I am Richard Ezaku, a student of Muni University pursuing a Master of Education in Educational Planning and Management. I am conducting research on the topic "***Teaching Methods and Learner's Academic Performance in Chemistry in selected Universal Secondary Education Schools in Arua District, Uganda"*** I am therefore requesting you to willingly participate in this research by responding to the items presented under the various sections in this questionnaire. Be as much transparent and truthful as possible when choosing a response. Your responses in this questionnaire will be used in improving the academic performance of learners in Chemistry. Besides, your responses in this questionnaire will be treated with the utmost confidentiality they deserve. However, you are free to stop giving your responses at any time if need be. Thank you in advance.

Yours sincerely,

**Ezaku Richard**
**2021/U/MED/00409**

### SECTION A: BACKGROUND INFORMATION

Name of school: _____

Please tick where appropriate.

1. Class:

| S.1 | S.2 | S.3 | S.4 | S.5 | S.6 |
|---|---|---|---|---|---|
| | | | | | |

2. Gender:

| Male | Female |
|---|---|
| | |

3. Age bracket:

| 10-15 years | 16-20 years | 21-25 years | Above 25 years |
|---|---|---|---|
| | | | |

4. Number of years of study in this school:

| Less than one year | 1-3 years | 4-6 years | Above 6 years |
|---|---|---|---|
| | | | |

**SECTION B: GROUP-DISCUSSION METHOD OF TEACHING**

In this section, respond to the items by ticking in the box corresponding to:

| **Scale** | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **Description** | Strongly Disagree (SD) | Disagree (D) | Not Sure (NS) | Agree (A) | Strongly Agree (SA) |

| **S/N** | **ITEMS** | **1 SD** | **2 D** | **3 NS** | **4 A** | **5 SA** |
|---|---|---|---|---|---|---|
| GDM 1 | Before the Chemistry lesson begins, teacher organizes all learners in my class in groups. | | | | | |
| GDM 2 | The Chemistry teacher gives work to learners in their groups. | | | | | |
| GDM 3 | The Chemistry teacher supervises my group's activities. | | | | | |
| GDM 4 | During the Chemistry lesson, learners in my group argue among themselves before they finally agree on common terms. | | | | | |
| GDM 5 | During the Chemistry lesson, the learners in my group discuss before presenting the work to the class. | | | | | |
| GDM 6 | During the Chemistry lesson, I actively participate in my group. | | | | | |
| GDM 7 | During the Chemistry lesson, I interact with other learners in my group. | | | | | |
| GDM 8 | During the Chemistry lesson, learners in my group teach themselves. | | | | | |
| GDM 9 | After discussion, my group presents its work to the rest of the class. | | | | | |
| GDM10 | At the end of the Chemistry lesson, the teacher harmonizes all the groups' presentations. | | | | | |

**SECTION C: INQUIRY-BASED METHOD OF TEACHING**

In this section, respond to the items by ticking in the box corresponding to:

| **Scale** | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **Description** | Strongly Disagree (SD) | Disagree (D) | Not Sure (NS) | Agree (A) | Strongly Agree (SA) |

| S/N | ITEMS | 1 SD | 2 D | 3 NS | 4 A | 5 SA |
|---|---|---|---|---|---|---|
| IBM 1 | During the Chemistry lesson, the teacher gives me the opportunity to ask questions. | | | | | |
| IBM 2 | During the Chemistry lesson, the teacher gives questions that require me to search for answers and solve. | | | | | |
| IBM 3 | During the Chemistry lesson, the teacher asks questions that require wide knowledge about the subject matter being taught. | | | | | |
| IBM 4 | The teacher attends to me individually during the Chemistry lesson. | | | | | |
| IBM 5 | The Chemistry teacher encourages me to freely think and carry out investigations. | | | | | |
| IBM 6 | I go to the Chemistry laboratory to carry out my own experiments. | | | | | |
| IBM 7 | I convince other students to search for more information in Chemistry. | | | | | |

