UNIVERSITY OF CAPE COAST

COMPARATIVE STUDY OF HIGH AND LOW ABILITY JHS STUDENTS' ACHIEVEMENT USING TRADITIONAL AND PERFORMANCE ASSESSMENT IN AHANTA WEST MUNICIPALITY

PATIENCE LANGEE

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BY

PATIENCE LANGEE

Thesis submitted to the Department of Education and Psychology of the Faulty of Educational Foundations, College of Education Studies, University of Cape Coast, in partial fulfilment of the requirements for the award of Master of Philosophy degree in Measurement and Evaluation

SEPTEMBER 2021

DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my own original research and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's Signature……………………………….Date…………………..

Name: ……………………………………………………………………………...

Supervisors' Declaration

We hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Principal Supervisor's Signature……………………..Date…………………..

Name: ……………………………………………………………………………

Co-Supervisor's Signature……………………………Date…………………

Name: ……………………………………………………………………….....

ABSTRACT

Assessment is sometimes implemented without assessors knowing which assessment type could enhance students' achievement in tests in schools. This study compared traditional and performance assessment to determine the assessment type which could maximises high and low ability JHS students' achievements in tests. The descriptive cross-sectional survey with quantitative approach was used. The population for the study was 2499 JHS students in Ahanta West Municipality. The cluster and lottery method of simple random sampling procedures were used to select a sample size of 234 students for the study. Teacher-made achievement tests were used to collect the data. Descriptive statistics, bar graphs, paired sample t-tests, multivariate analysis of variance and multiple linear regression were employed to analyse the data. Results of the analyses revealed that both high and low ability JHS students' achievements in tests were improved when assessed with performance assessment type. The results further showed that traditional assessment provides the better prediction of high ability students while, in contrast, performance assessment better predicts achievement of low ability students' achievements in tests. For these reasons, it was concluded that educators at JHS should be mindful of the assessment type they use to assess their students. It was recommended that assessors at the JHS level should adapt and integrate high percentage of performance assessment tasks mixed with less traditional tasks in assessing students order to maximise the students' achievements in tests and examinations.

KEY WORDS

Traditional assessment

Performance assessment

Mixed items test

Tasks

Students' achievement

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DEDICATION

To my dear brother, the late Richard Kojo Paddy

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CHAPTER ONE

INTRODUCTION

Background to the Study

As more and more educators use assessment, they increasingly recognize that the process has the power to transform instruction and the society. Mussawy (2009) noted that assessment is the road map that determines the extent to which students are achieving the predetermined learning goals of education. Lambert and Lines (2000) explained assessment as the process of gathering, interpreting, recording and using information about students' responses to educational tasks in making relevant decisions. This means that assessment is seen as an ongoing process which aims at understanding and improving student learning and involves making expectations explicit and public. It also sets appropriate criteria and high standards for quality learning and to systematically gather, analyse, and interpret evidence to determine how well performance matches those expectations and standards. Finally, the resulting information is used to document, explain, and improve achievement.

It is important to know that assessment serves a number of purposes and provides an indication of how well expected learning outcomes in the curriculum are being achieved (Ampiah, 2011). This means assessment is important to most stakeholders, especially the teacher as well as the students. It makes teachers focus on individual learners, the learning community, the institution or the educational industry as a whole and helps the student understand himself or herself better, based on the functionality of the decisions made using assessment results (Tamakloe, Atta, & Amedahe, 2005).

According to Wiggins (1989), the aim of assessing is primarily to educate and improve students' achievement. This aim can be achieved through a planned educational process based on some important advantages such as how to assess the students' achievement in advance (Demirel, 2007). As noted by Linn and Miller (2005), students' achievements can be measured using various assessment types. Two major types of assessment frequently used are traditional type of assessment and performance-based assessment. (Birenaum, & Feldman, 1998).

According to Çaliskan and Yigittir (2008), traditional assessment is an approach which includes assessment tools, generally, focusing on attainments in intellectual abilities, that is, the cognitive area. The assessment procedures assume that, all students should learn the same thing, and rely on rote memorization of facts. Also the procedures are typically objective and essay type of tests which must be completed within a specific amount of time and requires a single and correct response for each item. Furthermore, traditional assessment offers little opportunity for demonstration of thought processes characteristised by critical thinking skills because the items are composed with limited complex learning outcomes. It uses conventional types of tests such as multiple-choice, short-answer, definitional essay items and standardized tests (Mdelacruz, 2015). The traditional assessment procedures are useful in assessing the student's grasp of information, concepts, terms, processes, and rules, that is, factual knowledge that forms the foundation needed for the student to advance to higher levels of learning (Dikli, 2003). Moreover, the results tend to have evidence of high validity and reliability (Mueller, 2016). However, as noted by Mueller, traditional assessment procedures provide limited ways for students to demonstrate what they have learnt making it rigid and fixed, standardized and charactised with a fixed and limited timing. Students are time-pressured to finish the test and this invokes feelings of anxiety that is detrimental to learning.

Performance assessment, on the other hand, allows students to actively develop their approaches to demonstrate what they know about tasks or skills under defined conditions, knowing that their work will be evaluated according to agreed-upon standards (Project Appleseed, the National Campaign for Public School Improvement, 2018). To Birenaum and Feldman (1998), performance assessment allows the students to be assessed on complex learning outcomes which most at times involve hands-on activity to produce a product. As stated, "performance assessment requires examinees to construct or supply answers, perform or produce something for evaluation" (Madaus & Dwyer, 1999, p. 690) such as conducting a science investigation, constructing an original product, providing a response as in writing an explanation of one's solution to a mathematics problem or writing a persuasive essay. This implies that, "performance tests measure skill or ability… and scoring often requires subjective judgment" (Frey & Schmitt, 2010. p 109). Performance assessment procedures measure students' cognitive thinking and reasoning skills and their ability to apply knowledge to solve realistic and meaningful problems. In other words, they are designed to closely reflect the performance of interest, allow students to construct or perform an original response, of which predetermined criteria is used to evaluate the student's work by an assessor. The performance assessment procedures are, generally, seen by educators as more valid indicator of students with different abilities achievements. However, performance assessment procedures are (a) harder to evaluate; (b) time consuming, especially during the administration stage; (c) labour intensive during development of tasks; (d) susceptible to unfairness due to subjectivity in scoring; and (e) less economical to be used on large participants (Mueller, 2016).

According to Mellroth (2014), students' achievement is assessed, either by comparing students with one another (norm-referenced) or according to goals in the curriculum (curriculum or criterion referenced). To Mellroth, the norm-referenced form makes it possible to study students' relative achievements, rank achievements and identify a top percentage population as the high ability students. Gagné (2005) noted that, high ability students tend to maintain their position through their formal schooling. This implies, high ability students are persistent to inert characteristics towards continuous achievement. The characteristics subsume self-motivation, self-efficacy and low level of test anxiety (Jaglois & Kitchel, 2014). These characteristics create the disparity between the high and low ability students in the classroom.

Similarly, according to McCoach and Siegle (2001), low ability students are those who appear capable of succeeding in school but are nonetheless struggling with academic work. It is further stated that low ability students also, attend school without books or homework, and appear to choose not to study for exams (McCoach & Siegle). They are students who seem unphased by parents and teachers' pleas that their grades now will affect the rest of their professional lives. Dzulkifli and Alias (2012) also noted that low ability students are easily distracted emotionally, especially with the onset of anxiety and this result in pregnable performances. However, Dzulkifli and Alias argued that low ability students are more assertive. To them, it depicts they have strong personality; tend to be independent and dominant; have the capability to stand up for their rights and possess attributes needed for attainment of their achievements. The foregoing findings denoted that, students who perform poorly academically may still have strong and positive personal characteristics that can help them to succeed.

According to Gilleece, Cosgrove and Sofroniou (2010), equity in education cannot be achieved until differences created in examinations are eliminated between groups in terms of achievement. That is, the individuals in the group should be perceived as the same in academic achievement.

Researches have shown that, both high and low ability students can be in a positive direction of achievement if an appropriate assessment procedure is employed for them (Taylor *et al.*., 2016; Yaduvanshi, & Singh, 2019). According to a study by Agyei and Mensah (2018), the best predictor of students' achievement is a traditional assessment procedure. This indicates that the use of traditional assessment enhances students with different abilities learning and achievement as well.

Meanwhile, Arhin's (2015) and Woodward, Monroe and Baxter's (2001) studies revealed that performance assessment has the capacity of giving the true achievement of students with different abilities. Some studies explained that, students think very differently from one another, and hence in performance tasks assessment, students who received the same information at the same time do process the information in diverse opinions to arrive at the answer (Dickinson & Butt, 1989; Webb, Nemer, & Zuniga, 2002). This depicts that both high and low ability students can vary their achievements when performance assessment procedure is employed to assess them.

Comparing these two types of assessment and evaluating them as to which is effective in the classroom, educators in academia and other advocates have been clamouring on which type of assessment is appropriate to use in the classroom (Rufina, Rosaroso & Rosaroso, 2015). Hitherto, Attom (2017), Shepard (2000) and Rufina *et al.* opted to have performance assessment as their way of assessing student learning over traditional assessment. However, Bill and Luara (as cited in Shepardson & Adams, 1996) had diverse views of both assessment types and noted that:

> "… students who generally do well on a traditional style assessment showed more success on the traditional assessment questions. Those same students appeared to not do as well on the performance assessment questions. Students who generally do poorly on a traditional style assessment showed greater success on the performance style assessment questions. Those same students continued to do poorly on the traditional assessment. There is a need to use a combination of performance and traditional style questions on assessments to reach a wide range of student learning styles". (p. 274).

Mussawy (2009) on his part argued that, assessors use a very narrow range of assessment strategies that omit both the teacher and student preferences in designing assessment tools. He explained that, teachers' rationale and students' preferences of an assessment type influence the process through which the subject matter is tested and the way students precede with learning.

In spite of this, teachers and students have limited input as to which assessment type should be employed for standardised examinations. This has been a major concern especially to the teachers as they see some of their students; especially the low ability ones, being rated as failures in standardised examinations because the assessment type used do not suit those students. Another effect is students' achievements barely reach 100 percent; yet concludes in frequent fluctuations in Basic Education Certificate Examination (BECE) and West African Senior Secondary School Certificate Examination (WASSCE) results each year.

The impact of the assessment type used is the same in many districts within Ghana and Ahanta West Municipality is not an exceptional. Yearly analyses of BECE results in the Municipality reveal the fluctuation. This is shown in Table 1.

Table 1: Ahanta West BECE Yearly Report

Year	Number of candidates	Percentage (%) passed	Percentage (%) failed
1996	778	86.0	14.1
1997	916	79.6	20.4
1998	1075	39.6	60.4
1999	1048	45.7	54.3
2009	1915	53.4	46.6
2010	1554	47.2	52.8
2011	2028	25.8	74.2
2012	1662	32.3	67.7
2017	2145	75.4	24.6
2018	2515	72.0	28.0
2019	2628	86.0	14.0

Source: EMIS Report (2019)

Table 1 shows that in 1996 candidates performed best with 86.0% passed and only 14.1% failure. In 1997 and 1998, the passing rate reduced to 79.6% and worst of 39.6% respectively. Subsequently, from 1999 through to 2009, there was a drastic increase in the passing percentage until 2010 and 2011 when the fluctuation occurred again with reduced passing rate of 47.2% and

25.8% respectively. However, from 2012 there has been a consistent increased in the passing rate with 86.0% in 2019 which is the same to percentage passed in 1996.

These views of the teachers and Ahanta West EMIS (2019) report were confirmed by Adusei's (2017) study. This gives an indication that the assessment type which could yield students' maximum achievements should always be employed. Ideally, the appropriate type will provide accurate feedback about student progress, build students' self-confidence and self-esteem, enhance learning and develop teacher's skills in evaluation (Goodrum, Hackling, & Rennie, 2001). As a result of these, educators clamour for an assessment type that can better determine students with different abilities achievement in examinations.

Statement of the Problem

The issue of assessment is a subject of concern to stakeholders in education (Kapukaya, 2013) as it directs them to the kind of decision that needs to be made when the assessment results are released (Salvia & Ysseldyke, 2001). That is, students' achievement in an examination determines how best learning outcomes and national educational goals have been achieved. This tends to depict the future workforce of the country.

To ascertain the ultimate achievement of students in examinations, necessary resources are made available by stakeholders before the inception of assessment itself (Awolugutu, 2016). For instance, teachers work hard to cover all outlined contents, learning outcomes and thinking skills purported to be assessed so that desired achievements would be attained.

However, as noted by Owusu-Kyeremaa (2010), academic achievement rarely reaches the level of attainment desired by the stakeholders anytime examination results are released in Gana. This led to the conduct of many studies on how to enhance achievements of every student. Numerous reasons such as truancy, teacher practices of teaching (Baidoo-Anu, 2017; Owusu-Kyeremaa) and assessment (Yeboah, 2017), among others, have been addressed (Awolugutu, 2016) yet, students do not seem to be attaining expected targets.

Meanwhile, students are generally, pre-informed of the learning outcomes they will be assessed on and the assessment procedures that will be employed during examinations. These are confirmed by some studies that the form of assessment adopted determines the way students approach learning for an examination (Adusei, 2017; Afful, 2014). Also the Ghanaian curriculum had specifically indicated that both the traditional and performance assessment procedures should be used to assess students (Ministry of Education [MOE], 2012). What then baffles most stakeholders, especially, the curriculum developers and examination authorities is, why students' performance still lags behind target of attainment when students are assessed with items based on the expected learning outcomes and the appropriate assessment procedures stated.

The situation is not different in Ahanta West Municipality. For instance, an interaction with teachers in the Municipal revealed that there is a challenge in enhancing students' achievement in examinations. Nevertheless, the teachers believed there is a tendency of enhancing students' achievement especially the low ability ones, if the assessment type used is in their predilection and suits them. In addition, the 2018 BECE results of the municipality indicating 28% failure (WAEC, 2018) confirmed the teachers' notations. Further analysis among the four electives subjects using the same report outlined where the failure lies. This is shown in Table 2.

Table 2: Elective Subject Analysis of 2018 BECE Results

Subject	Percentage (%) passed	Percentage (%) failed	Total (%)
English Language	74.63	25.37	100
Mathematics	69.96	30.04	100
Social Studies	79.80	20.20	100
Integrated Science	71.39	28.61	100

Source: WAEC Report (2018)

Table 2 reveals that high percentage of failure occurred in Mathematics and Integrated Science. These are the two main practical subjects at the JHS level and obviously might been affected by the assessment type used employed to assess the students.

Notwithstanding the consequences, research have shown that the assessment type (traditional or performance) used depicts how different ability students' achievement is in an examination (Eshun & Abledu, 2001; Leon & Elias, 1998). The question then arises as to "which type of assessment can better help different ability students to demonstrate their achievements, generally, such that the set target could be attained?" Meanwhile, research has also indicated that achievement can be improved among students with different abilities (Yaduvanshi & Singh, 2019) through the employment of an assessment type (Agyei & Mensah, 2018).

Many studies have been conducted to find out the right assessment type suitable to improve achievement of students. The study of Adjei and Mensah

(2018) compared the two assessment types. Their results revealed that traditional assessment is a better option to enhance students' achievement in examinations. However, Adjei and Mensah concentrate less on whether traditional or performance assessment could better enhance different ability students' achievement in examinations.

Arhin (2015) and Eshun and Abledu (2001) conducted similar studies at a senior high school and teacher training college levels respectively. Although Arhin compared only the assessment types, Eshun and Abledu compared students' achievements at the ability levels in addition to what Arhin did. The studies' results favoured performance assessment in enhancing different ability students' achievement in examinations.

In addition, Leon and Elias' (1998) study which delved in each assessment type and mixture of traditional and performance assessment tasks, also supported performance assessment as the best tool to enhance students' achievement in examinations. However, the study ended without considering achievements at the different ability levels. Notwithstanding the fact that many relevant studies less considered the impact of each assessment type on different ability students, none of them was conducted at the JHS level in Ghana.

It is therefore, important to turn our attention to the need for an appropriate assessment type that can better determine the achievement of students with different abilities at the JHS level. Hence, this study compared identified high and low ability JHS students' achievement using traditional and performance assessment in Mathematics and Science in Ahanta West Municipality.

Purpose of the Study

The purpose of the study was to compare high and low ability Junior High School students' achievement in Mathematics and Integrated Science using traditional and performance assessment tasks and to determine the better predictor of the two assessment types that maximise students' achievements in examinations. More specifically, the study was to:

1. compare performance of different (high and low) ability students when assessed using traditional assessment procedure and performance assessment tasks on equivalent content and learning outcomes in Mathematics and Integrated Science.
2. investigate whether different ability students will similarly perform when assessed using mixed items of traditional and performance assessment in Mathematics and Integrated Science.
3. compare the performance of high and low ability students when assessed using performance assessment in Mathematics and Integrated Science.
4. compare the performance of high and low ability students when assessed using mixed items of traditional and performance assessment in Mathematics and Integrated Science.
5. determine a better predictor of achievement for high and low ability students when assessed using traditional assessment procedures and performance assessment tasks in Mathematics and Integrated Science.

Research Questions

1. How do high ability students perform on mixed items of traditional and performance assessment tasks in Mathematics and Integrated Science?

2. How do low ability students perform when assessed using mixed items of traditional and performance assessment in Mathematics and Integrated Science?

Research Hypotheses

H_O 1: There is no statistically significant difference in mean scores between traditional assessment and performance assessment of high ability students in Mathematics and Integrated Science.

H_A 1: There is a statistically significant difference in mean scores between traditional assessment and performance assessment of high ability students in Mathematics and Integrated Science.

H_O 2: There is no statistical difference in the performance of low ability students when assessed on the equivalent content and learning outcomes in Mathematics and Integrated Science using traditional assessment and performance assessment tasks.

H_A 2: There is a statistical difference in the performance of low ability students when assessed on the equivalent content and learning outcomes in Mathematics and Integrated Science using traditional assessment and performance assessment procedures.

H_O 3: There is no statistical difference in the performance of high and low ability students in Mathematics and Integrated Science when assessed using performance assessments.

H_A 3: There is a statistical difference in the performance of high and low ability students in Mathematics and Integrated Science when assessed using performance assessments.

H_O 4: There is no statistical difference in the performance of high and low ability students in Mathematics and Integrated Science when assessed using mixed items of traditional and performance assessments.

H_A 4: There is a statistical difference in the performance of high and low ability students in Mathematics and Integrated Science when assessed using mixed items of traditional and performance assessments.

H_O 5: There is no better predictor of achievement for high ability students assessed using an assessment type tasks in Mathematics and Integrated Science.

H_A 5: There is a better predictor of achievement for high ability students assessed using an assessment type tasks in Mathematics and Integrated Science.

H_O 6: There is no better predictor of achievement for low ability students assessed using an assessment type procedure in Mathematics and Integrated Science.

H_A 6: There is a better predictor of achievement for low ability students assessed using an assessment type procedure in Mathematics and Integrated Science.

Significance of the study

The study's results should be useful to the following authorities.

Educators at the JHS level: The findings of the study will help educators in the classroom to adopt and integrate the appropriate assessment type in developing their assessment tools for assessing different ability students; such that, both high and low ability students achievement will be enhanced in Mathematics and Integrated Science examinations. That is, the findings will provide rich information on why classroom educators will have to opt for the assessment type that will suit both the high and low ability students in a classroom.

Authorities in examination bodies: The findings of this study should be of interest to the authorities in charge of developing assessment tasks for standardised examinations at the JHS level. The findings will suggest the reasons for which the (authorities) examiners will have to adopt and integrate the appropriate assessment type in constructing tasks for the standardised examinations at the JHS level. This is because, the use of the appropriate assessment type will enhance both the high and low ability students' achievement in the examinations.

Authorities in Curriculum development: The findings will immensely assist curriculum developers to use the appropriate assessment type tasks in designing comprehensive assessment procedures in the text books for use of students at the JHS level. This will enable the developers to appropriately assess students with different abilities, purposely, to determine the extent to which students are achieving the predetermined learning goals of education at the JHS level.

Research Assumptions

The study assumed that:

1. The teachers and students have treated the selected topics used to construct the achievement tests.
2. Students whether high or low ability and irrespective of their locations can perform equally on the achievement tests.

3. High ability students are generally better than low ability students in terms of achievement in examinations.

Limitations

The use of achievement tests as the data collection instruments was the weakness of this study. There is the tendency of intruding measurement errors in individual student's performance as in any measurement in education and psychology during data collection. That is, physical and emotional challenges such as illness, fatigue and trauma might set in. Relatively these errors would wrongly cause some students to attain low or high scores in the tests. These in turn, limit the attainment of true scores for the affected students and eventually lead to a wrongful determination of their achievements in tests, hence might affect the results and generalization of this study.

Delimitation

A study that compares students' achievements in the assessment types is comparatively time consuming, demanding and expensive to accomplish especially with the aspect of performance assessment involved. Therefore, for the performance assessment aspect only on-demand (paper-and-pencil and hands-on equipment and resources) tasks were used to collect the data.

Further, in terms of population coverage, the study was conducted in Ahanta West Municipality in Western Region of Ghana. This is because; the municipality is reported by Ghana Statistical Service (2014) as multi-occupational and it includes the two major component of agriculture (fishery and farming). These occupations always have impacts on students' academics and hence achievements. The study was narrowed to the second year junior high school students in public schools. This is because the second year students have acclimatized themselves better to the JHS system and are free from the impending BECE.

The study was also delimited to the expertise of the researcher in developing the test tasks (testing instruments) to assess students' achievements and scoring as well, not any other soliciting tools. The purpose was to enhance the testing conditions, limit test pollution and cheating which might affect the results.

Definitions of Terms

A word or phrase might have multiple meaning. Therefore, the following words are defined to depict their meaning as used in this study.

Traditional assessment: Tests that require the same response from all participating students and are scored uniformly. For the purpose of this study, it includes all objective tests and definitional essays that do not require more than ten lines of writing to response to a task.

Performance assessment: The assessment procedures that require students to do or perform a hands-on activity order to accomplish a task. In this research, it includes authentic, alternative, performance-based-assessments and persuasive paper-and-pencil tasks.

Mixed items test: A combination of traditional and performance assessment tasks in one testing instrument.

Tasks: Individual test items in an instrument that students must respond to.

Students' achievement: Students' typical attainment in tests.

Organization of the Rest of Study

The study is in five chapters. The first chapter covers the introduction which looked at the background to the study, statement of the problem, purpose, research questions and hypotheses, research assumptions significance, delimitations and limitations of the study. The second chapter engulfs review of related literature. It focuses on the two major learning theories and their modes of assessment. It further discusses the two assessment types and some empirical studies' findings of impact of each assessment type on students' achievements. The third chapter describes the methodology adopted, the population and sampling procedure, instruments development, data collection and means of analysing the data. The results and discussions of the findings are presented in the fourth chapter while the fifth chapter summarises the whole research which further includes the key findings, conclusions and recommendations based on findings. Suggestions for further research are provided.

CHAPTER TWO

LITERATURE REVIEW

Introduction

Assessment practice had been the hallmark of every educator in determining students' strengths and weaknesses including their achievements (Van de Watering, Gijbels, Dochy, &Van de Rijt, 2008). Assessment cannot be accomplished without the initial components which involve teaching and learning since assessors assess what have been taught and should be learned by students. This creates a triad among teaching, learning and assessment (Graham, 2016). That is, teachers assess what they teach and students learn what they will be assessed on. Indeed, assessment is carried out on what students have been taught and learned by students.

Assessment aims at determining students' achievements from an instruction. As Graham (2016) has noted, learning occurs when learning objectives, instructions and assessment are closely in line. This alignment makes the three reinforce each other to indicate what educators can assess to make assessment process valid for ability targeted objectives (Graham) including improving students' achievements. McMillan (2007) believed the assertion by noting that, with a reliable assessment, student's achievement level can be enhanced. McAlpine (2002) added the view that educators use assessment to evaluate the progress of understanding made by students. This raises the question on which assessment procedure will better depict the achievement level of students.

This chapter addresses the review of related literature in relation to the assessment types (that is, traditional and performance). The chapter is in three sections. The first section is the theoretical review covering the behaviourist and constructivist learning theories and their respective modes of assessment. The second section is the conceptual review constituting the concepts of traditional and performance assessments. The section deals with modes of assessments, their characteristics, advantages and disadvantages. The section also includes the psychometrics of testing; of specifically validity and reliability. The final section engulfs the empirical review of related studies on traditional assessments, performance assessments, as well as the mixture of both assessment types on students' achievements.

Theoretical Framework

Behaviourist Learning Theory

The behaviourist learning theory sees learning as the changes in behaviour in either form or occurrence of observable performance. To this, Bush, (as cited in Weegar & Pacis, 2012) believed learning as seen by behaviourists is "only observable, measurable, outward behaviour worthy of scientific inquiry" (p. 2) created by a stimulus in the environment. This means, learning occurs when responses to a specific stimulus presented in the environment is accurately executed.

According to Cox (2011), behaviourism is an individual act with its roots on the principle of stimulus-response associations with conditioning as the central idea. Conditioning process is central to behaviourism because behaviourists believe that the learner's mind is a "black box" (empty) and needs to be occupied with knowledge through conditioning (Stevens-Fulbrook, 2019; Wilson & Peterson, 2006). Therefore, behaviourists conditioned (trained) learners to respond to stimulus presented in the environment. That is, learning occurs, only when students provide desired responses to given tasks (stimuli). Ertmer and Newby (1993) expatiated this by citing an instance that

> "when presented with a math flashcard showing the equation "2 + 4 = ?" the learner replies with the answer of "6." The equation is the stimulus and the proper answer is the associated response. The key elements are the stimulus, the response, and the association between the two" (p. 7).

In accomplishing this task, the student must know how to demonstrate the proper response, as well as the conditions under which that response would be appropriate.

Deducing from this, it is true to say that, stems of traditional assessment procedures such as multiple choice, true or false, short answer tasks among others are stimulus created by assessors for students. Also, as behaviourists require students to use the conditioning process of stimulus-response association in attaining response to each stem, in traditional assessment, students read, comprehend and make the association with a key displayed or an issue, then, provide it as the response to the stem. This is demonstrated by selecting or writing a word, a phrase or sentence accurately to indicate the achievement of a learning outcome. Therefore, low or high ability students potential in forming the accurate association between stimulus and the response of each task indicates the correct scores to be attained in traditional assessment. Thus, student's achievement in an examination constructed using traditional assessment tasks depends on the accuracy of the association formed.

Conversely, as Cox (2011) posited, proponents of behaviourism have indicated that students need to be told or directed to an act before they can demonstrate it. To Mathews (1996), this process is most effective when using the lower-order thinking skills which is a passive strategy employed for procedures in traditional assessment type.

Inferring from Cox (2011) and Mathews (1996) the use of lower-order thinking skills in constructing tasks is a passive strategy employed for procedures in traditional assessment type. This is because the tasks assess students' grasp of information, definitions, facts, principles, processes, concepts, rules; thus, factual knowledge required for higher learning of students (Dikli, 2003). This implies that low or high ability students are favoured with lower thinking skills anytime traditional assessment tasks are employed for an examination. For this reason, this current study aims at finding out which of the ability group of students is better favoured with traditional assessment.

Convincingly, the ultimate aim of behaviourism is to elicit the desired response to a given target stimulus (Ertmer & Newby, 1993). That is, the behaviourist has interest only in the resulting learning outcome but not the process of exhibiting it. This idea is rooted on the assumption that human behaviour can be predicted, Ivan Pavlov (as cited in Stangor & Walinga, 2014) hence, there is no need for determining what happens in the mind of an individual. Obviously, this confirms what Stevens-Fulbrook (2019) said, that the responses to stimuli can be objectively measured because behaviourism discounts any independent activity of the mind.

In building on Ertmer and Newby (1993), behaviourism evidence is rooted in the manner with which a student response to question items of the traditional assessment procedures. As noted already, students respond to tasks either by selecting options, matching statements, filling in empty spaces, giving definitions, listing or stating steps in an activity. In these procedures, assessors do not require how the student makes up the response. Black and Williams (1998) acknowledged that traditional assessment procedures ignore what happens in what they referred to as the "black-box" (mind) of students when the assessor is accounting for students' achievement in an examination.

As Shepard (2000) posited, the traditional assessment culture is heavily influenced by the old paradigms (behaviourist learning theory) and the belief in objective and standardized testing. Multiple-choice and open-ended assessments are typical test formats of the assessment culture (Watering *et al*., 2008). Winn (as cited in Ertmer & Newby 1993) aligned with these allusions and noted that "no attempt is made to determine the structure of a student's knowledge nor to assess which mental processes it is necessary for them to use" (p. 7). Rather, students are characterized as being reactive to conditions in the environment as opposed to taking an active role in discovering the environment. These, therefore, make students create all possibilities of obtaining the correct responses to every stimulus presented to them. These characteristics make ways for guessing, cheating, among others, to elicit right response to items in the traditional assessment procedures.

According to McLeod (2013), behaviourists use the scientific methodology of studying human behaviour and believe that the individual actions or performances are determined by the environment hence no one has free will of learning on his/her own. This confirms the concept of stimulus-response association that is reflective in traditional assessment procedures, especially in the objective test tasks. Tasks serve as the stimuli that elicit response (answers) that the individual select or provide.

Referencing from the behaviourist point of view, when carrying out assessment, the assessment procedures and conditions should be made the same for all the testees, both high and low ability students just as in traditional assessment. This is because; the behaviourist believes students react to stimulus from the environment in the same direction and degree. In view of this both low and high ability students were assessed with same tasks constructed for the tests. This revealed how achievement is for each ability group of students when assessed using traditional assessment.

Behaviourist Mode of Assessment

Assessment is at the forefront of teachers' understanding and interpretation of the cognitive achievement of students (Salvia & Yesseldyke, 2001). This is an indication that, assessment of students' achievement is an essential part of every learning activity. However, as noted by James (2006), most learning theories hardly indicate how assessment should be carried out in the respective models of learning, thus, making it difficult in stating exact assessment procedure for a particular learning theory. Meanwhile, the working principles of a theory are the reflective directions of how knowledge should be assessed in the theory.

Many studies have revealed the common features of the behaviourism in traditional assessment (Abulnour, 2016; Black & Williams, 1998; Guey, Cheng & Shibata, 2010; James, 2006; Shepard, 2000; Weegar & Pacis, 2012). These subsume time bound assessments which are rigid and fixed, questioning tasks mostly in the lower domain that require short but similar answers from all students, and finally believes in continuous exercises (practice) to demonstrate perfection. Students' performance is usually interpreted as either correct or incorrect and sometimes partially correct. Also, the assessment is "taken under strictly controlled conditions and every test question is required to assess the same skill" (Abulnour, p. 36) which involves recalling facts, defining and illustrating concepts, and associations in applying explanations (Ertmer & Newby, 1993). Guey *et al*. agreed with this assertion and noted that traditional assessment covers knowledge and comprehension domains of the Broom's taxonomy. These features as noted by Abulnour, do not investigate the thinking processes that students used to obtain the responses. Furthermore, the assessment concludes with extrinsic motivators such as grades, prizes, and privileges, as well as recognitions and praises, (Weegar & Pacis).

Inferring from the preceding paragraph on behaviourist mode of assessment, it is obvious that, behaviourist employs traditional assessment procedures to elicit responses to the created stimuli in the environment. For an instance, Shepard (2000) expatiated that, the behaviourist learning theory has influenced and enveloped traditional approaches of assessment. The most approaches used are the written tests in which the student selects or composes a response to a prompt (Dikli, 2003). These subsume objectives and short essays items.

However, many educationists and psychologists are declining form the behaviourism concept of learning and assessment (Lane, 2010) because of the unexplainable reasons of mental activities and the belief in stimulus/response associations (Graham, 2016). This creates confusion as whether students really understand concepts and have the ability to apply such concepts in the future.

Constructivist Learning Theory

Constructivist learning theory posits that new knowledge generation is built from the fundamentals of one's own previous comprehension and experience (Stevens-Fulbrook, 2019). According to Stevens-Fulbrook, understanding of a new concept is based on reflections of prior knowledge and experiences acquired from theories and interactions in the environment. This means, past knowledge and experiences lie at the center of constructivism. As noted by Vygotsky (cited by Willson & Peterson, 2006), individuals are competent to develop a concept because their minds are not empty vessels.

In relation to this, Guey *et al.* (2010) posited that the individuals are the sole developers of new knowledge. This implies, constructivism is about individuals developing knowledge on their own but not retrieving it from others. Therefore, in constructivism, learners are taught on how to practice independent learning by using their experiences as opportunities to demonstrate comprehension and skills in appropriate situations (Abulnour, 2016).

There is an implication of this constructivist view of learning for assessment in cooperative education. It is likely that students' starting points are all different; each having differing levels of prior work and life experiences. Thus, assessment needs to acknowledge that each student learns different things from his or her perspective, each being of potential value and merit. For this reason both high and low ability students were assessed using performance assessment tasks. This is because, performance assessment allows this free will of students using individual prior knowledge and experiences in providing responses to tasks.

According to Bush (as cited by Weegar & Pacis, 2012), constructivism is determining how students construct meaning from concepts. Thus, how cognitive processes are employed and skills are demonstrated using experiences. Abulnour (2016) agreed with this assumption and explained that, students are always "actively engage in making meaning and building knowledge by manipulating, creating, and exploring new information to fit their belief systems and prior experiences" (p. 13). He explained further that, the experiences are constructed uniquely and in diverse approaches but mostly turns to one meaning. Wilson and Peterson (2006) justifying the assumption said, it makes every approach of interpretations to be correct and rejects the assumption of "only one correct" approach to an interpretation of information by everyone. Wilson and Peterson further noted that everyone's interpretation is uncontrolled so far as the diverse processes are tailored toward making the same meaning. Obviously, this makes constructivism to be characterized by multiple approaches to knowledge acquisition and interpretation.

However, as Abulnour (2016) argued, interpretations to acquired knowledge might be wrongfully put. This, therefore, means the learning process will require strict and appropriate guidance during knowledge acquisition. The guidance fosters learners' ability to accurately demonstrate new knowledge through relevant and/or observable activities that will link with already acquired experiences articulated as "we know by doing". Wilson and Peterson (2006) believed the aspect of executing what is known, is understood not only in the theoretical frame, but one's ability to apply knowledge and skills in developing products. This implies that, constructivists judge the extent of understanding by using both the process of attaining knowledge and the products developed by applying knowledge gained.

Making reference from the constructivist view of learning, attention needs to be given to preparing students for their perspective in ways that enable them to draw upon their existing knowledge schemas to link this to the possible stimuli afforded by the environment. Assessment needs to find ways of probing their reactions to both the intellectual and emotional experiences they have. Also, assessment needs to include ways of enabling students to link what they know with workplace practices. This is done by allowing them to demonstrate their prior experiences and knowledge practically in developing observable products. Further, students' procedural and conditional knowledge need to be emphasized through hands-on activities in assessment by assessing the process used to develop a product. Finally, when preparing students for academic work, and subsequently assessing the learning, it is advisable to allow for both verbal and imaginable expressions of learning. In views of these, performance assessment was used purposely to determine whether high and low ability students' achievements will be maximised or not.

Constructivist Mode of Assessment

Lane (2010) stated that, "the deeper the understanding of how individuals acquire and structure knowledge and cognitive skills, and how they perform cognitive tasks, the better able we are to assess students' cognitive thinking and reasoning and obtain information" (p. 7). Thus, assessment is better implemented with a learning theory supporting and explaining how knowledge should be assessed when acquired. Lane confirmed this assertion that, the theories serve as the pre-requisite tools for designing assessments to determine students' achievements. To achieve this, assessors conform to the assumptions of the theories to design the assessment tasks just as Lane had indicated that "it is important to point out that much of what is known in the development of expertise is based on studies of students' acquisition of knowledge and skills in content domains" (p. 7). This implies that, the cognitive process theories are the fundamentals for assessment design and interpretation in educational systems.

According Abulnour (2016), assessment in constructivism is done in two ways: (a) how best students are able to use materials and theory taught to develop products, and (b) the process students will use to develop products. Meanwhile, Wilson and Peterson (2006) said the processes as well as the products are equally source of information for evaluation. This means constructivists assess cognitive activities of students by allowing students to demonstrate acquired knowledge through the process of performing a challenging task or in a developed product. Cox (2011) noted that the processes and/or products are pregnant with evidence based experiences which are used to read students' cognitive processes. These pieces of evidence are present when tackling tasks such as debates, discussions, reporting documentaries, real life activities with concrete examples or in moulding objects.

Furthermore, Abulnour (2016) and Cox (2011) noted that, the constructivism assessment modes require cognitive actions such as independent means of analysing questions/tasks, critically thinking to inquire, or collaborate and research into issues at hand and to evaluate. This implies that assessment tasks are constructed to incorporate higher-order thinking skills of the cognitive domain by Broom taxonomy to make students employ critical thinking to solve problems. Such assessment tasks require students to apply what they learnt by demonstrating proficiency in investigative projects, laboratory practicals, experiments, paper and pencil tasks, and on demand performance tasks which prepare the individual for real life evaluation. Constructivists, therefore, prefer learners to execute genuine thoughts that will better stimulate evaluation as embedded in performance assessment more than in traditional assessment.

In delineating the conceptual frameworks of constructivism and performance assessment, Rudner and Boston (as cited in Nnorom & Okafor, 2011) confirmed that in performance assessment "the process of assessment is itself a constructivist learning experience, requiring students to apply thinking, skills, to understand the nature of high quality performance, and to provide feedback to themselves and others" (p. 206). This means that, constructivism and performance assessment are in tandem in numerous ways and share common features such as presented below:

1. Thinking skills: Constructivists and performance assessors require students to employ critical thinking skills in tackling tasks (Abulnour, 2016). This explains why verbs such as discuss, evaluate, estimate, among others, which incorporate Broom’s higher-order thinking skills are used in constructing the tasks.
2. The assumption of accepting multiple and relevant responses to a given task: Here, there is “no one and universal single” correct answers to a task but various forms of responses that express the same concept of knowledge are correct (Lane, 2010; Wilson & Peterson, 2006). This encourages students to use various approaches to arrive at the exact product without any restrictions.

3. Cognitive process in tackling tasks: Both constructivists and performance assessors believe in students applying learnt contents in solving realistic life problems and/or developing products (Cox, 2011).
4. Means of judgement: Constructivists and performance assessors use processes as well as products of tasks to judge understanding of taught contents (Lane, 2010; Wilson & Peterson, 2006).
5. Performance of tasks: Constructivism and performance assessment are characterised by students performing or doing something to demonstrate acquired knowledge and skills (Cox, 2011; Lane, 2010).
6. Constructivism encompasses variety of activities that suit the learning styles of individual students, their needs, talents, interests and academic background (Stevens-Fulbrook, 2019). Performance assessment has similar assumption of permitting students to employ various processes that suit the individual characteristics of students to solve a given task (Lane, 2010).

Conceptual Framework

The study was guided by the conceptual framework presented in Figure 1.

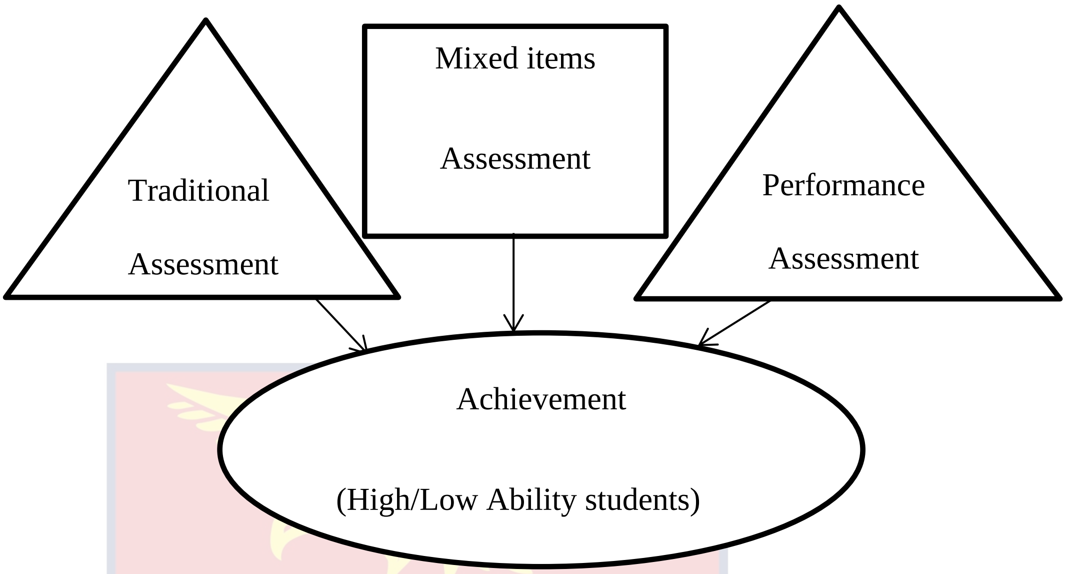

Figure 1: Study's Conceptual Framework

Explanation to the Framework

The framework constitutes two major assessment types which are traditional assessment and performance assessment in the triangles. The merging of the assessment types provided whole assessment type of mixed items of traditional and performance assessment. That is, the halves (traditional assessment or performance assessment) in each triangle merge to form the whole (mixed items) in the rectangle. Each assessment type has a unique result on high or low ability students' achievements (oval) in examinations. The conceptual framework, therefore, describes the achievement of high or low ability students' in examinations when (a) traditional assessment, (b) performance assessment or (c) mixed items of traditional and performance assessment is employed to assess them.

Conceptual Review

Traditional Assessment

A global observation indicated that traditional assessment has been the main tool for obtaining information concerning students learning since the early 18th century of education (Khalanyane & Hala-hala, 2014). The authors added on that, this assessment mode is criticised as not been efficient and accurate in determining students' competency and application of skills and requires individuals to execute responses in predetermined manner. However, many others have different views on traditional assessment.

Although authorities and measurement experts have not clearly defined traditional assessment, Arhin (2015) believed that traditional assessment is the assessment tools that make students select correct answers or recall knowledge in accomplishing a task defined in the assessment. Such assessment tools are unable to assess the higher-order cognitive skills of the Broom's taxonomy because the tasks require students to recall information and to select answers amid incorrect options present. This aspect of the assessment encourages passiveness since students do little or nothing at all to construct their own answers to any given task. Obviously, the assessment tools portray partial achievement of students in the assessment because only knowledge and comprehension levels are mostly assessed.

The work of Gronland (2006) opined that, an assessment type is defined by how real and complex the tasks are and the time frame required by the student to complete the assessment. To him, the assessment procedures that are constructed to assess limited realisms and complexities and require limited time for completion are traditional assessments. That is, the assessments are completed within a given time frame. Concerning the complexity of tasks, Gronland noted that because the assessment measures the lower cognitive skills and assume the presentation or acceptance of just and only one or single correct response to a task the procedures demand every student to learn the same thing in a specified dimension for measurement of accuracy. This demand, therefore, is the root to rote memorization of facts, definitions, theoretical concepts, fundamental assumptions and processes which often offer little opportunity for the demonstration of the thought processes including critical thinking.

Also, as asserted by Van der Watering *et al.* (2008), the presuppositions create standardization nature of processes in traditional assessment. Hartman (2019) confirmed the assertion by saying that, traditional assessments such as objective tests are standardised tests that possess tasks with very few answer options. Hartman noted that, the tasks tend to lack reality in context as students' response to questions without illustrating any critical thinking or reasoning skills. However, this assertion is not in accordance with reality since students do execute some degree of unobservable cognitive process in response to tasks. Hartman added on that, the worse effect of traditional assessment causes teachers to be teaching to the test especially, how to identify correct options to tasks. Van der Watering *et al.* added their view to oppose traditional assessment usage, by stating that, the assessment "test items emphasize only the results, while the students' thinking processes cannot be known. In addition, it is also not known whether the students' response is a result of their thinking or the result of guessing" (p. 656). Van der Watering *et al.* explained further that the assessment tools lack evidence and authentic arguments to how answers are attained. Obviously, based on these assumptions, traditional assessment procedures are efficient for mastery of subject matter since they contain the influence of behaviourism, as illuminated by the objectivity of responses and standardization of the testing process.