**SECTION D: LECTURE METHOD OF TEACHING**

In this section, respond to the items by ticking in the box corresponding to:

| **Scale** | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **Description** | Strongly Disagree (SD) | Disagree (D) | Not Sure (NS) | Agree (A) | Strongly Agree (SA) |

| S/N | ITEMS | 1 SD | 2 D | 3 NS | 4 A | 5 SA |
|---|---|---|---|---|---|---|
| LM 1 | During the Chemistry lesson, all information about the topic to be studied comes from the teacher. | | | | | |
| LM 2 | The Chemistry teacher gives me all the notes during the lesson. | | | | | |
| LM 3 | All the questions during the Chemistry lesson are asked by the teacher. | | | | | |
| LM 4 | The teacher does not give opportunities to learners to answers any question raised by their fellow learners but instead answers them. | | | | | |
| LM 5 | During the Chemistry lesson, I only listen and take notes from the teacher. | | | | | |
| LM 6 | I am not given chance to ask questions during the Chemistry lesson. | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| LM 7 | During the Chemistry lesson, the teacher does not attend to me individually in class to find out what I have not understood. | | | | | |
| LM 8 | During the Chemistry lesson, the teacher teaches the subject very fast. | | | | | |
| LM 9 | The teacher covers a lot of work than I can understand within the Chemistry lesson. | | | | | |

**SECTION E: ACADEMIC PERFORMANCE**

Indicate your response to the items in this section by ticking appropriately in the column boxes against the statement of your choice in the table.

| **Scale** | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **Description** | Strongly Disagree (SD) | Disagree (D) | Not Sure (NS) | Agree (A) | Strongly Agree (SA) |

| **S/N** | **ITEMS** | **1 SD** | **2 D** | **3 NS** | **4 A** | **5 SA** |
|---|---|---|---|---|---|---|
| AP 1 | I understand all the Chemistry topics. | | | | | |
| AP 2 | I can do all mathematical calculations in Chemistry. | | | | | |
| AP 3 | I can apply the knowledge got from Chemistry to solve a problem in my environment. | | | | | |
| AP 4 | I can handle and manipulate all the apparatus used during Chemistry practicals. | | | | | |
| AP 5 | I can make and record observations during Chemistry practicals. | | | | | |
| AP 6 | I can interpret experimental observations and draw conclusions from the observations. | | | | | |
| AP 7 | I can draw a diagram to show any apparatus used in the Chemistry laboratory. | | | | | |
| AP 8 | I can draw and label all the diagrams to show the preparation of any gas. | | | | | |
| AP 9 | I can draw and label all the diagrams to show any chemical process. | | | | | |

**THANK YOU FOR YOUR CO-OPERATION**

## APPENDIX VII: CHEMISTRY LESSON OBSERVATION CHECKLIST

School: _____ Class: _____ Lesson duration: _____

The table below shows the activities which are the indicators of the three teaching methods in the study. These are; Group-discussion method, inquiry-based method and lecture method. The researcher will tick either "YES or "NO" for each activity performed during the lesson.

| S/N | ITEMS | YES | NO |
|---|---|---|---|
| **1** | The teacher organizes all learners in groups. | | |
| **2** | The teacher gives work to learners in groups. | | |
| **3** | The teacher supervises groups' activities. | | |
| **4** | Learners discuss in their groups before presenting their work to the class. | | |
| **5** | Learners argue among themselves within the group before they finally agree on common terms. | | |
| **6** | Learners actively participate in their groups. | | |
| **7** | Learners interact among themselves. | | |
| **8** | Learners do peer teaching in their respective groups. | | |
| **9** | After discussion, groups present their work to the rest of the class. | | |
| **10** | The teacher harmonizes learners' presentations at the end of the lesson. | | |
| **11** | The teacher gives learners the opportunity to ask questions. | | |
| **12** | Learners are given problems (questions) to solve. | | |
| **13** | The teacher asks probing questions. | | |
| **14** | The teacher attends to learners individually in class. | | |
| **15** | The teacher encourages learners to freely think and carry out investigation. | | |
| **16** | Learners are given the opportunity to explore. | | |
| **17** | Learners go to the laboratory to carry out their own experiments. | | |
| **18** | The teacher is the source of all knowledge. | | |
| **19** | The teacher gives learners all the notes during the lesson. | | |
| **20** | The teacher asks all the questions during the lesson. | | |
| **21** | The teacher answers any question raised by learners instead of requesting fellow learners to answer the question. | | |
| **22** | Learners only listen and take notes from the teacher. | | |
| **23** | The teacher presents the subject matter at his/her own speed. | | |
| **24** | The teacher does not check on learners' progress during the lesson | | |
| **25** | The teacher covers a huge amount of work within the lesson than what learners can absorb. | | |

**END**