Furthermore, traditional assessment possesses shortcomings of measuring student achievements against empirical standards. Zimmerman (2003) explained this notion by noting that the assessments (a) do not promote students learning, (b) are weak determinants of individual abilities as it labels students wrongly, (c) omits content emphasizes by restricting learning outcomes, (d) measures limited range of knowledge and (e) omits the important educational goals in assessments. Bol, Stephenson, O'Connell, Nunnery (1998) also held a similar view by expatiating the negative notion of traditional assessment and stated that, it assesses precision act that focus on products other than the procedural aspect of learning. To Bol *et al.*, the proponents of traditional assessment believe the assessment gives more valid measure of students' achievements; but they forgot that a student's raw score could contain the error of guessing that the student might incorporate in the selection of correct responses to the tasks in an examination.

However, Hartman (2019) raised an argument to sustain traditional assessment procedures by opining that the procedures are easily administered, analysed and used for comparisons of students' achievements. Hartman also believed the assessments are diagnostic in nature as they help teachers to determine the exact strength and weak points of students in an instruction. Van der Watering *et al.* (2008) joined in the argument that students believe traditional assessment are those assessment tools that are easy because there is little or no difficulty in their preparations, and turns to produce high achievement scores. Ideally, such ideology should be present in students since the tools assess lower cognitive skills and not reasoning or critical thinking processes. To Van der Watering et al., these thoughts of students create positive impression of traditional assessment to both teachers and students and have caused the rampant usage of its procedures by professionals.

Obviously, traditional assessments are frequently employed by classroom teachers during and after lessons. According to Quansah (2018), teachers use the objective test and essay formats as quizzes and exams for formative and summative purposes during a termister or semester course because of the ease in constructing and scoring process of the test tasks. However, Quansah was displeased with the response nature of traditional assessment tasks because, the chances for guessing the correct answer in some objective tests are high and besides the practice of bluffing in definitional essay tests. He further noted that the Ghanaian's national standardized tests for the pre-tertiary educational cycles are examples of traditional assessment employed for students to demonstrate what they have learnt for the duration of the programme. This is indisputable, since both examinations employ multiple-choices, short-answers and essays procedures. However some tasks of the Science and Mathematics related subjects entails performance tasks. For instance, general Science students of the second cycle are examined on practicals in disciplines such as Physics, Chemistry and Biology (WAEC Exams Time Table, 2020). This means that the examinations take the form of a mixture of traditional and performance tasks.

The foregoing discussion gives a direct picture of traditional assessment. That, the procedures are written tests comprising numerous tasks completed in limited specified timing. It also requires the use of lower-order thinking skills and memorization and recalling of facts.

Modes of Traditional Assessment

According to Alkharusi (2008), the proponents of traditional assessments outline modes of implementing the assessment through objectives tests and essays pertaining to recalling of facts and definitions. Amedahe and Asamoah-Gyimah (2016) also noted that objective tests require students to select or recognize correct or best response from given alternatives or provide short response to a test task while in the essays students reason and write brief paragraph from memory. Amedahe and Asamoah-Gyimah explained further that, objective tests can be classified as selection and supply types depending on the demand of the task in the test; multiple-choices and short-answers tool test tasks are respective examples. These modes are equally addressed by educational measurement experts, notably Dilku (2003), James (2006), Lovely Professional University (2012) and Nitko (2001). Amedahe and Asamoah-Gyimah and Dilku gave clear description of each as follows:

Multiple-choice questions: Each item consists of a stem which may be in a question form or an incomplete statement and a number of alternatives, usually between three to five. It requires the selection of correct or best response (key) from a set of displayed alternatives.

True or false items: The tasks present the student with a statement and request the student to indicate which of the two potential responses is true or false.

Matching test items: Matching test is made up of two columns. The first contains statements called premises while the second column contains responses or options to the statements. Here, the test requires the student to make an association between a task (statement) and a choice that have a well-defined relationship to the given task.

Short-answer tests: They are tasks that allow the student to provide a letter, word, phrase, clause or statement to a complete an incomplete task.

Definitional essays tests: These allow students to employ their freedom to articulate thoughts by constructing their own answers to tasks in writing. That is, students are supposed to explain the meaning of information through writing using their own words. This does not require students to demonstrate critical thinking skills but recalling facts when responding to the tasks.

Characteristics of Traditional Assessment

Based upon the descriptions of traditional assessment by measurement experts (Amedahe & Asamoah-Gyimah, 2016; Dilku, 2003; James, 2006; Lovely Professional University, 2012; Nitko, 2001), the following features are their identifiable characteristics:

Cognitive skills: The assessment procedures generally assess the lower-order thinking skills that require students to recall, recognize and reconstruct a body of knowledge. The procedures aim at strengthening the student's memorization and comprehension skills.

Means of responding: Traditional assessment procedure provides limited ways for students to demonstrate what they have learned through selection or composing a few words to response to given tasks.

Nature of tests**:** The procedures use numerous tasks in one testing time. The tests are rigid and fixed with time limits. This makes traditional assessment standardized format and easier to administer on large students.

Scoring process: The tests are easy to score because of the demand of precision in responses that require objectivity scoring process and direct attention solely on academic intelligence.

Advantages of Traditional Assessment

Content sampling: Traditional assessment tests grant a wide range of content coverage so as to assess a large range of learning outcomes in a single testing period. This helps in explaining the content-validity of the scores (Amedahe & Asamoah-Gyimah, 2016).

Scoring reliability**:** Most tasks of traditional assessment have the capability of allowing easy development of scoring keys to accurately and easily score tasks by machines, clerks, paraprofessionals and even students (Hartman, 2019). This occurs because there is only one correct answer to each task. Obviously, the presence of objectivity in the scoring process makes the assessment procedures highly reliable to measure students' achievement.

Determination of psychometric properties: Most traditional assessments procedures afford and are amendable to statistical computations such as item analysis, validity and reliability of test scores. This helps in determining good and reliable tasks for future use (Amedahe & Asamoah-Gyimah, 2016).

Cost of execution: Traditional assessment procedures are more economical to execute mostly on a large scale as compared to performance assessment (Lane, 2010) because their administration require a few equipment (papers and pencils/pens) and the scoring are easy to execute.

Challenges/Disadvantages of Traditional Assessment

Traditional assessment procedures, though simple to carry out, have some challenges.

Aligning tasks to cognitive domain: The main challenge to traditional assessment procedures is the difficulty in constructing the tasks to meaningfully reflect the full cognitive domain by the assessor (Nitko, 2001). Obviously, some objective tasks measure the higher-order thinking skills. Although the table of test specifications may be drawn to guide the process of writing tasks (Etsey, 2012), test constructors mostly mismatch tasks to the appropriate elements within the domain. The response processes to such tasks require intense thinking or computations beyond the level of recalling that measure knowledge and comprehension of information. This assertion is mostly observed in Mathematics objective tests. For example, when students are asked to identify the mean of a data such as 7, 2, 5, 7, 8, 9, 10, 3, 6, in a multiple-choice test, the process requires finding the sum of all digits before dividing the sum by the total occurrence of digits to obtain the mean. This computation is beyond mere recalling to recognize displayed answers.

Difficulty in construction: Assessors are faced with the difficulty of adhering to the numerous rule delineating to traditional assessments construction especially multiple-choice tasks. This challenge is present from planning through to reproduction stage of the test development process.

Presence of errors in scores: Obviously, traditional assessment test scores contain measurement errors like any other assessment, infused in by guessing and even cheating (Amedahe & Asamoah-Gyimah, 2016; Dilku, 2003; Nitko, 2001). This occurs, because the student does not present any evidence to demonstrate the thinking process when tackling a task.

Performance Assessment

According to Lane (2010), educational reform in the 1980s was based on the premise that too many students knew how to repeat facts and concepts, but were unable to apply those facts and concepts to solve realistic problems that require complex thinking and reasoning skills. Thus, performance assessment is a great way to make learning meaningful to students and to encourage them to be creative, innovative, and constructive. Meanwhile, as posited by Lane, performance assessment is an essential component and process in education yet with limited recognition and practice in many nations. Osterlind (2006) noted this assertion by saying that performance assessment got its recognition when traditional assessment of knowledge using multiple-choice could not give better account of individuals' knowledge in demonstrations, performance tasks, proficiency in writing skills, creation of products and even group work in tests. However, Khattri, Kane and Reeve (1995) believed that performance assessment is unknowingly practiced by assessors in diverse procedures. Regardless of the fact that performance assessment was informally known to assessors, the authors believed it is an old tool that is used to measure students' cognitive, affective and psychomotor skills

On the other hand, Leon and Elias (1998) believed performance assessment originated from the Chinese proverb "I do I understand" because the assessment tasks require application of learnt content in realistic situations. The authors believed the assessment tasks encourage demonstration of learnt concepts in using activities that are thought provoking and require dedication and responsibilities from students. This made Khalanyane and Hala-hala (2014) to say that performance assessment emphasizes on procedures employed to solve unique problems in society. This is an indication that tasks of performance assessment require students to act by performing or constructing a product other than recalling and selecting existing answers to a task.

Madaus and Dwyer (1999) stated that, "performance assessment requires examinees to construct or supply answers, perform or produce something for evaluation" (p. 690). In this form of assessment students are engaged in an action to accomplish a task. Nitko (2001) noted that in performance assessment, students use acquired knowledge and skills from diverse fields in accomplishing the task which is related to a learning target. Thus, the requirement of performing an activity is rooted on knowledge and skills learnt in the classroom. Arhin (2015) in his view said students show their mastery of skills and competencies by doing activities they are capable of taking on their own. This implies that, in performance assessment, students develop their own solutions to tasks posed to them. The demonstration of proficiency occurs in solving complex problems such as a contextual mathematical problem which ensures that, both the process used in reaching a product and the product itself are assessed (Nitko).

Performance assessment is characterised by assessing multiple learning targets especially with tasks that require the students to create objects, produce a report or to put up a demonstration of an activity or event (Lane, 2010; Nitko, 2001). The assessment procedures require execution of more than one learning outcomes in accomplishing a task. An instance is when a student is asked to demonstrate a hands-on activity. In this process, the student will initially picture the whole activity at a glance, outline principles involved, gather and arrange relevant materials if required before putting up the demonstration just to ensure that the activity incorporate all necessary principles and assumptions. This confirmed what Herrera *et al.*., (as cited by Mussawey, 2009) said that, performance assessment tasks assess all aspects of student learning through determining means by which students assimilate information, store and apply information in novel ways. However, Nitko argued that, every learning target cannot be assessed using performance assessment. Such learning targets include declarative statements that need to be assessed with traditional tasks because they require recalling of facts.

Performance assessment has multiple names based on the diverse perception of authors. Brown and Hudson (as cited in Koné, 2015), said the assessment is also known as authentic assessment or performance–based assessment because the assessment procedures allow students to produce responses that are similar or exactly to the real thing in life by using their own productive skills. Brooks (1999) and Oosterhof (2001), on other hand, said performance assessment subsumes authentic and alternative assessments because all of them require the employment of higher-order thinking skills.

Darling-Hammond (as cited in Koné, 2015) posited that performance assessment judges students on laid down criteria essential for the precise performance of the activity similar to the work place. Similarly, the Standards for Educational and Psychological Testing, indicating that performance assessments "emulate the context or conditions in which the intended knowledge or skills are actually applied" (American Educational Research Association [AERA], American Psychological Association [APA], & National Council on Measurement in Education [NCME], 1999, p.137). To the proponents, performance assessment has a broad range of assessment types subsuming authentic, alternative and performance-based assessments and these are interchangeable based on evidence of similar characteristics existing among them (Brooks; Herman, Aschbacher, & Winters, 1992).

However, Frey and Schmitt (2007) argued to differentiate between authentic and performance assessment by noting that authentic assessment tasks ensure the presentation of the real world in its activity and interpretations while the performance assessment ascertains the degree of a skill or ability. Kane, Crooks, and Cohen (as cited in Lane, 2010) said, "the close similarity between the performance that is assessed and the performance of interest is the defining characteristic of a performance assessment" (p. 4). This means, is just not the exact answer but any desired response that relates the original requirement is acceptable and describes the assessment. To limit the argument, Meyer (1992) believed only the assessor has the capability of determining when a task is authentic or performance assessment depending on the laid down criteria of authenticity that seem essential to the assessor.

Performance assessment is perceived by proponents to portray two distinctive functions (Lane, 2010; Lane & Stone, 2006; Herman *et al.*, 1992; Wiggins, 1990). First, it is an instructional strategy that increases learning and second, it is a measure of students' cognitive processes and skills (Shepard, Flexer, Hiebert, Marison, Mayfield & Weston, 1995).

Commenting on the assessment aspect, Lane (2010) said the assessment measures the degree of cognitive activities and skills especially of students applying knowledge in solving challenging problems. The assessment tasks require students to provide responses to problems through hands-on activities that engulf series of investigations, reasonable guessing, and judging their own work based on pre-determined standards or criteria. To Lane, performance assessment is best expatiated if "proficiency can be explained by the cognitive processes and skills involved in solving the performance task as well as the strategies chosen for a solution, having the potential to provide rich information for diagnosing strengths as well as gaps in understanding for individual students as well as groups of students" (p. 4). To agree with Lane, performance assessment embraces every student in the process irrespective of the uniqueness of the student (Bland & Gareis, 2018) and this includes the physically challenged students (Webb *et al*., 2002). The visually impaired students in a drama class will just listen to description of styles in a dance and execute accurate response by demonstrating the style to the assessor.

Obviously, some essay tasks can be performance assessment if there is a presumption of measuring evaluative thinking skills and ability process involving higher-order cognitive skills (Frey & Schmitt, as cited in Bland & Gareis, 2018; Ohlsen, 2007). To expatiate this argument, Kon, Tan and Ng posited that, "essay assessments reflect more intellectually challenging learning goals and include more authentic, open-ended assessments tasks such as sustained written prose where students are asked to elaborate on their understanding, explanations, arguments, and/or conclusions" (as cited in Bland & Garies, p. 59). Ohlsen added his voice by noting that, performance assessments involve an element of unpredictability especially in open-ended questions that require multiple answers. To him, students' perspectives are inherently unpredictable for a teacher who values order and predictability. This confirms that persuasive essays are performance tasks. However, not all essays are performance assessment especially definitional essays that require explanation of terms.

In totality, the key elements which run through the descriptions of performance assessment include the use of complex tasks, application of knowledge, ability and skills exhibition, and the acceptance of variety of responses to a task. Fusing these elements, performance assessment is an assessment type that measure students' cognitive thinking skills and their ability to apply knowledge in solving realistic and meaningful problems. In other words, they are designed to closely reflect the exact performance in the real world, allow students to construct or develop an original response, and for the teacher to use predetermined criteria to evaluate students' work. The literature further explains that, as assessment turns to be more open-ended such that students' responses become intensively complex, the assessment tasks become hands-on activities engulfing real life activities.

Modes of Performance Assessment

According to Stiggins (2007), in performance assessment, there are variety ways tasks can be presented to attain appropriate response from students. Nitko (2001), however, outlined the modes of which performance assessment tasks are executed as follows:

Structured, On-Demand Tasks: Here, the assessor exercises control over all activities in the assessment process. It includes when and how administration should occur, when and how materials should be used during examination/testing and even the expected outcomes of the tasks. The structured on-demand tasks include:

1. ***Paper and pencil tasks*** such as solving a complex contextual mathematical problem, and drawing diagrams and graphs to illustrate mathematical or scientific idea. As noted by Lane (2010), the tasks also include persuasive essays or written performance tasks which can be stand-alone or text-based prompt writings that cause students to synthesize and apply knowledge through rethinking of issues.
2. ***Equipment and resources tasks*** that require students to use materials to respond to given tasks. These include moulding or developing an object, taking measurement of an object and carrying out hands-on activity in the Science classroom.

Natural Occurring or Typical Performance Tasks*:* In these tasks the assessor observes the best occurring typical performance of the students in the natural settings. The tasks pose difficulty to assessor because he/she has limited control over the activities students perform and the responses as well. An example is observing how each student is performing hands-on activity in a group.

Long-Term Projects*:* In projects, students are required to make use of prior knowledge (targeted learning outcomes) to design series of complex topics which aid them in accomplishing a specific but complex task. Projects take days, weeks or months to be completed since students are required to do library research, referencing, communicate through written reports on data collection process, analysis and interpretation, and outlined evaluative conclusions built from agreed upon criteria between the assessor and students. Projects can be individual or in collaborative base work depending on the request of the assessor. Students' projects include building a model or craft work of an object and writing on how it was built, designing an application software in ICT or surveying and writing on the impact of teenage pregnancy in a community.

Portfolio: According to Stiggins (2008), a portfolio is a collection of evidence, gathered over time, which gives insight to the student's growth in understanding and skill development. Portfolio allows students to take responsibility for their own learning with little input from a teacher so that they can make evaluative conclusion about themselves. Every activity in portfolio is an indicator of what the student knows and is able to do. The collection may include test results, student written work, projects, videos, tapes, or other artifacts of student involvement/work.

Demonstrations: Tasks of demonstration require students to carry out observable hands-on activities or exhibit body gestures to execute acquired knowledge and skills in accomplishing a task. Demonstrations are mostly completed within a short time frame. Tasks possess evaluative criteria best known to the assessor and students. Examples include exhibition of a dancing style to a cultural troupe, and an activity built on scientific principles to illustrate proficiency in using a piece of equipment or a technique.

***Experiments**:* Experiment is an "on-demands performance in which a student plans, conducts and interprets the results of an empirical research study" (Nitko, 2001, p. 258) to a set of questions developed from logical guesses known as research questions/hypotheses. In experiments, students use inquiry skills and systematic procedures with scientific based explanations to reach the conclusion on an issue or phenomena. An example of an experiment is an investigation of brightness of bulbs in series and in parallel connections in the laboratory. Another example given by U.S. Department of Education (2005) is when…

> "Floating Pencil was provided to students with a set of materials, including bottles of freshwater, salt water, and "mystery" water. Students are required to perform a series of investigations to determine the properties of salt and freshwater, and to determine whether the bottle of mystery water is salt water or freshwater" (p. 10)

Lane (2010) added tasks to it as follows:

> "Is the mystery water fresh water or is it salt water? How can you tell what the mystery water is? When people are swimming, is it easier for them to stay afloat in the ocean or in a freshwater lake? Explain your answer." (p. 19)

Oral Presentations and Dramatizations: Oral presentations are the main vehicle students use to exhibit their knowledge and skills through articulation such as verbal communication in interviews, recitals of poems, debates, dramas and speeches. However, in dramas, oral presentation are used in conjunction with explicit body gestures to help communicate messages clearly while in debates logical, persuasive and evaluative arguments are used in convincing the audience. For instance, students might be asked to research both sides of the issue and to deliver persuasive speeches on the issue.

Simulations and Contrive Situations*:* These are on-demand tasks in which students are asked to role-play an event in its natural settings and respond to thought provoking questions built from the mimic event displayed. Here, students are engaged in imitation of a real life problem that they must solve using the knowledge and skills they have gained in a course of study (Rudner & Boston, 1994; Wiggins, 1990). An example is when a student is made to role-play the practice of puberty rites among the Krobos, and the assessor observes and questions the purpose of an activity in the event.

Characteristics of Performance Assessment

Osterlind (2006) outlined three characteristics that create disparity between performance assessment and traditional modes of assessment as follows:

Approach of responding to tasks: Students are required to construct their own responses either by performing a hands-on activity or writing a persuasive essay that uses relevant knowledge and skills acquired.

Cognitive skills Involved: Obviously, proponents of performance assessment intend to measure higher-order thinking skills. Therefore, thought provoking and challenging tasks (Hibbard, 1996) are developed purposely to ensure students employ critical reasoning skills when responding to tasks. The tasks also measure the students' ability to defend and support issues with evidence to make informed and valid inferences (Wiggin, 1990). As noted by US Department of Education (2005), hands-on activities satisfactorily ascertain the degree of students' problem solving and reasoning skills.

Scoring session: Performance assessment scoring requires experts in the field of study to pass evaluative judgments to students' responses because the assessments take into consideration each student's individuality and background, how prior knowledge and experiences are used in responses, the learning contents and academic standards as well to evaluate students' works and further determine students' achievement. The process ensures that, evaluative criteria are made known both to student and the scorer (assessor) in advance. The evaluate criteria are given to students so that they know the requirements of their works (responses) and how they will be evaluated.

Advocates of performance assessment have outlined the characteristics that are commonly featured in many works, Ashbacker (as cited in Osterlind, 2006, p 234) as follows:

1. Students perform, create, or do something that requires higher-order thinking or problem-solving skills (not just one right answer).
2. Assessment tasks are also meaningful, challenging, engaging, and instructional activities.
3. Tasks are set in real world context or a close simulation.
4. Process and cognitive behaviour are often associated with the product.
5. The criteria and standards for performance are public and known in advance.

Advantages of Performance Assessment

***Limitation of measurement errors*:** The assessment eliminates guessing and cheating (Lane, 2010; Lane & Stone, 2006; Nitko, 2001) because the procedures afford multiple perspectives of responding to tasks based on the performance standard/criteria.

Provision of valid measurement: Performance tasks provide valid measure of students' achievements (Khattri *et al*., 1995; Lane, 2010; Lane & Stone, 2006; Wiggins, 1990) because students construct observable products to portray that, their thinking skills and what they can do were inferred from acquired knowledge and skills.

***Assessment of multiple learning outcomes*: A task assesses more than one learning outcome (Oosterhof, 2001). Here, students are required to retrieve from a broad range of knowledge and skills that incorporate many learning outcomes to accurately raise responses for accomplishing a task.

Challenges/Disadvantages of Performance Assessment

Performance assessment poses the following threats to its users and limits its usage by assessors:

Construction of performance assessment tasks: The construction of complex tasks to incorporate higher-order thinking skills requires in-depth learning of test crafting skills and continuous practice to develop high proficiency in the construction. The skills subsume, determining and developing meaningful tasks to depict the standard of cognitive processes, which incorporate application of knowledge and variety of skills (Khattri & Sweet cited in Warner, 2004) in the process of developing a product. As Nitko (2001) noted, the challenge lies in determining the content to serve as a guide for crafting the performance tasks to reflect the required thinking skills. A challenge also exists in ascertaining that tasks communicate clearly the requirements (materials/equipment to use and standard of performance) and time frame that students are expected to work with. As expatiated by Hayes cited in Nnorom and Okafor (2011), there is difficulty in ensuring tasks portray explicitly the purpose, outcomes, standards and expectations that would be understood by every student and assessor who attempt the tasks.

Crafting scoring rubrics: The crafting of the rubrics for performance assessment tasks is as difficult as the development of the tasks. The rubric describes the standard required from students since it must contain all possible responses to each task in a test. The assessor, therefore, is expected to outline all possible answers (products) and explicitly detailed description of process, if required, to every task that will be evaluated. Since performance assessment assumes multiple perspectives of students, this requirement is a necessity that should be executed by assessors (Green & Hawkey, 2012, Lane, 2010; Wiggins, 1990). To ascertain objectivity in the scoring process and also distinguish among the excellent, good and poor students, scoring levels should be developed by assessors to indicate each score to its corresponding standard of performance in the scoring rubric (Green & Hawkey, 2012; Koné, 2015; Nitko, 2001)

Time and energy consumption: Performance tasks construction, administration and scoring processes require expertise (Lane & Stone, 2006; Oosterhof, 2001; Osterlind, 2006) to accomplish. These processes which take a lot of time and energy because they impose a lot of responsibilities on assessors, many of whom possess inadequate skills in tasks construction and scoring rubric development.

Cost of execution**:** It is more expensive to carry out performance assessment to students especially on a large scale (Lane & Stone, 2006; Oosterhof, 2001) because the equipment is scare and hence difficult and expensive to access.

Content sampling: Limited subject matter and a few tasks are sampled for the assessment process (Nitko, 2001) because more time and energy are required for accomplishing performance assessment tasks.

Corruptibility**:** Performance assessment assumes that performance standards/criteria for evaluation (evaluative criteria) are explicitly made known to students in advance (Herman *et al.*, 1992; Lane & Stone, 2006) before administration of the tests. Assessors therefore have to explain the evaluative criteria to students of which they may unintentionally and indirectly give off tasks especially to the smart and test wise students. Also, elements of biasness such as in rater drift, halo and carryover effect (Amedahe & Asamoah-Gyimah, 2016; Nitko, 2001) may be incorporated during scoring due to the subjectivity in scoring.

Psychometrics in Assessment

There are a number of concerns on ascertaining good psychometric properties in assessment. For the purpose of this study, the focus is on validity and reliability. In developing sound assessments, the validity and reliability standards evaluating assessment approach must be addressed to support the technical adequacy for accountability. These standards pose educational and social values for both evaluative judgements and appropriate decisions to be made for their use on students' achievements.

Validity

According to Messick (1989) validity is "an integrated evaluative judgment of the degree to which empirical evidence and theoretical rationales support the adequacy and appropriateness of inferences and actions based on test scores or other modes of assessment" (p. 13). Similarly, the AERA, APA and NCME (1999) noted that validity determines "the degree to which evidence and theory support the interpretations of test scores entailed by the proposed use of tests" (p. 9). This implies that, validity, articulates the extent to which empirical evidence built on theoretical perceptive is providing meaningful and insightful explanations and utilization of test scores but not the assessment instruments in question. Obviously, this indicates that, assessments with high validity posed tasks to measure the intended purpose of the assessment. This measure is obtained from several pieces of evidence (validity evidence) (Amedahe & Asamoah-Gyimah, 2016; Crocker & Algina, 1986; Nitko, 2001; Tamakloe *et al*., 2005). It is important to obtain high validity pertaining to the assessment type adopted so the intended interpretation and use that will be made with the results will be appropriate especially in certification and selection and placement purposes.

Validity Evidence of Traditional Assessment

Amedahe and Asamoah-Gyimah (2016) outline three main pieces of evidence of validity as follows:

Content validity: This focuses on content representativeness and relevance of tasks in the assessment instrument. That is, by ensuring tasks are sampled from the wider range of domain of performance and also possess the assessor's user domain. In the traditional assessment procedures, this is achieved by developing the table of test specification. The table helps to proportionately sample tasks from all appropriate domains.

Criterion validity: This evidence relates to the linkage between the test score and future measures to be taken. It provides two measures of evidence: (a) *Concurrent validity,* which indicates the extent to which the current performance of a student on an assessment can be predicted from another assessment from the same domain, such that one can be used or an alternative to the other. (b) *Predictive validity* which determines the extent to which future performance of a student can be determined using previous or past performance. This criterion validity evidence is attained through correlation of the two (current and past) variables of concern. In traditional assessment, students' past records in previous tests are used to predetermine their performance in subsequent but related tests.

Construct validity: This determines the means of providing evidence to explain that assessment tasks infer certain educational and psychological traits or mental processes. Generally, this evidence is ascertained by ensuring that, the domain to be measured and the mental process required in the assessment are well defined and analysed respectively. An example is a mathematical reasoning task that requires students to find the age of a mother who had her 18 years old son when she was 21 years.

Validity of Performance Assessment

Validity issues in performance assessment are difficult to ascertain. As noted by Osterlind (2006), the difficulties emerge from (a) the intention that performance tasks must measure higher-order thinking skills; which tends to give multidimensional interpretation to cognition and neglects observation of latent constructs, (b) the idiosyncrasy and uniqueness involved in tackling performance tasks in tandem to its single administration and (b) it frequent administration to small number of students; which tends to provide insufficient date set for statistical analysis thereby limiting normality and linearity. However, proponents of performance assessment posited that, measures are more valid in determining students' achievements simply because of the presence of actual performance or a simulation of tasks for observation (Lane, 2010; Lane & Stone, 2006; Linn, Baker & Dunbar, 1990). Moreover, in performance assessment a single task assesses multiple abilities. For instance, a task that require students to mould and explain how an equipment works will surely, assess the skills of drawing, measurement, moulding, communication and demonstration. To justify these assertions, it is important to build on the existing three criteria (content, criterion and construct) of validity evidence for evaluation. Meanwhile, Nitko (2001) noted that, validity evidence is a unitary concept because all validation focused on providing evidence for inferences on test score. Linn *et al.* (1990) and Nitko suggested the criteria for evaluating validity of performance assessment for obtaining the unitary concept as follows:

Content evidence: The content quality aspect includes evidence of content representativeness, relevance, and technical qualities which evoke evidence ascertaining that content of the assessment is consistent with the current understanding in the study field. The content is true reflection of the content domain.

Consequential evidence: The consequential aspect appraises the implications of score interpretation and uses on both intended and unintended purposes of the assessment. For instance, the impact of the assessment on teaching and learning process in the classroom and students' achievement in examinations.

Substantive evidence: This aspect focuses on how empirical evidence and the theoretical rationales are repeating themselves in students thinking skills and processes as executed in responding to tasks. As known in performance assessment, tasks assess the higher-order thinking skills and assessors are required to validate the assertion by outlining (a) "a detailed description processes and abilities that they claim to be assessing, (b) a clear demonstration of how each type of task or assessment exercise can assess each of these processes and thinking skills, (c) evidence from research studies that demonstrate that students use the thinking processes and skills that are claimed" (Nitko, 2001, p. 48.).

Generalization evidence: This aspect focuses on examining the extent to which interpretation and uses of results are appropriate for generalizing to different population of students, environments, purposes or even tests tasks. This allows for the assessor to observe the assessment scores in a broader perspective and encourage generalization of decisions using the results.

Practicality evidence: This aspect engulfs efficiency, practicality, instructional features and even cost involved in the assessment system. All these require the use of appropriate procedures to increase validity during the construction stage, production, administration and scoring sessions.

Internal structure evidence: Here, the focus is on the interrelationships existing among assessment tasks and the results as whole. That is the extent at which the tasks in instrument are reflecting the scores of the assessment. Meaning the tasks should assess the abilities or skills intended to be measured by the assessor such that, the performance (results) will determine the extent to which the student possesses those abilities.

External structure evidence: This aspect ascertains the extent of relationship that exists between the assessment results and other variables or criteria of measure beyond the assessment variables. That is the evidence is on how students' achievements reflect their future performances in fields such as on job. The validation process subsumes both predictive and concurrent validity evidence.

Reliability evidence: This focuses on the consistency of assessment result over time, multiple raters and content domain. That is how stable assessment results are when the same instrument is administered to same students in different periods of timing, or different raters score the same student responses.

Reliability

Reliability is the "consistency of measurement over time" (Tamakloe *et al.*, 2005, p. 201). That is, the reproducibility of student's performance on an assessment administered on different times or on the response from one task to another. In order words, reliability in assessment ensures that two measures of students' performances are either high or low to ascertain the stability, dependability, trustworthiness, and consistency in measuring the same thing each time (Worthen, Borg & White, 1993). A reliable assessment, therefore, means students repeat the exact or equivalent response to the same task or an instrument administered on multiple occasions or a similar score is obtained from multiple raters who score the same student's work. These unveil the listed indicators. It is, therefore, important to obtain high consistency of students' scores in examinations because the results are used for making decisions (Amedahe, 1989). As a means of caution, it is necessary to adopt an assessment type which will aid students to attain uniform interpretation of tasks so that students can produce equivalent and relevant responses to similar tasks at all times. This will increase the tendency of enhancing students' achievements in examinations.

Methods of Estimating Reliability in Traditional Assessment

Test-retest reliability: Here, a group of students is made to take the same instrument on two different occasions or time with an interval and the scores are correlated using Pearson Product Moment procedure for stability or consistency over time (Amedahe & Asamoah-Gyimah, 2016). Traditional assessment procedures are mostly estimated using correlation because the formats require fewer resources to be accomplished. It is worthy of note that this is not easily applicable to performance assessment because of its construction nature.

Alternative/Equivalent forms reliability: In this method, the same students are made to take two forms of assessments which are either parallel or alternative to each other. The purpose is to ascertain the "degree of generalization about students' performance from one assessment to another" (Amedahe & Asamaoh, 2016, p. 72). The two test administrations are done on the same day or occasion or with a brief interval (Crocker & Algina, 1986) just to relieve fatigue on students. This method is least practiced for performance assessment because the assessment demands for labour, time and specified equipment for its implementation.

Split-half reliability: This method is used in estimating the internal consistency of items in a single test administered to students (Nitko, 2001). It is most suitable for estimating reliability of traditional procedures such as multiple-choice and true/false objective tests, but not applicable in performance assessment because in performance assessment there is no single correct answer to a task.

Kuder-Richardson reliability: This is another method for estimating internal consistency of objective type tests which are dichotomously scored. According to Osterlind (2006), the method is used to estimate the extent to which performance on an item relates to the overall test scores. It also used to determine whether all items measure the same trait or students' performance on each item. Hence, it is useful in traditional assessment procedures, especially for determining the score variance accredited to the construct that is been measured in the test and not meaningful applicable to performance assessment.

Reliability of Performance Assessment

Objectivity in scoring has been the key reason for which issues on reliability of performance assessment are concerned. The allusion that, "not only one and single answer" is correct but there are variations in the appropriateness in performance is the root evil of subjective scoring which lowers reliability of the results and hence the validity as well. For example, in a task that requires students to separate a mixture of cereal chaff and pins, the students can use any of the separating methods, namely handpicking, winnowing, or filtration to attain the same results. Since they all have different processes, the scoring marks will also differ, therefore, limiting reliability and hence the validity as well. Obviously, this aspect could be reversed if assessors accurately execute the following:

1. Crafting performance tasks along with performance criteria and rubrics (Nitko, 2001)
2. Outlining performance criteria to students in advance (Osterlind, 2006; Wiggins, 1990)
3. Do not allow students to choose from multiple performance tasks in examinations (Nitko, 2001) and
4. Strictly adhering to scoring rubric and performance criteria in scoring students' responses (Nitko, 2001; Lane, 2010; Oosterhof, 2001; Osterlind, 2006; Wiggins, 1990).

In all, to limit the errors in test scores for high accountability, the issue of construct representation and relevance should be enhanced by ensuring that there is absence of clues and technical flaws in all tasks (Nitko, 2001). This aids students to respond to tasks accurately and appropriately, and attain uniform interpretation of tasks.

Empirical Review

The Impact of Assessment Types on Students' Achievements

The influence of assessment types on students' achievement has been a subject of research for many years. Commencing with a study conducted in Ghana by Agyei and Mensah (2018) on a senior high students' performance in Mathematics, it was contended that each assessment type has unique impact on students' achievement. Using a descriptive design with census sampling, the authors involved 145 first year elective Mathematics students in the study. Data was collected using different achievement tests of traditional formats and performance assessment procedures as well as a questionnaire that measured the perception of the class test on student studies in Mathematics. The aim of the study was to determine assessment procedure that could correlate to students' exam scores and predict their achievement in examinations.

Agyei and Mensah (2018) used the correlation analysis and found that the traditional assessment correlated better with achievement and is the better enhancer students' achievements in examination. Agyei and Mensah believed the result is an ideology that frequent use of traditional assessment determines students' commitment to intensive learning and also achievements in examinations.

In the same study Agyei and Mensah explored the influence of two performance assessment procedures namely class presentation and project work on students' achievements in examinations. It was observed in the correlation results that both assessment procedures had positive impact and to enhance students' achievement in the examination.

The final aim of the study was to determine the best predictor of students' achievements in examination using traditional assessment, class presentation and project work. The results of regression analysis showed that the traditional assessment is the best predictor with a value of 0.828, class presentation showed a value of 0.064 and project work 0.017. Hence, the results depicted that traditional assessment has strong influence in students' achievement in examinations and this was confirmed by the students' responses to the questionnaire in the study.

Agyei and Mensah (2018) believed the high success rate in the traditional assessment is because the tasks incorporated lower-order cognitive skills and were much closer to students "accessible level". This was confirmed in the study's write up by Agyei and Mensah that student performed well when easy tasks are used to assess them. To Ehrlich as cited by Agyei and Mensah, the students elevated their "morale, self-belief, and determination to work hard to maintain good scores" (p. 135). However, the same students were unable to response accurately to challenging tasks exposed them and hence performed worse in the same assessment. To Agyei and Mensah, this was consistent with their study.

In addition, Agyei and Mensah (2018) believed the prevalent use of traditional form of assessment lead to the high students' achievement. This argument was supported with a fact that most traditional assessment procedures can be administered without prior notice to concerning students and yet students will perform better. However, this cannot occur in performance assessment where students need notice and performance criteria to guide their demonstrations and means of attaining high scores. The support to the argument is an indication that performance criteria were not outlined to students in advance before the commencement of the assessment.

Inferring from the preceding paragraphs, Agyei and Mensah (2018) explored the impact of the assessment types in just of school; thus, a single school's students were used as the sample for the study. A sample size of 145 for a descriptive survey with a quantitative approach was out place since the approach requires a large sample size for generalization of the study findings. Also, involving other schools' in the study could have given a better picture of the findings about the impact of assessment type on students' achievements. In line with this ideology, 234 students from 12 schools were involved in this very study.

Furthermore, Eshun and Abledu (2001) did an experimental study in Ghana to examine the effect of different assessment types in Mathematics among teacher trainees. In the study, a tutor was engaged to teach the same contents and use traditional assessment procedures to assess both experimental and control groups. The experimental group had intervention in various performance assessment procedures. Achievement tests were the main data gathering tools use to collect the data while journals writing, portfolios and interviews were used to confirm the benefits trainees derived from performance assessment. For the achievement tests, both groups were administrated with a test each on traditional assessment and performance assessment.

The posttest analysis conducted using descriptive statistics indicated that, there was an improvement in achievement to both control and experimental groups in traditional assessment procedure adopted. Notwithstanding that, in the performance assessment, improvement reflected only in favour of the experimental group who were given the intervention before the post tests were conducted. This caused the Eshun and Abledu (2001) to state that, performance assessment activities improve students' achievements in examination by enhancing their problem solving abilities in novel situations.

The descriptive statistics of the study further revealed that, low, average and high ability students in the experimental (performance assessment) group outperformed and increased in achievement than their colleagues in the control (traditional assessment) group. Upon observation, the low ability students' achievement in Mathematics was enhanced through an exposure to performance assessment tasks. Eshun and Abledu (2001) backed their findings by saying that the performance tasks retained taught concepts and skills which were efficient tools for the demonstration of cognitive processes than as observed in traditional assessments.

However, the results of Eshun and Abledu's (2001) study was not in line with that of Adjei and Mensah (2018) who found that traditional assessment enhances students' achievement in examinations. Furthermore, basing on the variable of interest in the study, the researchers could have used descriptive survey instead of the experimental design. This could have granted them opportunity to report directly on the impact of each assessment type on students' achievements. In view of this, I opted for the descriptive survey design for this currents study.

A similar work on performance assessment was an action research conducted by Avis (2014). He used the assessment to increase students' interest and achievement in Science examinations. In the study, Avis used quasi-experimental design and purposively sampled 78 final year students who decided to pursue Science as a programme for further studies. The study aimed at determining the impact of performance assessment on students' interest and achievement in Science, when it is a ready tool for the further studies. The author engaged the subject teacher to do the intervention. The teacher exposed the control group of 33 students to traditional assessment and the experimental group of 35 students to performance assessment.

Data was collected with unit (achievement) test, Science Attitude Scale (SAS) and a Science Motivation Questionnaire II (SMQ II). In order to determine how student's cognitive skills were used in responding to tasks the unit test contains only performance assessment procedures.

For the purpose of the study, the descriptive statistics of the unit test indicated that the experimental group's score in pre-test (M=27.14, SD = 7.63) increased in the post test (M = 60.11, SD = 10.60). A comparison made using the groups posttest score indicated the experimental group (M = 60.11, SD = 10.60) outperformed the control group (M = 37.62, SD = 10.16). Avis (2014) explained the difference in performance by noting that, the exposure to performance assessment had positive impact in the students' achievements in the Science examinations. He concluded that the exposure of students to performance assessment approach "promotes and supports learning series at the classroom by improving academic performance" (p.76). He justify the conclusion by arguing that in performance assessment, students have the ability of interacting with both tangible, symbolic and abstract information and therefore, they turn to learn from diverse sources which raised their achievement scores in the examination.

Notwithstanding the inputs made by Avis (2014), the focus was on students' achievements and therefore, methodologically, could have used the design that requires no intervention in the study. Thus, a descriptive survey as used in this very study could have been a better option in observing the variable of interest in the study.

Furthermore, Hancock (2007) examined the impact of the two assessment types on students' achievement among graduate students. He adopted the experimental research method and exposed the two groups to same content of instruction but administered different assessment type to each group to evaluate the programme. The result showed that the group exposed to the performance assessment performed better than the group who was exposed to the traditional paper-and-pencil assessment in their final examination. Hancock explained the finding that the performance assessment group attained high scores because students had the opportunity to exhibit their competency in authentic ways which could not happen in the traditional assessment group. He explained further that the individual students executed essential knowledge and skills required at every stage hence got the accorded score for each stage or step taken for the accomplishment of the challenging tasks.

Additionally, studies examined the extent to which students' achievements can be best enhanced by traditional assessment, performance assessments, or a mixture of both assessment types. Leon and Elias' (1998) study resulted in favour of performance assessment as the best indicator and enhancer of students' achievement, followed by traditional and the least being the mixture of both. Leon and Elias defended the results by saying that the nature of performance assessment allowed the students with the potentials in practical aspects to demonstrate their knowledge and skills to redeem their academic achievements of which they could not do in traditional assessment. Explaining further, the authors believed that performance assessment saved those students tagged with poor academic achievements (low ability students) and maintained the high ability students as well because both students' achievements were enhanced in the examination (Leon & Elias).

As a means notification, Leon and Elias (1998) suggested educators should desist from the habit of using traditional assessment records to accept students who are failures as successful ones in the society. However, assessors should realize that the weak students are actually the potentials and dependable ones to sustain the future, Taylor (as cited in Leon & Elias, 1998). Therefore, Leon and Elias noted that the interpretation of the test scores is an important indicator of the student identity rather than the test score itself. To them, many students are being misrepresented with traditional assessments procedures more specifically as low ability students because such students performed better in performance assessments but worse in traditional assessments as observed in their study. To justify the assertion, Leon and Elias noted that, performance assessment evoked students' creativity incorporated with diverse cognitive processes. These creativity skills were present with the low ability students that the traditional procedures of assessments could not unveil. Meanwhile, these skills are indicators of student demonstration of thinking process which are key to the assessors. This means that the students possessed more opportunities than as thought by assessors which could be exhibited but not through writing.

This finding has been confirmed in Koné's (2015) study which revealed that motivated students responded positively to performance assessment procedures which further enhanced their achievement in examination. Kim (2005) also observed that performance assessment improves students' achievements in examinations, especially when students are encouraged to take assessments in short durations.

Another and more similar study conducted by Arhin (2015) confirmed previous studies of Hancock (2007), Kim (2005), Koné (2015) and Leon and Elias (1998) on performance assessment as an indicator of senior high school students' achievements in Mathematics examinations. Arhin employed the quasi-experimental research method and randomly sampled two intact classes for the study in Cape Coast, Ghana. With 42 and 40 participants in experimental and control groups respectively, performance tasks were used to assess the experimental group as the treatment while the control group received a placebo. Achievement test and questionnaire which determined students' attitude to Mathematics were administered to collect data.

In Arhin's (2015) work, descriptive and t-test statistics results of the test landed in favour of the experimental. He explained his observation that the performance assessment motivated the students to solve challenging tasks using sequential processes that cause them to be awarded corresponding mark for each step and aided them to achieve better scores in the tests. This means, students, did not memorise the processes of tackling challenging problems as is typical in traditional forms of assessment but demonstrated their creative abilities in arriving at the correct responses to the tasks. Arhin, upon this finding, concluded that performance assessment improves students' achievement in examinations by encouraging them to own the process of solving given problems.

Taking a critical observation of Arhins' (2015) work, it appears that design adopted granted him the opportunity to use the sample size of 82 and a single school. These however, limit the capability of basing on the study's finding to make any meaningful generalization. For this reason, the descriptive design guided this current study, involved 12 schools hence; a larger sample size was used. This granted me the opportunity to understand the impact of assessment types on students' achievement on a broader perspective. Also, Arhin's focused was on the general academic ability of students. It would have been better to explore the impact of each assessment type on each ability group of students. Therefore, this very study observed the impact of each assessment type on the high and low ability students' achievements.

Woodward *et al.* (2001) delved into the impact of performance assessment on students with different abilities in Pacific Northwest and came out with varying results. The authors observed that even the physical challenged students have the capability of enhancing their achievement in performance assessment. It was clear from the results of the study that students with learning disabilities outperformed normal students in achievement. This was an indication that low ability students have chances of improving their achievement when assessed with performance tasks.

A similar work compared high and low ability students but by administrating competency-base and performance assessments respectively to novice trainee nurses in Netherlands (Fastre´, Van der Klink & Van Merrie¨nboer, 2010). The low ability students outperformed the high ability students. In a way of justification, Fastre´ *et al.* made it clear that the low ability students knew the requirement criteria for the assessment and hence demonstrated desired behaviours to attain better scores. Meisels, Atkins-Burnett, Xue, Bickel, and Son's (2003) study confirmed the assertion with results indicating that both ability students have similar chance of enhancing their achievements although the low ability students attained better scores than the high ability students.

However, in contrast, similar studies revealed that performance assessment is a better indicator of high ability students' achievements in examinations (Fuchs *et al.*, 1999; Kim, 2005). For instance, in Kim's study, the descriptive statistics showed that the performance assessment favoured the high ability students at (M = 0.572, SD = 0.556) while low ability students were at (M = 0.566, SD = 0.556).

The study of Warner (2004) in Ohio, however, reported that students' achievements in performance assessment (paper-and-pencil test and oral presentation) tasks were practically low. Meanwhile, it was confirmed in the study that teachers frequently utilize performance procedures for assessment in their classrooms. Warner believed that the low achievements in the assessment had its roots from (a) students' inability to construct knowledge and skills as desired to attain high scores for the tasks, (b) students in the "study might have lacked experience in solving such real-world problems, (c) lack of familiarly and experience with solving ill-structured problems", (p. 68 - 69) and (d) inadequate content knowledge due to poor pedagogical strategy from teachers.

Meanwhile, Brookhart's (1997) study in America had a similar view but was not in all subjects as it reported that performance assessment (homework that is in models) had a negative effect on the students' achievements in Mathematics but a positive result of achievement in Science. Brookhart believed the results is a reflection of the nature of the subject and how it functions by stating that "Science lends itself to oral and written reports and to projects; Mathematics lends itself to practice problems and therefore to homework" (p. 329).

A similar study by Al-Sadaawi (2007) in Riyadh City, Saudi Arabia using twelve primary schools revealed that the performance assessment had a positive effect on students' achievement in Science as compared to traditional form of assessment. Al-Sadaawi employed the mixed method research design that used 265 participants from 12 schools and 6 teachers engaged to provide tuition to the experimental and control groups for nine weeks. The experimental group consisting of 6 schools received tuition using performance assessment procedures while the rest of the schools formed the control group had instruction in traditional assessment. Al-Sadaawi gathered data administering achievement tests and interviews to students and questionnaire to the teachers.

Generally, the incorporation of intervention as occurred in Al-Sadaawi's (2007) study results in favouring one assessment type to the others. For this reason this current study implemented none intervention. It reported on the impact of each assessment type on students' achievements in examinations.

The descriptive and independent sample t-test analysis of the tests used in Al-Sadaawi's (2007) study showed the experimental group (N= 136, M = 16.69, SD = 3.49), that had the performance assessment approach outperformed the control group (N= 129, M = 15.37, SD = 3.55) who received traditional instructional assessment approach at $t(263) = 3.05$, $p = .003 < .01$. Also, the researcher realized that the assessment further have the capability of giving good predictions to students' achievement in examinations for Science as revealed by the linear regression analysis (about 23 percent variation) on students' average scores in each assessment type with a moderate positive correlation of 0.484. The study also revealed that performance assessment supports low ability students in enhancing achievements in examinations.

The findings supported the results of Gray and Sharp (as cited in Al-Sadaawi, 2007) that, as students are more frequently assigned or are involved with challenging tasks, the more effort they make and invest in the tasks. This means, the more the low ability student is exposed to performance assessment tasks, the greater chance they have to be successful in examinations. On the issue of prediction, Al-Sadaawi said when individual students demonstrate the tasks properly, the assessment gives valid indicator of each student's progress toward achievement. Hence, this gives the valid prediction to students' achievements.

However, Al-Sadaawi (2007) noted that the sole use of performance assessment for examination gives inadequate account of students' achievement in examinations. His reason was that most classroom instructions are based on traditional behaviourist learning theory which emphasizes the recalling and rote memorization of facts, principles, definitions, and statements. Hence to him, when researchers use performance assessment as a study tool, their results usually give no positive effects on students' achievements. This assertion is confirmed by Brookhart (1997) and Warner (2004) but contradicts the findings of Arhin (2015) Kim (2005), Koné (2015) and Woodward *et al.*'s (2001) studies that used only performance assessment and found that it enhanced students' achievements in examinations. Meanwhile, Huff (as cited in Al-Sadaawi, 2007) justified the argument on employing only performance tasks for assessment with a fact that, achievement will be in the "negative effects because the students are not familiar with performance tests" (p. 241). Al-Sadaawi joined the argument by noting that because performance assessment requires drastic alteration in instructional strategies, teaching learning materials, learning methods and even the environment could be possible causes of students' failure in performance assessment examinations.

Nevertheless, Al-Sadaawi (2007) suggested that, it is important to mingle both assessment tasks (mixed items of traditional and performance tasks) so as to have useful impact of traditional and performance assessment in examinations. As Haury (cited in Al-Sadaawi) suggested, " a balanced assessment system involving different types of assessment is needed to give a detailed, multi-perspective picture of student accomplishments, that may best serve all functions" (p. 246). Obviously, from Al-Sadaawi's study, performance assessment is an indicator for authenticating students' achievements in examinations.

Geographically, Al-Sadaawi's (2007) study findings in Saudi Arabia might be different from a current study conducted in Ghana. The difference in the characteristics of the respondents might give a different finding. Imperatively similar study should be conducted in the Ghanaian setting to confirm the truthfulness of the study findings. For this reason this study was conducted in Ahanta West Municipality of the Western region of Ghana.

Caygill and Eley (2001) also conducted a study on the effects of assessment formats in Mathematics and Science examinations. The authors administered four different assessment formats (oral exam, performance tasks, short-answer and multiple-choice questions) to the same individual students in both Mathematics and Science. Parallel tests (questions that require the same or similar response) were use in all formats. Since the researchers were interested in finding the best format that could give the best performance of students' achievement, group scores of the four formats were compared.

Caygill and Eley's (2001) study results indicated that oral exam gave best performance followed by multiple-choice, performance tasks and lastly short-answer tasks. The researchers alluded to the view that, high performance in multiple-choice over the others was the result of tasks containing flaws or clues that easily gave off the correct options and better still because by nature multiple choice tasks are easier to respond to. Caygill and Eley explained this assertion with an observed instance in the multiple-choice test of their work. That is, one third (1/3) of the students were able to select the right option to a task on mean of a data but were unable to describe how the mean was computed in the oral exam or even compute for it in performance task versions. The researchers realized that the students incorporated guessing to obtain the right option to the task. This observation confirmed what critics had noted about traditional assessment that it introduces measurement errors to the students achievement scores (Lane, 2010; Wiggins, 1990).

Again, the researchers observed that none of the students had the correct selection to a particular item in the multiple-choice test. With this observation, it was believed that the item inadequately functioned in the test, therefore, Caygill and Eley opined that "a correct answer on a multiple-choice question does not equate with a correct and complete understanding of the underlying concept" (p. 8) by the student.

In the performance assessment it was observed by Caygill and Eley (2001) that students had the disadvantage in communicating their Mathematics and scientific knowledge through writing. However, students were relieved of tension and therefore, demonstrated accurate thinking process on tasks that were more concrete in nature and required the use of equipment for accomplishment. This confirmed what had been noted already as "students are capable of solving quite difficult problems when they are free to use concrete apparatus to help them think the problem through" (New Zealand Ministry of Education, 1992, p. 13). This aspect encouraged students to perform better in performance tasks when compared to the short-answer test where only written responses were required.

Caygill and Eley (2001) observed that, students' performance on the four formats followed a trend based on the amount of support provided during the administration of each format's test. With this assertion they believed the support could be students' intelligence or physical support in use of equipment. The researchers noted the equipment supported or aided students to diverge from the mathematical or scientific means of thinking to practical or commonsense means of tackling problems which resulted in the variation of responses as mostly observed in performance assessment.

In reference to their study results, Caygill and Eley gave a laudable suggestion of employing multiple formats (mixed items of traditional and performance assessments) in an assessment. To them, it helps to elicit comprehensive responses and various characteristics from students concerning their achievements in examinations.

Furthermore, Taylor and Watson (2000) had a study in in Greenville, North Carolina with two nonequivalent groups, who were given similar treatments except for the assessment type administered. The authors used the quasi-experimental research with 95 participants. Achievement tests and questionnaire which determined the impact of assessment type on students were used to collect the data for the study.

The analysis of covariance (ANCOVA) indicated no significant difference exists between the group that attempt traditional assessment and the other group who answered performance tasks. To Taylor and the colleague, the finding asserts that both assessment types have equal impact on students' achievements in examinations. The assertion was confirmed by the nontesting (performance assessment) group who received no treatment that they were at ease with the hands-on tasks and projects that helped them to follow laydown procedures in attaining higher scores than their colleagues in the testing(traditional assessment) group who got treatment interventions. This is an indication that test anxiety is limited when students are tackling performance tasks. It then reduces the level of tension on students that leads to easy retrieval and application of prior knowledge and skills in accomplishing challenging tasks. This was the main reason for which students have to attain high scores to be at par with their colleagues in the traditional assessment group.

Based on the finding of the study, Taylor and Watson (2000) suggested that it is adequate to use one assessment type to assess students learning outcomes since both traditional and performance assessments have the same impact on students' achievements in examinations. This assertion, however, is in contradiction to other studies whose results revealed that just a single type of assessment is inadequate to give a complete and comprehensive view of students' achievements because their studies have portrayed that each assessment type have unique impact on students' achievements in examinations (Agyei & Mensah, 2018; Al-Sadaawi, 2001; Arhin, 2015; Caygill & Eley, 2001; Hancock, 2007; Leon & Elias, 1998; Shepard *et al*., 1995; Webb *et al*., 2002)

Meanwhile, Taylor and Watson (2000) used the results of the study to make an argument. To the authors, students in the traditional assessment group prepared for the examination and that enhance their achievement although the element of test anxiety existed in the students. On the other hand, students in the performance assessment group though were free of test anxiety, prepared well for the performance of tasks to enhance their achievements. This is because, there was pressure on them to gain high scores in the performance assessment activities. Obviously, both groups faced negative pressures in a way and yet attained similar achievements. This means that similar impact is exerted by each assessment type on students' achievements in examinations (Taylor & Watson).

Cox (2011) added his voice to the view of Taylor and Watson with similar finding in his study. He confirmed that both assessment types improved students' achievements in the examination. Therefore, Cox suggested examinations should subsume different assessment types because he believed that students by their nature will be provided with opportunities to demonstrate their abilities in diverse ways.

Webb *et al.* (2002) also found that both assessment types had positive impact of enhancing students' achievement in examinations but with low scores in traditional assessment. The reason to this stance by Webb *et al*. was that students had difficulties in retrieving exact or accurate responses to tasks in the traditional assessment. Hence, students either offered incorrect answers or left response spaces of some tasks blank in the tests. Webb *et al*. gave an instance they observed concerning a group test in the study. The researchers observed that a student gave an incorrect answer to a member in the group which was accepted without questioning on how the answer was attained. This frequently happens in traditional assessment (objective tests, short-answer and matching tasks) whereby majority of students provide the same response to a particular task which turns to be incorrect. It is obvious that some particular students give incorrect responses to their colleagues because those colleagues had difficulty in retrieving the correct responses to the given tasks. A clear indication that the nature of tasks or assessment type employed contributes to the achievement of students in examinations (Webb *et al*.).

A yearlong study report by Shepard *et al*. (1995) on the effect of introducing classroom performance assessment on students learning was presented at the annual programme held by American Educational Research Association. The researchers employed the experimental research design with purposive and random sampling to select 335 third graders for the study. The study intended to initiate performance assessment in the running of the curriculum that was used for standardized testing in state of Denver, Colorado, USA. The project trained teachers to implement the performance instruction and administered performance assessment to students in the schools selected as experimental schools while normal instruction and traditional assessment (multiple-choice and short-answer) were used in the control schools.

The comparison of the mean posttest results in 1993 indicated that the controlled schools outperformed the experimental schools in the traditional form of assessment while the vice versa occurred in the experimental group. This means the mode of instruction used and the mode of assessment tend to have impact on students' achievements in examinations. They explained that, every method of instruction has a unique assessment type that is required for improving students' achievement. The researchers further noted that students in each assessment type group adopted unique learning strategy for each type of test.

Shepard *et al.* (1995) argued in favour of all researchers who suggested mixing of assessment types by saying that, fairness in assessment is limited when only one assessment type is adopted in an examination especially for summative purposes. This is an indication that examinations should incorporate approaches from the two main assessment types (Birenaum, & Feldman, 1998). Examples are the current BECE and other WAEC examinations for pre-tertiary institutions in Ghana. The examinations subsume multiple-choice, short-answers, essay and performance tasks.

Summary of Review

The literature review is based on the comparison of the two major assessment types; traditional and performance assessments and their impact on students' achievement in examinations. The initial section of the review concentrated on theories backing this study. The literature indicated that behaviourist and constructivist learning theories have direct reflections on the implementation of traditional and performance assessments respectively. That is, the behaviourist and traditional assessor believe in provision of precise response from memory to tasks while the constructivist and performance assessor expect performance of an activity using acquired knowledge. To the latter group, their expectation depicts complete learning and achievement of learning targets by students.

The conceptual review section on the assessment types indicated that, traditional assessment procedures such as multiple-choice and definitional essay tests require rote memorization of information to either select answers from displaced options or construct a precise response to tasks. On the other hand, the performance assessment tasks such as hands-on experiment and persuasive essay tests demand demonstration of thinking process by performing an activity using various processes to attain target responses. The section also subsumes the conceptual issues of characteristics, advantages and challenges of implementing each assessment types.

The final section looked at the empirical review on the impact of each assessment type on students' academic achievement in examinations including the contradictions of findings by different studies which call for this study. The literature revealed findings that indicated that (a) either one of traditional assessment or performance assessment have more impact on students' achievement, (b) both assessment types have similar impact on students' achievement and (c) a mixture of both assessment types provides better impact of students learning and achievement in examinations

CHAPTER THREE

RESEARCH METHODS

The rationale for the study was to determine the most suitable assessment type using traditional, performance and mixed items of traditional and performance types for JHS students' achievement in Ahanta West Municipality in Mathematics and Integrated Science.

This chapter focuses on how the study was conducted. It discusses the methods and approaches under the following sub-sections: research design, population, sampling procedure, research instruments development processes, data collection procedure and finally, data analysis procedure.

Research Design

The researcher employed the descriptive design with the cross-sectional survey method. The choice of the design was with the notion that it allowed the researcher to collect data from selected individuals in a single time period concerning the current state of junior high school students' achievements when assessed with different assessment types in order to determine the assessment type which will enhance students' achievement in examinations. That is the design has the capability for finding the current impact of traditional assessment and performance assessment on students' achievement since it "…examines a situation as it is. It does not involve changing or modifying the situation under investigation," (Leedy & Ormrod, 2010, p. 182). The design was, obviously, appropriate for the study because the researcher was not interested in manipulating any variable but to report on the impact of the assessment types on students' achievements. Therefore, the design aided in soliciting data from the respondents without any manipulation of variables (Ary, Jacob & Sorensen, 2010; Best & Kahn, 1998) to answer the research questions and test the hypotheses.

According to Ary, Jacob and Razavieh (2005), descriptive research design focuses on how to determine the status of a defined population with respect to certain variables. It aids in giving the true picture of the population in the study and further explains the variables in the study without any change in state of characteristics. Thus, it encourages observations of situations in their natural states and not in altered environments. This made the design suitable for the study because the researcher collected the data from the students (testees) in their various schools to determine and reported exactly the way things are.

Furthermore, Cohen, Manion and Morrison (2007) added on that, descriptive research with the cross-sectional approach has merits of allowing the researcher to develop instrument and encourages piloting for revision of items to ensure a good measure of psychometric properties before accessing it on for a large scale data collection. The design suit the study since the researcher developed achievement tests to collect the data in order to ascertain the generalization of the study results to the population. This is confirmed by Cohen et al. and recommended by Leedy and Omrod (2010) that descriptive survey method is purported for generalization of research findings so that inferences could be made about the past experiences, opinions, characteristics and attitudes of the population. Meaning, descriptive survey has the ability of helping the researcher to obtain accurate answers from the larger group of sample (Fraenkel & Wallen, 2003). Therefore, the adoption of the descriptive design ensured attainment of the ultimate level of accuracy in the study.

However, besides the numerous strengths of descriptive survey design, it has some weaknesses. Cohen *et al*. (2007) stressed that, the design procedure can lead to biasness in the sample statistic hence it's adoption calls for a careful and accurate sampling procedure to ascertain accurate and adequate sample size for a study. They continued that the design has the tendency of dropping potential participants of the study; some respondents may leave some items of research instrument blank or wrongfully attended to. These weaken the sample size of the study because an unresponsive item in an instrument is an indirect way that a participant will decline from the study.

Irrespective of the weaknesses of descriptive survey design mentioned above, it was still deemed appropriate for the study. It helped the researcher to use the assessment types in determining the form of assessment which maximise students' achievements in examinations.

Study area

The study took place in Ahanta West Municipal; one of the 14 districts in Western Region of Ghana. Ahanta West has a land area of 636km^2 and share boarders with STMA and Effia Kwesimintsim in the east, Mpohor and Tarkwa Nsuaem to the north, Nzema East to the west and gulf of guinea in the south.

The entire municipal has a population of 106,215 constituting 4.5 percent of the region's occupants as at the time 2010 population and housing census was conducted (Ghana Statistical Service, 2014). The census analysis indicated that the largest number of the economically active persons were students. It further stated that the people are highly engaged in agriculture, forestry, fishery, service and sales and craft and related trades with just two per cent in managers, professionals and technicians. (Ghana Statistical Service).

Observation from the analysis indicates that students in Ahanta West might exhibit some behaviour in their achievements when assessed with different assessment types in examination. For this reason the study was conducted in Ahanta West Municipal.

Population

According to Ary *et al*. (2010), population is the larger group to whom the study results will be generalised on. They stressed on that a population should be well defined so that a researcher can easily sample from it to conduct the study. The population for this study comprised of all JHS students in the Western Region of Ghana. The targeted population was the 58 public JHS students with an enrolment of 7527 in the Ahanta West Municipality in the 2019/2020 academic year. For the purpose of this study the accessible population was the second year (Form 2) JHS students in the Municipality with a total number of 2499 in five (5) educational Circuits as at December 18, 2019 (EMIS Report, 2019). The distribution of the students' enrolment in each Circuit is presented in Table 3.

Table 3: Distribution of the Population of the Second Year (Form 2) Junior High School Students in the Ahanta West Municipality by Circuits

Cluster (Circuit)	Enrolment
Abura	455
Agona	693
Ewusiejoe	447
Apowa	495
Dixcove	409
Total	2499

Source: Field survey (2020)

The JHS Form 2 students were selected because they have been acclimatized to the junior high system when compared to the JHS Form 1 students. JHS Form 3 students were exempted because of their BECE examination.

Sampling Procedures

Sample refers to subset of a larger population with whom the study is conducted on, purposely for inferring results to the same population (Leedy & Omrod, 2010). In this study the cluster sampling procedure with a multistage technique was employed to select the representative sample because it was impossible for the researcher to form a sampling frame for the study (Babbie, as cited in Creswell, 2014). The Municipality has five educational Circuits. The Circuits were used as clusters. The number of schools in each cluster is shown in Table 4.

Table 4: The Number of Junior High Schools in the Educational Circuits in the Municipality

Cluster	Number of Schools
Abura	11
Agona	14
Apowa	8
Dixcove	11
Ewusiejoe	14
Total	58

Source: Field survey (2020)

Three out of the five cluster of schools (educational Circuits) were selected using the lottery method of simple random sampling. According to Ary *et al*. (2010), when the population of the study is similar in characteristics of interest, the simple random sampling technique is appropriate because there is an equal chance of selecting to each element of the sample frame. To select the respective schools, the simple random sampling by the lottery method technique was employed again. Four single stream schools were selected in each of the three clusters to ensure fair distribution of schools in the clusters totalling 12 schools. Intact classes in the selected schools were used as the participants for the study. The distribution of the selected Circuits with their respective schools and enrolment are shown in Table 5.

Table 5: Distribution of Circuits and School Selected

Cluster	Number of schools	Selected School	Enrolment
Abura	4	GREL Basic	72
		Gyabenkrom M/A	26
		Princess Catholic	28
		Aketachi M/A	30
Agona	4	Agona S.D.A Basic	47
		Aboadi M/A	72
		Himakrom M/A	29
		Banso S.D.A Basic	20
Ewusiejoe	4	Ewusiejoe M/A	34
		Bokoro M/A Basic	30
		Beahu M/A	72
		Beahu Catholic Basic	28
Total	12		488

Source: Field survey (2020)

The participants in the selected schools summed up to 488. This sample size was as large compared to Krejcie and Morgan's (1970) suggested sample size of 335 for population of 2499. In this case, even if a few students declined participation in the study, the sample size would be adequate. Thus, the sampling unit for the study was classes from the various selected schools.

Research Instrument

The instruments used for the study were teacher-made traditional and performance achievement tests. The researcher opted for achievement tests based on the assertion that it is the tool that can be designed to measure cognitive processes on mastery and proficiency in diverse areas of taught contents (Ary *et al*., 2010; Cohen *et al*., 2007). That is, the tools were suitable to measure the variable of interest, which is achievement of students. Furthermore, as opined by Ary *et al*., "the advantage of a researcher-made test is that it can be tailored to be content specific; that is, it will match more closely the content that was covered in the classroom" (p. 203). This choice of tests therefore, offered me the opportunity to develop items that have coverage in learning outcomes of taught contents.

Seven different test instruments were used to collect data. The instruments were (a) Ability Determination Test [ADT (Mathematics & Integrated Science)], (b) Main Test-Traditional Assessment for Mathematics (TAM), (c) Main Test-Performance Assessment for Mathematics (PAM), (d) Main Test-Mixed Items for Mathematics (MIM) /Final Test for Mathematics (FTM), (e) Main Test-Traditional Assessment for Integrated Science (TAIS), (f) Main Test-Performance Assessment for Integrated Science (PAIS), and (g) Main Test-Mixed items for Integrated Science (MIIS)/Final Test for Integrated

Science (FTIS). For the main tests, which constituted six different instruments, each subject is made up of three aspects. These are traditional assessment, performance assessment and mixed items of traditional and performance assessment. The mixed items were constructed from the same learning outcomes and content used to construct the traditional and performance assessment items.

The instruments were designed and developed by the researcher under the expert direction of the supervisors. Test items were constructed based on treated topics selected from the 2019/2020 academic year's scheme of work in the Municipality based on the teaching syllabi (MOE, 2012) of Mathematics and Integrated Science. In order to ascertain the coverage of each topic in the tests, the researcher herself went round to collate the topics from the respective subject teachers of each sampled school including the piloted school. The topics for each subject served as the content areas on which the respective assessment instruments were built. That is, the test items covered common taught topics as shown in the Table 6.

Table 6: Term One Scheme of Work for JHS Two

Subject	Term One Topics
Mathematics	Statistics
	Rational Numbers
	Mapping
	Linear Equations and Inequalities
Integrated Science	Elements
	Metals and Non-metals
	Chemical Compounds
	Mixtures
	Carbon Cycle
	Reproduction in Humans
	Heredity
	Photosynthesis
	Food and Nutrition
	Infections and Diseases

Instrument Development Process

The instruments for data collection were developed following the principles and processes of test development as suggested by experts (Allen & Yen, 1979; Amedahe & Asamoah-Gyimah, 2016; Crocker & Algina, 1986) from the preliminary stage through to development, and final stage of review and reproduction.

At the preliminary stage, the researcher consulted literature to aid in familiarizing herself with the best practices and the principles that must be followed in the construction of good tasks after which the objective for the instruments were developed.

Development Stage

In the development stage, the researcher used the collated topics taught by the teachers in conjunction with the Bloom's Taxonomy to construct the test plans (table of test specification) for each test (see Appendix D, G, K, L, O, S, V, and Z) just as noted by (Etsey, 2012). The table of test specification (TOTS) aided the researcher to avoid lop-sidedness and inadequacy of sampling from the topics during the construction of the items. These ensured content representativeness and relevance for each instrument just as Nitko (2001) noted. The procedure guaranteed that, the assessment tasks reflected the learning outcomes specified in the syllabus and ascertained the content validity of the tests' scores.

In writing the individual tasks for the instruments the researcher adhered strictly to the test plans (TOTS). The restricted response type of task was used to construct essays and performance tasks. The purpose was to aid students to interpret each item as the researcher intended and to discourage biasness when scoring. This improved the scoring reliability and hence validity.

During the writing of the test tasks, the language, operational level of the students and clarity of the tasks were considered. These aided in conveying uniform meaning and single interpretation by all students and further allowed them to respond appropriately to the stimuli without bluffing. Each task of the instruments was immediately accompanied by its scoring key (see Appendix

AD) at the construction stage (Amedahe & Asamaoh-Gyimah, 2016; Crocker & Algina, 1986; Nitko, 2001; Quaigrain & Arhin, 2017).The seven tests are described as follows:

1. **Ability Determination Test (ADT) for Mathematics and Integrated Science.**

To ensure that both assessment types are present in the instrument, the test comprised of multiple-choice, matching, constructed response (essay) and on-demand performance tasks. It constitutes two battery tests. These are Mathematics (Part I) and Integrated Science (Part II). Each battery has three Sections: A, B and C (see Appendix M). In the Mathematics, the Section A constitutes 15 multiple-choice tasks with four options, Section B contains five simple constructed response tasks and Section C has six simple performance tasks. For Integrated Science, it consists of (15) multiple-choice tasks with four options in Section A, three simple constructed response tasks and a matching item with six (6) premises and seven (7) options in Section B and five (5) simple performance tasks in Section C. The test was taken by the students in 2 hours 15 minutes of one sitting. The time allotted for the test was with the notion of allowing ample timing for students to attempt every item so as to determine their maximum ability.

2. **Traditional Assessment for Mathematics (TAM)**

The test has two Sections, A and B (see Appendix T) and was made up of 20 multiple-choice tasks with four options in Section A and five simple constructed-response (essay) items in Section B.

3. **Performance Assessment for Mathematics (PAM)**

The test instrument (see Appendix Q) consists of six on-demand tasks.

4. **Mixed Items for Mathematics (MIM)/Final Test for Mathematics (FTM)**

This test has three Sections, A, B and C (see Appendix AB). There are 20 multiple-choice tasks with four options in Section A, five simple constructed-response (essay) tasks in Section B and six on-demand tasks in Section C.

5. **Traditional Assessment for Integrated Science (TAIS)**

This test also consists of 20 multiple-choice tasks with four options in section A and six simple constructed-response tasks in Section B (see Appendix AA).

6. **Performance Assessment for Integrated Science (PAIS)**

The test (see Appendix X) composes of seven on-demand tasks.

7. **Mixed Items for Integrated Science (MIIS)/ Final Test for Integrated Science (FTIS)**

The test is in three Sections, A, B and C (see Appendix AC). Section A has 20 multiple-choice tasks with four options, the Section B with six simple constructed-response tasks while the Section C is made up of seven on-demand tasks.

The traditional assessment components (Sections A and B) of the tests were constructed ensuring that more than 60% of the tasks suit the lower-order thinking skills from knowledge, comprehension and application (see Appendix K, L, S, and Z*)*. The performance tasks engulfed the higher-order thinking skills (see Appendix D, G, O, and V) from analysis, synthesis and to evaluation (creating) which required the students of 'what to do with the facts'; that is to first understand the facts, then connect the facts, categorize the facts, manipulate the facts and use them in new situations to obtain new solutions to problems (Nursalam, Angriani, Darmawati, Baharuddin, & Aminuddin, 2018).

To illustrate the cognitive process that will lead close to true score attainment as posited by (Crocker & Algina, 1986), the mixed items of each subject area constituted similar tasks from the same content and learning outcomes used previously to construct both traditional and performance assessments. However, the Section A of mixed items for Integrated Science was the same items of Section A of traditional assessment that were reconstructed with different wordings to express the same concept. This ensured that the students read, understood and interpreted each task before they attempt to produce responses.

Concerning the time allotted for students to attempt all tasks in the tests, the traditional assessment together with performance assessment tests of each subject took 2 hours 25 to be completed while the mixed items/final tests lasted for 2 hours 30 minutes. The tests time apportioned was in alignment to BECE time allocations for each subject, and suggestion made by measurement expert (Nikto, 2001). Also, clear and concise instructions were spelt out for the entire tests (see Appendix M, Q, T, X, AA, AB and AC). This encouraged students to attempt tasks as expected in order to attract the required marks and enhance students' interest in the entire tests.

Meanwhile, the researcher developed more multiple-choice tasks (20 for each subject's ADT (see Appendix C and F), and 30 each for TAM and TAIS, (see Appendix N and U) than the intended number of tasks for the Section As. The purpose was to make room for future scrutinisation and selection of appropriate tasks for the traditional tests.

Review and Reproduction Stage

The reviewing process of the instrument/tests aimed at ascertaining the content and construct validity of the written tasks for the intended purpose. It began with the researcher reviewing each instrument after constructing each test and putting it aside for three weeks. Tasks were critically scrutinized to detect flaws after which necessary corrections were made. Tasks were examined again by six experienced professional Mathematics and Integrated Science teachers at the JHS level. Thus, three teachers examined each subject's instruments. They helped to confirm that the tasks carry the appropriate meaning of the constructs that the researcher intended to measure. An example was, whether the performance tasks required students to use deep thought in manipulating materials to arrive at answers. Further, to confirm that clarity of each task matched the ability of the students, the teachers reviewed the test contents, language aspects of tasks and scoring keys as well. The reviewers' judgements and feedbacks were subsequently taken in good faith and all corrections were appropriately made. The instruments together with their soring keys were forwarded to the researcher's supervisors for their expert review. They offered some suggestions for improving the content and structure of some of the tasks. Those corrections were made.

Tasks of each instrument were assembled into test packages (see Appendix E, H, P, Q, W, X, AB and AC). Samples were printed and pilot tested in Kejabil M/A Junior High School in the Apowa Circuit of Ahanta West Municipality. The Circuit was not selected to participate in the study. The ADT was administered on January 13, 2020, TAM, PAM, TAIS, PAIS, MIM and MIIS on January 17, 2020 while the FTM and FTIS were administrated on

January 20, 2020. The same students took all the tests. A total of 42 JHS Form Two students in the class participated in the tests. 30 students who attempted every task of all the nine tests scripts were selected.

The scripts were scored and the item analysis; specifically item difficulty (*p*) and item discrimination (D) indices for the multiple-choice tasks were computed (see Appendix I, J, R and Y). The item analysis made the researcher to observe the characteristics of the tasks and was sure that tasks were of appropriate standards for inclusion in the examinations. It further improved the quality of the tests (Gronlund, 1998), and justified the instrument usage for a larger group of testees especially for norm referenced interpretations (Crocker & Algina, 1986). Tasks with *p*-values between 0.2 and 0.9 were considered good and acceptable but those less than 0.2 (too difficult) and more than 0.9 (too easy) were unacceptable (Quaigrain & Arhin, 2017). Although Allen and Yen (1979) had noted that "item difficulties of about .3 to .7 maximize the information the test provides about differences among examinees" (p.121), tasks with *p*-values of 0.8 and 0.9 were maintained to motivate and sustain the students' interest especially the low ability students in the tests.

In addition, the discrimination indices were used along with *p*-values to select the final tasks. As posited by Ebel, cited in Crocker and Algina (1986) item discrimination indices (D) greater than 0.40 (> 0.40) are very good items, 0.30 to 0.39 are good but may require some revision, 0.20 to 0.29 are online and requires serious revision while items with D-values less than 0.2 (< 0.20) are deemed inappropriate for inclusion in test instruments. Combining what the above literature proposed concerning *p* and D values, the computed item analysis for the section A of Mathematics ADT (see Appendix AH) indicated that all the tasks fell in the acceptable *p*-values and should be maintained in the test. However, five (25%) of the tasks (5, 7, 8, 9, and 13) were omitted because they had D-values less than 0.2 (< 0.20). The accepted 15 tasks were re-arranged according to difficulty indices (see Appendix AI) for Section A of Mathematics ADT (see Appendix M).

The computed item analysis for the section A, Integrated Science ADT (see Appendix AJ) depicted that for the *p*-values, two (10%) of tasks were too easy to be maintained in the test. The two (3 and 5) tasks were also part of five (25%) tasks (3, 5, 11, 16 and 20) that possessed D-values less than or equal to 0.2 (≤ 0.2). As already noted by Crocker and Algina (2006) they should be revised or completely be omitted. Since the researcher is interested in fifteen tasks, the faulty tasks were exempted. The remaining tasks were re-ordered (see Appendix M) from easy to difficult (see Appendix AK) as Section A for Integrated Science ADT.

The item analysis of Mathematics traditional assessment for Section A (see Appendix AL) revealed that ten (33.3%) tasks including item 1, 2, 3, 8, 10, 12, 13, 18, 19, and 21 need to be removed from the test because they possessed discrimination power less than 0.2 (< 0.2). The tasks could not discriminate among the testees although they have the recommended difficulty indices. The accepted tasks were arranged in decreasing order of difficulty indices (see Appendix AM) as the Section A of TAM (see Appendix T)

The computed item analysis for Section A of Integrated Science traditional assessment indices (see Appendix AN) resulted in ten (33.3%) items that could not give a better discrimination between the high and low ability students. The tasks had D-values less than 0.2 (< 0.2) although they possessed the acceptable difficulty indices. The tasks were 2, 6, 10, 17, 18, 23, 25, 26, 27, and 30. They were taken out of the test. The remaining twenty items were arranged from the highest *p*-value to the least indices (see Appendix AO) and in the instrument (see Appendix AA).

For the mixed items instruments, the Section A's subsumes similar items of traditional assessments. Only the difficulty indices were computed in order to rearrange the items from easy to difficult (see Appendix AP and AQ) for each subject's mixed items.

The Section A tasks of the instruments for ADTs, TAM, TAIS, MIM/FTM), and MIIS/FTIS were arranged from the easiest to the most difficult (see Appendix M, T, and AA). The intent was to motivate students to attempt all items in the instruments (Nitko, 2001). Sections B's and C's of ADT, Section B of TAM and TAIS and performance tasks instruments were vetted by the researcher's supervisors and were maintained as they are.

To determine the reliabilities of the instruments, the pilot testing data was analysed with the help of version 23 of SPSS. The main tools used were the Kuder-Richardson Formular 20 (KR_{20}) and inter-rater correlation procedures. Since the Section A tasks were dichotomously scored and had different difficulty levels (see Appendix AI, AK, AM, AO, AP and AQ), the KR_{20} was employed to compute their respective reliabilities (see Appendix AF). The Section A of Mathematics ADT, Integrated Science ADT, TAM, TAIS, MIM/FTM and MIIS/FTIS had reliability coefficients of 0.61, 0.68, 0.61, 0.72, 0.86 and 0.86 respectively. It is obvious that the Kuder-Richardson Formular 20 (KR_{20}) reliability coefficients for Mathematics ADT, Integrated Science ADT and TAM are lower in value because the test tasks are heterogeneous. This is noted by Nitko (2001) that "when the assessment tasks are heterogeneous, results from KR_{20} coefficient procedures are lower" (p. 69).

Further, the inter-rater reliability specifically the alpha coefficient interclass correlation was used to compute the reliabilities of the Sections B, C and performance assessment instruments as suggested by (Lane, 2010). The interclass correlation was chosen because it is appropriate for computing the reliability of continuous variables that are measured on the interval scale, and are scored by two raters (Hallgren, 2012). The alpha reliability coefficient for Mathematics ADT Section B was 0.94 and 0.98 for the Section C. For Integrated Science ADT, Section B was to 0.97 and section C was 0.96. The traditional assessment instruments had the alpha reliability coefficients of 0.94 for Section B of TAM while TAIS was to 0.93. The performance assessment instrument for PAM was 0.97 and the PAIS was 0.95. With the mixed items, MIM/FTM Sections B and C both stood at 0.98 while MIIS/FTIS Section B was 0.90 and the C was 0.96.

For the reliability of the main study (see Appendix AG), the Cronbach's co-efficient alpha estimated an internal consistency of .80. The researcher opted for the Cronbach's alpha coefficient reliability based on the recommendation made by Cronbach (as cited in Ebel & Frisbie, 1991) that, it is suitable for the estimation of internal reliability of tasks of varying points including essays.

Reproduction Stage

This was the final stage of the instruments development process. The procedure was done after all necessary inputs were factored in to achieve a valid and reliable test instruments which would measure the achievement of the student.

Determination of High and Low Ability Groups

Before the data collection commenced, the Ability Determination Test (ADT) instrument was first administered to all students as the initial test. Its purpose was to determine each student's academic ability. The test tasks were scored and individual scores ranked and used to categorise the students into high and low ability groups (see Appendix AE). The groups were created using the twenty-seven per cent (27%) each of upper (U) and lower (L) scores as the high and low ability students respectively as suggested by measurement experts (Crocker & Algina, 2006; Nitko, 2001).

Data Collection Procedure

The researcher obtained an introductory letter (see Appendix A) from the Department of Education and Psychology for the study. The letter was used to seek permission from the Ahanta West Municipal Education Directorate to undertake the study in the Municipality. Copies of the obtained documents from the authorities were sent to the headteachers of the selected schools to seek permission within a period of one month before data collection commenced.

During the school visits, the purpose of the study was explicitly explained to the heads and the students in order to encourage them (students) to participate. For example, students were made to know why they need to participate in the tests such as having the first time experience of performing practicals based on concepts learnt. In order for students to give their maximum performance, they were given the outline of topics to be covered by the tests in both Mathematics and Integrated Science and were encouraged to prepare for the tests in advance. Also, students were assured of confidentiality and anonymity in participating in the study. This prevented them from dropping out of the study.

Further, in order to be assured of feasibility of data collection in the schools, a proposed data collection schedule [Tests Administration Schedule (see Appendix B)] was given to each school's authorities for their approval. This ensured none of the schools' activities coincided with the proposed dates scheduled for data collection (tests administration).

The researcher embarked on follow up visits to all sampled schools within a period of one week before the scheduled dates of the tests administration. One main key issue addressed was to remind the school authorities and the students of the impending tests to be taken. The tests were administered in the various selected schools and classes at the scheduled time.

The researcher employed the service of three first degree holders in education as assistants in administering the tests. The assistants were trained on test administration procedure to aid them acquire basic knowledge of test administration and ensure uniform conditions for the students. The administration of the tests was done in conducive environments for testing. All these helped hopefully, to limit errors being introduced in the test scores (Amedahe & Asamoah-Gyimah, 2016).

There were three sessions of the test administrations, with each taking a maximum of 2 hours 30 minutes to be completed at one sitting. That is, a day was allocated for each school to take the tests. The data collection commenced on February 17, 2020 and ended on March 4, 2020. Thus, a maximum of three weeks were used to administer the tests.

In the first session, the traditional assessment and performance assessment tests of each subject were administered to the students, a week after the Ability Determination Tests (ADTs). The second session tests were administered in an hour after the first session. The one hour interval helped to reduce fatigue on the students. The final session was held within a minimum break of five days.

The tests were administered in a class form with the help from the assistants on the agreed upon dates in the various selected schools. Souvenirs (a long rule each) and all apparatus needed for answering performance task items were distributed to all participants before the first session of tests commenced. This motivated the students to participate fully in all the tests.

After the sessions of testing were completed, the students were appreciated for their time and knowledge shared with the team. Letters of appreciation together with a few of the apparatus used for answering the performance tasks were given to the authorities of each school. Completed answer scripts were collated, scored and package in envelopes to ensure safety of responses.

Of the 488 students from the sampled schools, 434 students representing 88% took all the tests and hence participated in the study. However, 234 students forming a total of the high and low ability groups; was used for the data analysis. Each test (TAM, TAIS, PAM, PAIS, MIM, MIIS, FTM and FTS) was used to determine the students' achievement in the respective subjects (Mathematics and Integrated Science).

Data Processing and Analysis

The students' responses to the main and final tests were scored and recorded as collected data for the study purposely, for the researcher to answer the research questions and test the hypotheses. The tasks of traditional assessment instruments (TAM and TAIS) had a total score of 30 marks of which each task in Section A was scored one (1) mark for selecting a key. For the Section B of TAM, tasks 1, 2, 3, 4, and 5 were subjectively scored 1, 1, 4, 2, and 2 marks respectively. For Section B of TAIS, tasks 1, 2, 3, 4, 5, and 6 were also subjectively scored 2.5, 0.5, 3, 1, 1, 1, and 1 mark(s) respectively. The performance tasks instruments (PAM and PAIS) had total score of 30 marks for each subject. For PAM tasks 1, 2, 3, 4, 5 and 6 were subjectively scored 3, 3, 12, 6, 3 and 3 marks respectively. The PAIS tasks 1, 2, 3, 4, 5, 6, and 7 were also scored subjectively as 5, 1, 3, 6, 5, 5 and 2 marks respectively. The mixed items instruments (MIM, MIIS, FTM and FTIS) of both subjects were scored using the same procedure of scoring in TAM, TAIS, PAM and PAIS instruments. This yielded a sum score of 60 marks to each mixed items instrument.

The scores of every instrument were converted into percentages so that a unified unit could be attained for easy comparison of the assessment types. The data (tests scores) were analysed using SPSS version 23. The analysis involved the computation of descriptive statistics specifically, means and standard deviations to answer the research questions, and inferential statistics; paired sample t-tests, multivariate analysis of variance (MANOVA) and multiple regressions to test the hypotheses. According Ary *et al*. (2010), the descriptive statistics aids "researchers to organize, summarize, and describe observations … and the inferential statistics determine how accurately inductive reasoning is employed to infer that what is observed in the part will be observed in the whole…" (p. 101). All hypotheses were tested at .05 significance level.

Research Question One

How do high ability students perform on mixed items of traditional and performance assessment tasks in Mathematics and Integrated Science?

This question sought to compare the achievement of high ability students on mixed items tests with traditional assessment and performance assessment tests of each subject. In order to do the comparison, means and standard deviations scores of each subject's assessment type were compared to the respective mixed items' descriptive statistics. The differences were presented by bar graphs.

Research Question Two

How do low ability students perform when assessed using mixed items of traditional and performance assessment in Mathematics and Integrated Science?

This question compared the low ability students' achievements on mixed items tests to their achievements on each subject's traditional assessment and performance assessments tests. The question was answered just as in research question one.

Research Hypothesis One

There will be a difference in the performance of high ability students in Mathematics and Integrated Science when assessed using traditional assessment and performance assessment on the same content and learning outcomes.

The hypothesis sought to find out the difference in high ability students' performance in traditional assessment and performance assessment tests. The paired sample t-test was used to test the hypothesis since the scores were measured on the interval scale using continuous variable and the same students were involved in both traditional assessment and performance assessment tests.

Research Hypothesis Two

There will be a difference in the performance of low ability students when assessed on the equivalent content and learning outcomes in Mathematics and Integrated Science using traditional assessment and performance assessment procedures.

Data on hypothesis two was analysed as in hypothesis one because it was interested in the difference in low ability students' performance in traditional assessment and performance assessment tests and the same students were involved in both assessment types.

Research Hypothesis Three

There will be a difference in the performance of high and low ability students in Mathematics and Integrated Science when assessed using performance assessments.

The hypothesis compared high and low ability students' achievements on performance assessments tests in Mathematics and Integrated Science to identify the difference between the ability groups. The two different ability groups of students were involved in the study. This, therefore, generated two tests' scores (one in Mathematics and the other in Integrated Science) which were used as the dependent variables. Both variables are continuous and measured on interval scale from the independent variable (ability groups). Thus, two dependent variables measured from one independent variable with two levels as high and low ability students. Therefore, the differences in achievements between the ability groups were identified with descriptive statistics, specifically, means and standard deviations and were statistically accepted with one-way multivariate analysis of variance (MANOVA).

Research Hypothesis Four

There will be a difference in the performance of high and low ability students in Mathematics and Integrated Science when assessed using a mixed items of traditional and performance assessments.

The hypothesis is interested in the differences in high and low ability students' performance on mixed items tests in both Mathematics and Integrated Science. The procedure used to analyse the data regarding hypothesis three was used in tackling this hypothesis.

Research Hypothesis Five

Traditional assessment is a better predictor of the performance for high ability students than low ability students in Mathematics and Integrated Science.

The hypothesis involved prediction of performance for high ability students in an examination using their scores on traditional assessment and performance assessment tests. The predictor (scores on traditional and performance assessments tests) and criterion (scores on final test) variables are both continuous in nature. Hence, multiple linear regression was employed since two predictor variables (assessment types) were involved for the prediction of the criterion variable (achievement) in the final tests.

Research Hypothesis Six

Performance assessment is a better predictor of performance for low ability students than high ability students in Mathematics and Integrated Science.

There is a prediction of performance of low ability students in an examination using scores on traditional assessment and performance assessment tests. Similarly, this was analysed as in hypothesis five.

The next chapter presents the results of the analyses and discussion of the findings.

CHAPTER FOUR

RESULTS AND DISCUSSION

The aim of this study was to compare traditional and performance assessment to determine the assessment type which better increased high and low ability junior high school students' achievement scores in Mathematics and Integrated Science. The focus was specifically on: (a) comparing performance of high ability students when assessed using traditional assessment and performance assessment on the same content and learning outcomes in Mathematics and Integrated Science, (b) comparing performance of low ability students when assessed using traditional assessment procedure and performance assessment tasks on equivalent content and learning outcomes in Mathematics and Integrated Science, (c) investigating whether high ability students would similarly perform on mixed items of traditional and performance assessment in Mathematics and Integrated Science, (d) investigating whether low ability students would similarly perform when assessed using mixed items of traditional and performance assessment in Mathematics and Integrated Science, (e) comparing the performance of high and low ability students in Mathematics and Integrated Science when assessed using performance assessment, (f) comparing the performance of high and low ability students in Mathematics and Integrated Science when assessed using mixed items of traditional and performance assessment, and finally (g) determining a better predictor of achievement for high and low ability students in Mathematics and Integrated Science when assessed using traditional assessment procedures and performance assessment tasks.

This chapter presents the results and discusses the findings for the 234 Junior High School students who participated in all the nine tests.

Results of Data Analysis

Research Question One: How do high ability students perform on mixed items of traditional and performance assessment in Mathematics and Integrated Science?

The data pertaining to this question were analysed by comparing the means and standard deviations obtained by high ability students in Mathematics and Integrated Science. That is, the computed scores of mixed items were compared to each assessment type of traditional or performance tasks. Tables 7 and 8 present the results of high ability students' achievements in Mathematics and Integrated Science respectively.

Table 7: Results of Analysis of High Ability Students' Achievement in Mathematics

	Descriptive Statistics		
Assessment Type	N	Mean(M)	SD
Traditional	117	49.52	12.34
Performance	117	85.81	10.95
Mixed	117	70.69	10.27

Source: Field survey (2020)

Results of Table 7 indicate that high ability students' performance in Mathematics mixed items (M = 70.69, SD = 10.27) was better than their performance in traditional assessment (M = 49.52, SD = 12.34). However, the students performed far better in the performance assessment (M = 85.81, SD = 10.95) than in the traditional and mixed items (M = 70.69, SD = 10.27). The statistics shows that high ability students performed moderately on mixed items of traditional and performance assessment in Mathematics.

Table 8: Results of Analysis of High Ability Students' Achievement in Integrated Science

	Descriptive Statistics		
Assessment Type	N	Mean(M)	SD
Traditional	117	64.52	13.23
Performance	117	86.58	11.34
Mixed	117	76.86	9.69

Source: Field survey (2020)

From Table 8, it can be seen that high ability students performed best in performance assessment (M = 86.58, SD = 11.34), followed by mixed items (M = 76.86, SD =9.69) and traditional assessment (M = 64.52, SD =13.23) in that order. The trend of the results is similar to that of the Mathematics, which is an indication that high ability students performed moderately on mixed items, relatively poorly on traditional tasks and best on performance tasks in Mathematics and Integrated Science tests. The results on research question one are visually presented with bar graphs in Figure 2.

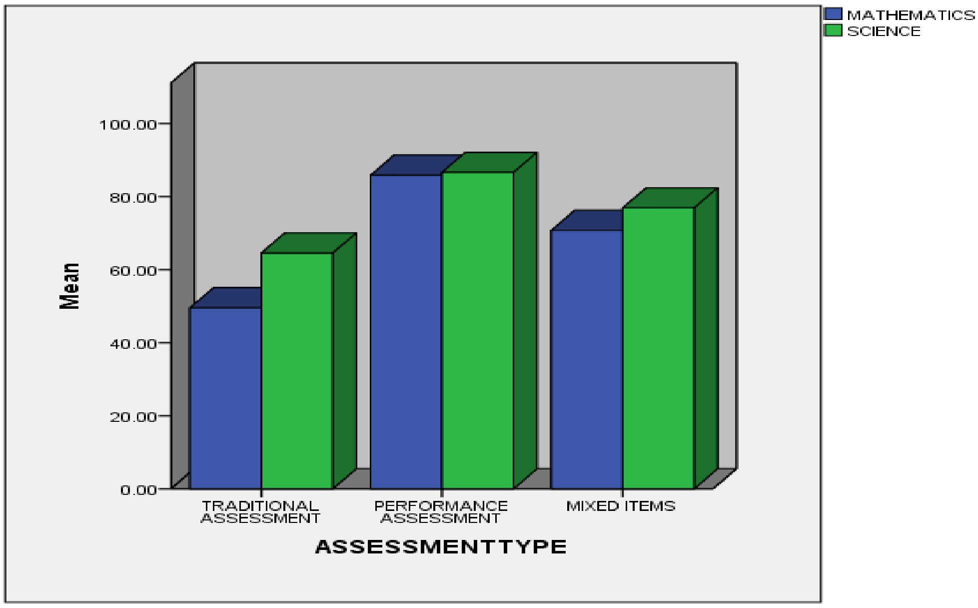

Figure 2: Bar Graphs Showing Mean Scores of High Ability Students Achievement on Traditional, Performance and Mixed Items Assessment for Mathematics and Integrated Science

Research Question Two: How do low ability students perform on mixed items of traditional and performance assessment in Mathematics and Integrated Science?

The data was analysed using descriptive statistics. Tables 9 and 10 present the results from the analysis.

Table 9: Results of Analysis of Low Ability Students' Achievement in Mathematics

	Descriptive Statistics		
Assessment Type	N	Mean(M)	SD
Traditional	117	27.40	8.17
Performance	117	83.50	12.38
Mixed	117	45.61	9.49

Source: Field survey (2020)

In Table 9, the low ability students' performance was best on performance assessment (M = 83.50, SD = 12.38), better on mixed items (M = 45.61, SD = 9.49), but worse on traditional assessment (M = 27.40, SD = 8.17). This means, low ability students performed moderately when assessed with mixed items in Mathematics test.

Table 10: Results of Analysis of Low Ability Students' Achievement in Integrated Science

	Descriptive Statistics		
Assessment Type	N	Mean(M)	SD
Traditional	117	33.83	12.26
Performance	117	89.91	10.41
Mixed	117	53.35	12.74

Source: Field survey (2020)

Similar trend of performance of low ability students in Mathematics is shown in their performance in Integrated Science in Table 10. The performance is best in performance tasks (M = 89.91, SD = 10.41), followed by mixed items (M = 53.35, SD = 12.74) and traditional assessment (M = 33.82, SD = 12.26) in that order. The finding revealed that low ability students, in general, performed better on mixed items but best on performance assessment. Figure 3 shows the results in bar charts in Mathematics and Integrated Science.

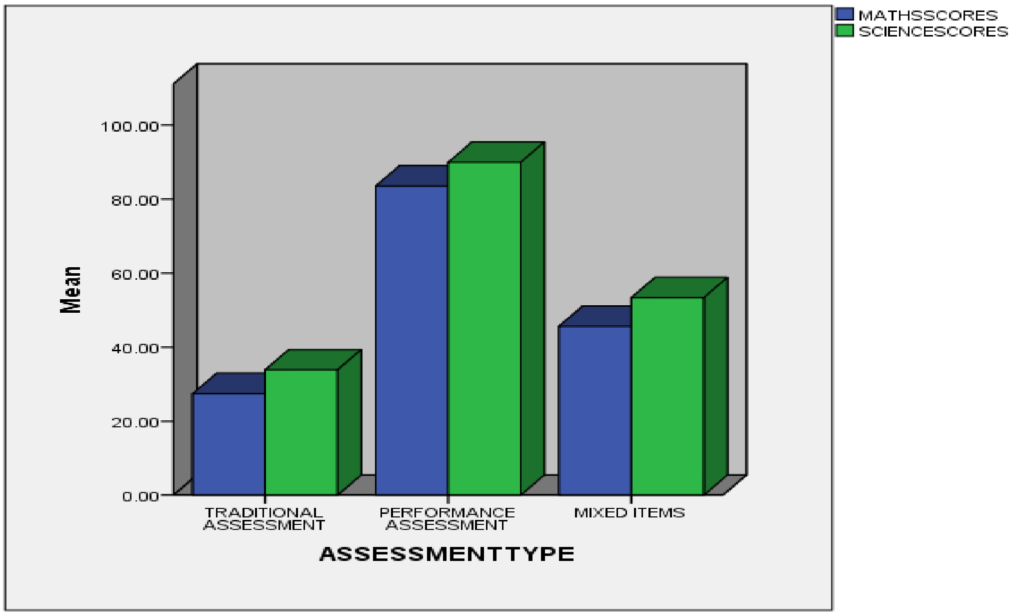

Figure 3: Bar Charts Showing Mean Scores of Low Ability Students on Traditional, Performance and Mixed Items for Mathematics and Integrated Science

Hypothesis One: There is no difference in the performance of high ability students in Mathematics and Integrated Science when assessed using traditional assessment and performance assessment on the same content and learning outcomes.

Hypothesis one was tested with paired sample t-test by comparing the mean scores of high ability students' achievements on traditional assessment and performance assessment for Mathematics and Integrated Science tests. The results are presented in Table 11.

Table 11: Paired t-test Results of High Ability Students' Performance on Traditional and Performance Assessment in Mathematics and Integrated Science

Subject	Assessment Type	N	Mean (M)	SD	T	Df	Sig. (2-tailed)
Mathematics	Traditional	117	49.52	12.34		116	.000
	Performance	117	85.81	10.95	25.09		
Integrated	Traditional	117	64.52	13.23		116	.000
Science	Performance	117	86.58	11.34	17.24		

Source: Field survey (2020)

Table 11 indicates that there is a statistical significant difference in students' performance in Mathematics on performance assessment (M = 85.81, SD = 10.95) and traditional assessment (M = 49.52, SD = 12.34), t(116) = 25.09, p < .000 (two-tailed) with a computed eta squared statistic of .84 depicting a large effect size. The table also shows a similar result of the high ability students' achievement in Integrated Science with a statistical significant difference on performance assessment (M = 86.58, SD = 11.34) and traditional assessment (M = 64.52, SD = 13.23), t(116) = 17.24, p < .000. The calculated eta squared of .71 indicating a large effect size using Cohen's d. This means that, the high ability students performed better in Mathematics and Integrated Science tests when assessed with performance assessment tasks.

Hypothesis Two: There is no difference in the performance of low ability students in Mathematics and Integrated Science when assessed using traditional assessment and performance assessment on the same content and learning outcomes.

This hypothesis was similarly tested as Hypothesis 1. Table 12 presents the results

Table 12: Paired t-test Results of Low Ability Students' Performance When Assessed with Traditional and Performance Assessment in Mathematics and Integrated Science

Subject	Assessment Type	N	Mean (M)	SD	T	df	Sig. (2-tailed)
Mathematics	Traditional	117	27.40	8.17		116	.000
	Performance	117	83.50	12.38	44.91		
Integrated	Traditional	117	33.83	12.26		116	.000
Science	Performance	117	89.91	10.41	41.03		

Source: Field survey (2020)

The results in Table 12 show that there is a statistical significant difference in performance of low ability students in Mathematics between performance assessment (M = 83.50, SD = 12.26) and traditional assessment (M = 27.40, SD = 8.17), t(116) = 44.91, $p < .000$ (two-tailed), with better results emerging from performance assessment, eta squared statistic of .94 showing a large effect size.

The results of achievement in Integrated Science also indicated significant difference in performance assessment (M = 89.91, SD = 10.41) and traditional assessment (M = 33.83, SD = 12.26), t(116) = 41.03, $p < .000$, with eta squared of .94 also depicting a large effect size. The statistical evidence from Table 12 implies low ability students tend to have higher achievements in Mathematics and Integrated Science when assessed using performance assessment than traditional assessment.

Hypothesis Three: There is no difference in the performance of high and low Ability students in Mathematics and Integrated Science when assessed using performance assessments.

Data pertaining to this hypothesis were analysed using descriptive statistics. The mean scores and standard deviations obtained are presented in Table 13.

Table 13: Mean Scores of High and Low Ability Students' Performance in Mathematics and Integrated Science in Performance Assessment

Subject	Ability Group	N	Mean(M)	SD
Mathematics	High	117	85.81	10.95
	Low	117	83.50	12.38
	Total	234	84.66	11.72
Integrated Science	High	117	86.58	11.34
	Low	117	89.91	10.41
	Total	234	88.24	10.99

Source: Field survey (2020)

A close observation from Table 13 indicates that, the high ability students (M = 85.81, SD = 10.95) performed better than the low ability students (M = 83.50, SD = 12.376) in Mathematics. However, the vice versa occurred in the case of Integrated Science scores with the lead being the low ability students (M = 89.91, SD = 10.41) performing better than the high ability students (M = 86.58, SD = 11.34). In order to ascertain statistically significance in the performance between the groups, a one-way multivariate analysis of variance (MANOVA) was conducted. The results are shown in Table 14. The two dependable variables were the performance assessment scores in Mathematics (PAM) and performance assessment scores in Integrated Science (PAIS) and the independent variable was the level of ability group.

Table 14: Results of One Way MANOVA of Low and High Ability Students' Performance on Performance Assessment in Mathematics and Integrated Science

Source	Dependent Variable (Subject)	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Ability Group	Mathematics	311.54	1	311.54	2.28	.132	.010
	Integrated Science	646.67	1	646.67	5.46	.020	.023
Error	Mathematics	31683.11	232	136.57			
	Integrated Science	27494.44	232	118.51			
Total	Mathematics	1709072.00	234				
	Integrated Science	1850283.00	234				

Source: Field survey (2020)

With no violation to all preliminary assumptions, there was no statistically significant difference in the Mathematics scores but a difference occurred in Integrated Science scores at F (2, 231) = 3.674, p < .027; Wilk's Lambda = .97; partial eta squared = .03. Dealing with the individual results of the dependable variables, the only difference attained with Bonferroni adjusted level of .025 was PAIS scores, F (1, 232) = 5.46, p = .020, partial eta squared = .02. This finding depicted that the low ability students outperformed the high ability students in Integrated Science while the difference in the Mathematics scores was just by chance and had no statistical significance in practice.

Therefore, the low ability students performed better than the high ability students when assessed with performance assessment procedures.

Hypothesis Four: There is no difference in the performance of high and low ability students in Mathematics and Integrated Science when assessed using a mixed items of traditional and performance assessments.

Table 15 presents the mean scores in the performance of high and low ability students on mixed items of traditional and performance assessments in Mathematics and Integrated Science.

Table 15: Mean Scores of High And Low Ability Students Performance in Mathematics and Integrated Science on Mixed Items

Subject	Ability Group	N	Mean (M)	SD
Mathematics	High	117	70.69	10.27
	Low	117	45.61	9.49
	Total	234	58.15	15.98
Integrated Science	High	117	76.86	9.69
	Low	117	53.35	12.74
	Total	234	65.11	16.32

Source: Field survey (2020)

An examination of the mean scores in Table 15 indicated that high ability students (M = 70.69, SD = 10.27) performed better on Mathematics mixed items than low ability students (M = 45.61, SD = 9.49). Similarly, on Integrated Science mixed items, the high ability students (M = 76.86, SD = 9.69) achieved higher mean score than the low ability students (M = 53.35, SD =

12.74). To statistically confirm these score differences, the one-way between-groups multivariate analysis of variance was run. Scores of Mathematics mixed items and Integrated Science mixed items were the dependable variables and level of ability group was the independent variable. The results are presented in Table 16.

Table 16: Results of One Way MANOVA of Low and High Ability Students' Performance in Mixed Items of Mathematics and Integrated Science

Source	Dependent Variable (Subject)	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Ability Group	Mathematics	36812.81	1	36812.81	376.89	.000	.619
	Integrated Science	32341.89	1	32341.89	252.48	.000	.521
Error	Mathematics	22660.81	232	97.68			
	Integrated Science	29718.44	232	128.097			
Total	Mathematics	850715.40	234				
	Integrated Science	1053963.00	234				

Source: Field survey (2020)

The results in Table 16 show that there was statistically significant differences between the high and low ability students on mixed items of both Mathematics and Integrated Science, F (2, 231) = 262.78, p < .000; Wilk's Lambda = .31; partial eta squared = .70. On a separate consideration of the results for each dependent variable, both scores attained statistical significance with the use of the Bonferroni adjusted alpha level of .025. This is indicated by the evidence of Mathematics mixed items at F (1, 232) = 376.89, p = .000, is significant with partial eta squared = .62, and Integrated Science mixed items at *F* (1, 232) = 252.48, p = .000, was also significant with partial eta squared = .52. The results of the analysis suggest that high ability students' performance improved than low ability students when assessed on mixed items of traditional and performance assessment procedures in Mathematics and Integrated Science.

Hypothesis Five: There is no better predictor of performance for high ability students in Mathematics and Integrated Science when assessed using traditional assessment and performance assessment.

In analyzing data related to this hypothesis, a multiple linear regression was run to predict the high ability students' achievements in final tests based on their previous performance in traditional assessment and performance assessment tests. Commencing with analysis of the Mathematics scores, after the entry of the predictor variables (scores of traditional test and performance test) into the model, a total variance of 44.8% was explained to cause the Mathematics final test's scores at, *F* (2, 114) = 46.21, p < .000. The analysis further showed that the predictor variables correlated significantly, with the achievement of the high ability students in the Mathematics final test. The summary of the analysis is presented in Table 17. Using the standardized coefficients, the regression equation model for predicting Mathematics achievement in examination is presented as:

HAS Mathematics Final Test Scores = 0.452 TAM + 0.449 PAM

Table 17: Regression Analysis of Assessment Types and High Ability Students' (HAS) Test Scores in Mathematics

	Coefficients				F-Test	
	Unstandardized Coefficient	Standardized	T	Sig	F	Sig
Intercept	27.283		5.83	.000		
Traditional	.289	.452	6.47	.000	46.21	.000
Performance	.323	.449	6.42	.000		

Multiple R = 0.669, R^2 = 0.448, *Adjusted* R^2 = 0.438, *Significant at* $P < 0.05$

Source: Field survey (2020)

Scrutiny of the collected data showed that traditional assessment is the stronger predictor of high ability students' performance in Mathematics final test when compared to performance assessment. Again on the issue of predicting achievement of high ability students in Integrated Science final test, Table 18 presents similar characteristics of the high ability students' performance in Integrated Science final test. The model explains approximately 13.1%, F (2, 114) = 8.62, p < .000 of the variance in the Integrated Science final test's scores for the high ability students when both independent variables (scores of traditional test and performance test) were entered into the model. The results indicated that traditional assessment associated, significantly, with the Integrated Science final test's scores but the performance assessment was not significant for the high ability students. The standardized coefficient model is presented as follows:

HAS Integrated Science Final Test Scores = 0.380 TAIS – 0.059 PAIS

Table 18: Regression Analysis of Assessment Types and High Ability Students' (HAS) Examination Scores in Integrated Science

	Coefficients				F-Test	
	Unstandardized Coefficient	Standardized	T	Sig	F	Sig
Intercept	71.225		12.85	.000		
Traditional	.228	.380	4.04	.000	8.62	.000
Performance	-.041	-.059	-.62	.534		

Multiple R = 0.363, R^2 = 0.131, *Adjusted* R^2 = 0.116, *Significant at* $P < 0.05$

Source: Field survey (2020)

Results from Table 18 also indicate that traditional assessment is the better predictor of high ability students' achievements in Integrated Science examination. Evidence from Tables 17 and 18 explain statistically that traditional assessment helps the high ability students to master the general knowledge in Mathematics and Integrated Science and is therefore, easily and accurately retrieved during examinations for the betterment of their performance. This implies, traditional assessment is the better predictor of performance for high ability students in Mathematics and Integrated Science examinations and therefore the null hypothesis is rejected.

Hypothesis Six: There is no better predictor of performance for low ability students (LAS) in Mathematics and Integrated Science when assessed using traditional assessment procedures and performance tasks.

The final hypothesis was tested just as the fifth one. For the Mathematics aspect, the entry of scores of traditional assessment and performance assessment tests into the model revealed that 12.7% of the variance is caused by the assessment types (F (2, 114) = 8.31, p < .000). There was a statistical significant difference for performance assessment but this was not so for traditional assessment. The result of the analysis as shown by Table 19 gives the standardized coefficient regression model as:

LAS Mathematics Final Test Scores = 0.027TAM + 0.351PAM

Table 19: Regression Analysis of Assessment Types and Low Ability Students' (LAS) Examination Scores in Mathematics

	Coefficients				F-Test	
	Unstandardized Coefficient	Standardized	T	Sig	F	Sig
Intercept	21.368		3.21	.002		
Traditional	.035	.027	.30	.762	8.31	.000
Performance	.301	.351	3.94	.000		

Multiple R = 0.357, R^2 = 0.127, *Adjusted* R^2 = 0.112, *Significant at* $P < 0.05$

Source: Field survey (2020)

Table 19 result indicated that performance assessment results had the higher positive impact on the low ability students' achievement in the Mathematics test. In Table 20, it is revealed that 26.5% of low ability students' performance in Integrated Science F (2, 114) = 20.54, p < .000 is explained by the assessment type adopted. And similarly, there was statistical significance for performance assessment which was not so for traditional assessment. The standardized coefficient equation for the performance is given as

LAS Integrated Science Final Test Scores = 0.137TAIS + 0.475PAIS

Table 20: Regression Analysis of Assessment Types and Low Ability Students' (LAS) Examination Scores in Integrated Science

	Coefficients				F-Test	
	Unstandardized Coefficient	Standardized	T	Sig	F	Sig
Intercept	30.868		6.26	.000		
Traditional	.078	.137	1.69	.094	20.54	.000
Performance	.318	.475	5.84	.000		

Multiple R = 0.515, R^2 = 0.265, *Adjusted* R^2 = 0.252, *Significant at P* < 0.05

Source: Field survey (2020)

From Table 20, performance assessment had the stronger prediction of achievement in Integrated Science examination for the low ability students. Significantly, the findings from Tables 19 and 20 both depict that there is a better predictor of achievement in Mathematics and Integrated Science examinations for the low ability students and this, particularly, is performance assessment. Therefore, the null hypothesis was rejected in favour of the research hypothesis.

Summary of Findings

The results have indicated that high and low ability students performed moderately on mixed items tests, best on performance assessment but generally weak on traditional assessment tests. Also, it was revealed that on performance assessments, the low ability students had high achievements than high ability students while the vice versa occurred on mixed items tests of both subjects. On the regression analyses, it was found that traditional assessment gave a better prediction to high ability students' achievements while performance assessment was the better predictor of low ability students' achievements in Mathematics and Integrated Science examinations.

Discussion of Research Findings

The discussion of the findings is rooted on the following results obtained from the data analysed:

1. The moderate performance of high and low ability students on mixed items of traditional and performance assessment in Mathematics and Integrated Science.
2. High ability students perform better in Mathematics and Integrated Science when assessed with performance assessment tasks than traditional assessment procedures.
3. Low ability students perform better in tests on performance assessment than traditional assessment in Mathematics and Integrated Science.
4. Low ability students' achievement is better than high ability students in Mathematics and Integrated Science when assessed using performance assessment tasks.
5. High ability students perform better than low ability students in Mathematics and Integrated Science when assessed using mixed items of traditional and performance assessments.
6. Traditional assessment gives better prediction of performance for high ability students' achievements in Mathematics and Integrated Science examinations.
7. Performance assessment is the better predictor of low ability students' achievements in Mathematics and Integrated Science examination.

The performance of high and low ability students on mixed items of traditional and performance assessment in Mathematics and Integrated Science

The analysis of the data revealed that both high and low ability students performed moderately on mixed items assessment, best on performance assessment and poor on traditional assessment in Mathematics as well as in Integrated Science. In this study, it was observed that the students concentrated much on the performance tasks in the mixed items with little attention on the traditional assessment tasks. This caused the moderate achievements in both Mathematics and Integrated Science tests.

Although none of the literature gave a moderate achievement in mixed items by students, the finding is in line with Caygill and Eley's (2001) study observation and allusion that, achievement reflects to the equipment support students received in each assessment type. That is, achievement is in an order according to the frequency of hands-on activities involving the use of materials, which aid students in reaching response to tasks present in each assessment type. This is true since none, little and full supports were provided to the students during traditional, mixed items and performance assessments respectively.

However, this finding contradicts Leon and Elias' (1998) finding which indicated that students performed worst in mixed items assessment but better in traditional assessment and best in performance assessment. In their study, they observed that, performance assessment allowed students with potentials in practical aspects to demonstrate their knowledge and skills clearly and apparently obtained high scores to redeem their academic image. This saved those low ability students and maintained the high ability students because both students' achievements were maximised in the examination (Leon & Elias, 1998). This observation on performance assessment is consistent with the current study and it implies that the low ability students are misjudged with traditional assessment procedures.

The difference in the performance of high ability students in Mathematics and Integrated Science when assessed using traditional assessment and performance assessment on the same content and learning outcomes

A scrutiny of results showed that, the high ability students performed well in both assessment types (i.e., traditional and performance) but have better achievements when assessed with performance assessment than traditional assessment in Mathematics and Integrated Science tests. The observation made during the scoring process revealed that the students attempted every task and provided all necessary information that aid them to attain the high scores in the performance assessment for both Mathematics and Integrated Science tests. However, in traditional assessment, some of the students could not identify correct options to multiple choices or provide precise responses to short answer tasks especially in the Mathematics tests. These, therefore, lead to the observed differences between achievements in the assessment types. This finding corresponds to the findings by Eshun and Abledu (2001) which indicated that high achievement in performance assessment by high ability students was due to their ability to sequentially solve novel problems in Mathematics and Science tests. The finding also links positively with Hancock's (2007) study which explains that students had the opportunity to exhibit their competency in authentic ways in performance assessment; which however, could not happen in the traditional assessment. This, therefore, resulted in the differences in the achievement of the assessment types. This finding, on the other hand, refutes Agyei and Mensah's (2018) study at the senior high school level which revealed that students' achievement was better in traditional assessment than performance assessment.

The difference in the performance of low ability students when assessed on equivalent content and learning outcomes in Mathematics and Integrated Science using traditional assessment and performance assessment procedures

Data analysed revealed that low ability students' achievements in Mathematics and Integrated Science tests improved when assessed with performance assessment format instead of traditional assessment. It was observed in this current study that the low ability students either provided incorrect responses to some tasks or left tasks unattempted in the traditional assessment tests. These, therefore, resulted in the low scores in the traditional assessment especially in Mathematics.

The finding is consistent with Webb *et al*.'s (2002) work, which also found that students' achievement was maximised in both assessment types but with low scores in traditional assessment. It further confirmed the assertion by Webb et al. that, students had difficulties in retrieving precise responses to tasks in the traditional assessment. A notable instance in this study was the inability of the students to identify the mode of a data set in the traditional assessment but was able to provide accurate response to the same task in the performance assessment. This frequently happens in tests of traditional assessment where majority of students provide the same response to a particular task which turns to be incorrect (Webb *et al*., 2002) because, they had the difficulty in retrieving the precise response to the tasks in traditional assessment. This could further be explained in terms of test anxiety that students develop in traditional assessment procedures (Taylor & Watson, 2000) which in turn, tend to produce low achievement in examinations.

On the part of high scores in performance assessment, it was observed that the low ability students were able to provide accurate and sequential process of responses to tasks given to them. This was one of the agreed upon standards in the performance assessment and it caused the rise in the scores for both Mathematics and Integrated Science. The observation in the scores confirmed Hancock's (2007) explanation that, the low ability students demonstrated essential knowledge and skills required at every stage or step for accomplishing a challenging tasks. This aided the students to attain the accorded score for each step taken. The finding also indicated that the performance tasks retained taught concepts and skills which were efficient tools for demonstration of cognitive processes than as observed in traditional assessments (Eshun & Abledu, 2001). This was true in this study because upon a critical observation, the low ability students' mean score on performance assessment was far better than the mean score of traditional assessment in Mathematics.

On the other hand, the finding did not confirm the results of Taylor and Watson (2000) that, using one assessment type to assess students learning outcomes is adequate and appropriate. This is because, both traditional and performance assessments have the same impact on students' achievements in examinations. It was observed in this study that the hands-on activities in performance assessment encourages the low ability students to follow laydown procedures in attaining better scores than as in traditional assessment.

The differences in high and low ability students' achievements in Mathematics and Integrated Science when assessed using performance assessments.

Results from analysed data showed that the low ability students performed better than the high ability students when assessed with performance assessment procedures. Obviously, this finding stood out clearly in the study. The response rate demonstrated by the low ability students revealed the extent of advance preparation and zeal they had for high achievement in the performance assessment examinations than the high ability students. Brookhart (1997), Woodward *et al.*. (2001) and Fastre´ *et al.*'s (2010) studies had related findings of this current work. Fastre´ *et al.* explained their findings that low ability students demonstrated the requirement to expectations of the assessors to attain high scores in the performance assessment. The finding further affirmed the assertion of Meisels *et al*. (2003) that both high and low students have opportunity of maximizing their achievement when assessed with performance tasks but performance tasks favour low ability students.

Further, these findings have shown that, high and low ability students demonstrated their acquired knowledge and skills to obtain the scores in performance assessment without memorization of procedures as perceived to occur in traditional assessment for the attainment of high scores. This aspect of the findings confirmed that of Arhin's (2015) finding which noted that performance assessment procedures make students to own the processes of tackling challenging tasks that cause the award of full marks in examinations. To explain better on the high mean scores of the performance assessments, the achievements appeared to be rooted on the exposure of students to the concrete materials, symbolic and abstract information in the performance assessment procedures especially in the Integrated Science tests. In contrast, these findings disagree with Fuchs *et al*. (1999) and Kim's (2005) study results that indicated that high ability students performed better than the low ability students when assessed with performance assessment tasks in tests.

The differences in the performance of high and low ability students in Mathematics and Integrated Science when assessed using mixed items of traditional and performance assessments

The results showed that high ability students' achievements were higher than low ability students when assessed on mixed items of traditional and performance assessment in Mathematics and Integrated Science tests. The finding could be explained with series of possible reasons including the following that (a) the low ability students failed to complete all tasks of traditional assessment components of the mixed items unlike in the performance assessment; (b) much of the low ability students' time and concentration were directed towards the performance tasks while paying little attention to the traditional tasks of the mixed items; (c) inability of the low ability students to precisely put to writing their mathematical and scientific knowledge; and (d) the tension aspect of test anxiety which is an integral part of the traditional assessment tasks that require precision in responses for a full score. These actions of the low ability students accounted for their low scores in the mixed items tests especially in Mathematics. The latter two (c and d) observations were noted by Caygill and Eley (2001) and caused them and Shepard *et al.* (1995) to assert that different assessment types should be mixed in assessing students in examinations. This is because the students will be relieved from the negative aspect of each assessment type and obtain a chance for maximising their academic performance in tests.

Furthermore, Al-Sadaawi (2007) believed that the mixed items procedure help teachers to assess both low-order and high-order cognitive domains. This is because, the traditional assessment components emphasize recalling and rote memorization of facts, principles, definitions, and statements in examinations, while performance assessment tasks call for high order abilities. This implies that adopting a single type of assessment may give incomplete information about the students' academic characteristics.

The predictor of performance for high ability students in Mathematics and Integrated Science when assessed using traditional assessment procedures and performance tasks

Results showed that traditional assessment is the better predictor of performance for high ability students in Mathematics and Integrated Science examinations. This was a notable finding among the high ability students. The high ability students produced responses to tasks of traditional assessment accurately and with precision to achieve the high scores and redeemed themselves from becoming failures. That is, since the traditional assessment tasks require students to some extent to do rote memorization of information for future retrieval, the high ability students tend to be good in retrieving information in the tests and hence causing traditional assessment to be the better predictor of their achievements in examinations. This finding strongly agreed with Adjei and Mensah's (2018) study finding. They found that traditional assessment is the best predictor of achievements in examinations. The high prediction occurred probably because the high ability students are used to traditional system of examinations.

The predictor of performance for low ability students in Mathematics and Integrated Science when assessed using traditional assessment procedures and performance tasks

In predicting the achievement of low ability students, the data analysed showed that performance assessment is a better predictor of achievement for both Mathematics and Integrated Science examinations. Evidence from the students' responses showed that performance assessment served as opportunistic ladder for the low ability students to push harder in hands-on creative activities to maximise their achievements in the examinations. This finding supports Al-Sadaawi's (2007) work which revealed that performance assessment do not only provide better prediction but also validates students' achievements in examinations. This is because the students deploy more knowledge and skills in tackling the challenging tasks of the assessment.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

Overview of the study

The study sought to compare identified high and low ability JHS students' achievements when they are assessed with different assessment types; that is, traditional, performance and mixed items of traditional and performance tasks in Mathematics and Integrated Science. The study further aimed at predicting an assessment type that would maximise each identified ability group students' achievement in Mathematics and Integrated Science at the JHS level.

Employing the descriptive survey method with cluster and simple random sampling techniques, 234 second year JHS students of the Ahanta West Municipality were selected to participate in the study. Eight achievement tests in each assessment type were constructed and used to collect the data for the study. Data was analysed using procedures of descriptive statistics namely, means, standard deviations, paired sample t-tests, multivariate analysis of variances and multiple regressions.

Key Findings

1. High and low ability Junior High School students performed better when assessed with mixed items tasks as compared to traditional assessment and performance assessment in Mathematics and Integrated Science tests.
2. High and low ability students' achievements in Mathematics and Integrated Science tests is maximised when assessed with performance assessment than with traditional assessment procedures.

3. Low ability students performed better than the high ability students when assessed with performance assessment procedures in Mathematics and Integrated Science tests.
4. High ability students' achievements is higher than low ability students when assessed on mixed items of traditional and performance assessment procedures in Mathematics and Integrated Science tests.
5. Traditional assessment is a better predictor of achievements for high ability students in Mathematics and Integrated Science tests while performance assessment gives a better predictor of achievement for the low ability students in Mathematics and Integrated Science tests.

Conclusions

The results of this study bespeak the general view that, different assessment types produce different results for different ability groups of students at the JHS level. Hence, educators and assessors should be mindful of the assessment type they use to assess their students. As observed in this study, both high and low ability students' achievements in Mathematics and Integrated Science examinations were best indicated when assessed with performance assessment procedures.

Also, assessors and educators at JHS should opt for mixed items of traditional and performance assessment to traditional assessment type for assessment purposes in Mathematics and Integrated Science, most especially in times when performance assessment implementation is limited at the JHS. This is because, the findings revealed that mixed items of traditional and performance tasks is the better option to enhance students achievements to traditional tasks for assessment of JHS students in Mathematics and Integrated Science examinations.

Meanwhile, with concerns from using mixed items tests that could favour both high and low ability students during examinations, the study revealed that the high ability students perform better than the low ability students. A procedure explaining its limitation in resolving lags in achievement on the side of the low ability students. This is because the mixed items tests still grant the high ability students an upper hand over the low ability students in examinations.

Further, it was found that traditional assessment is a better predictor of achievement for high ability students, while performance assessment predicted the achievement for the low ability students in both Mathematics and Integrated Science tests. Reasoning from this, the ability of the students who are to be examined should be the determinant of the assessment type to be employed for examinations.

Finally, as shown in the study, low ability students performed equally and better than the high ability students in Mathematics and Integrated Science respectively. This was revealed in the students' achievement mean values in performance assessment. There was no difference in their mean values in mathematics and the difference that occurred in Integrated Science was also in favour of the low ability students. Therefore, it is important to note that performance assessment should be the tool for closing achievement gaps between high and low ability students in examinations.

Recommendations

From the study findings, the following recommendations are made to be used at the JHS level.

1. Teachers should adapt, implement and integrate performance assessment procedures in assessing their students.
2. Schools with high enrolment of high ability students should use traditional assessment while schools with high enrolment of low ability students should employ performance assessment in assessing students.
3. Assessors should know the abilities of the students to be examined in order to employ the right assessment type for such students during examinations
4. Authorities in charge of developing assessment tasks for standardised examinations such as BECE should blend both assessment types, with high percentage being performance tasks compared to traditional assessment procedures in assessing students.
5. Authorities in Curriculum development especially National Council for Curriculum and Assessment (NaCCA) should design and implement comprehensive assessment procedures in the text books to be used for assessment purposes in the classrooms. The procedures should entail mixed items of performance tasks such as hands-on activities and the traditional test tasks.

Suggestions for Further Research

Based on this study the following are recommended for further studies.

1. Students may adopt various learning styles for tackling each assessment type tasks and these may reflect in their achievements. Researchers can conduct a study to investigate the learning strategies students adopt and more importantly the reasons associated with the achievements in each assessment type.
2. Also, this study was conducted in the Junior High Schools in Ahanta West Municipality and therefore it is limited in generalization of its findings. For this reason, a replication of this study in Primary, Junior and Senior High Schools in other districts of the regions of Ghana is recommended to authenticate the results and conclusion to advocate for its application in the national context.

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APPPENDICES

APPENDIX A

INTRODUCTORY LETTER

UNIVERSITY OF CAPE COAST
COLLEGE OF EDUCATION STUDIES
FACULTY OF EDUCATIONAL FOUNDATIONS
DEPARTMENT OF EDUCATION AND PSYCHOLOGY

Telephone: 233-3321-32440/4 & 32480/3
Direct: 033 20 91697
Fax: 03321-30184
Telex: 2552, UCC, GH.
Telegram & Cables: University, Cape Coast
Email: edufound@ucc.edu.gh

UNIVERSITY POST OFFICE
CAPE COAST, GHANA

15th November, 2019

Our Ref:

Your Ref:

TO WHOM IT MAY CONCERN

Dear Sir/Madam,

THESIS WORK
LETTER OF INTRODUCTION
MS. PATIENCE LANGEE

We introduce to you Ms. Langee, a student from the Department of Education and Psychology, University of Cape Coast. She is pursuing Master of Philosophy degree in Measurement and Evaluation and she is currently at the thesis stage.

Ms. Langee is researching on the topic:

"A COMPARATIVE STUDY OF HIGH AND LOW ABILITY JUNIOR HIGH SCHOOL STUDENTS' ACHIEVEMENT IN MATHEMATICS AND SCIENCE USING TRADITIONAL AND PERFORMANCE ASSESSMENT."

She has opted to gather data at your institution/establishment for her thesis work. We would be most grateful if you could provide her the opportunity and assistance for the study.

Any information provided would be treated strictly as confidential. We sincerely appreciate your co-operation and assistance in this direction.

Thank you.

Yours faithfully,

Theophilus A. Fiadzomor
Principal Administrative Assistant

For: (Dr. Irene Vanderpuye)
Head

APPENDIX B

TESTS ADMINISTRATION SCHEDULE

SCHOOL	ABILITY DETERMINATION TEST/FINAL EXAMS		MAIN TESTS
	Date	Time	1st Session:- 9:00am – 11:30am 2nd Session:- 12:30pm – 3:00pm Date
GREL Basic			24-02-2020
Gyabenkrom M/A	17-02-2020	9:00am – 11:30am	
Princess Catholic	And	12:30pm – 3:00pm	21-02-2020
Aketachi M/A	02-03-2020		
Banso SDA Basic			25-02-2020
Himakrom M/A	18-02-2020	9:00am – 11:30am	
Agona SDA Basic	And	12:30pm – 3:00pm	26-02-2020
Aboadi M/A	03-03-2020		
Ewusiejo M/A			27-02-2020
Bokoro M/A	19-02-2020	9:00am – 11:30am	
Basic	And		
Beahu M/A	04-03-2020	12:30pm – 3:00pm	28-02-2020
Beahu Catholic			

APPENDIX C

TABLE OF TEST SPECIFICATION FOR MATHEMATICS INITIAL POOL OF ITEMS

OBJECTIVE TEST

ABILITY DETERMINATION TEST

Content	**Cognitive Domains**							
	Knowledge	**Comprehension**	**Application**	**Analysis**	**Synthesis**	**Evaluation**	**Total**	**Percentage**
Statistics	1	5	1				7	**35.0%**
Rational numbers		1	3				4	**20.0%**
Mapping			2	2		1	5	**25.0%**
Equation and inequalities	1		2		1		4	**20.0%**
Total	2	6	8	2	1	1	20	
Percentage	**10.0%**	**30.0%**	**40’0%**	**10.0%**	**5.0%**	**5.0%**		**100%**

APPENDIX D

AREAS OF SELECTED ITEMS

CONSTRUCTED RESPONSE ITEMS FOR MATHEMATICS

ESSAY AND PERFORMANCE ITEMS

ABILITY DETERMINATION TEST

Topic	**Question number**										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Statistics								√	√	√	√
Rational Numbers	√			√							
Mapping					√						
Equations and inequalities		√	√			√	√				

APPENDIX E

INITIAL POOL OF ITEMS FOR ABILITY DETERMINATION TEST

(ADT)

MATHEMATICS: Section A
Time allowed: 30 minutes

Instruction: Circle the correct or the best answer from the options lettered from **A** to **D**. Each correct answer selected is 1 mark. Use the spaces at the right hand side to do any calculation.

Use the data below to answer questions **1** to **4**.
Ages of pupils in years: **1, 2, 1, 3, 2, 3, 4, 2, 5, 2.**

1. Find the model age.
- **A.** 1 year
- **B.** 2 years
- **C.** 3 years
- **D.** 4 years

2. Determine the mean age.
- **A.** 1.5 years
- **B.** 2.0 years
- **C.** 2.5 years
- **D.** 3.0 years

3. Calculate the median age.
- **A.** 2.0 years
- **B.** 2.5 years
- **C.** 4.0 years
- **D.** 5.0 years

4. What is the range?
- **A.** 1
- **B.** 2
- **C.** 4
- **D.** 5

5. Evaluate 2x + 3 = 5
- **A.** 0
- **B.** $\frac{1}{2}$
- **C.** 1
- **D.** 2

6. Subtract $2\frac{1}{5}$ from $3\frac{2}{3}$
- A. $1\frac{7}{15}$
- B. $2\frac{5}{6}$
- C. $4\frac{5}{12}$
- D. $7\frac{1}{15}$

Use the stem and leaf plot below to answer the question **7** to **9**

Stem	**Leaf**
0	1 3 3 4
1	1 1 2 3
2	0 0 0 1 5
3	6
4	0

7. List the raw data in ascending order from the stem and leaf above

- **A.** 1, 3, 3, 4, 11, 11, 12, 13, 20, 20, 20, 21, 25, 36, 40.
- **B.** 20, 1, 3, 11, 20, 20, 20, 21, 36, 25, 3, 4, 40.
- **C.** 3, 4, 11, 12, 13, 20, 11, 36, 40, 11, 13, 3, 1, 4, 20
- **D.** 40, 36, 25, 21, 20, 20, 20, 13, 12, 11, 11, 4, 3, 3, 1

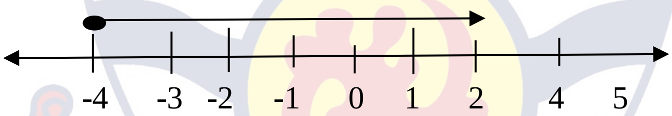
8. Determine the modal score.

- **A.** 3
- **B.** 11
- **C.** 20
- **D.** 40

9. What is the range from stem and leaf plot?

- **A.** 37
- **B.** 39
- **C.** 41
- **D.** 43

10. The numberline below indicates………..



- **A.** X < -4
- **B.** X > - 4
- **C.** X ≥ -4
- **D.** X ≥ 4

11. Simplify $5x-3=3x+7$

- **A.** -5
- **B.** 2
- **C.** 5
- **D.** 6

12. Simplify $\frac{3}{7}+\frac{2}{3}$

- **A.** $1\frac{1}{21}$
- **B.** $1\frac{2}{21}$
- **C.** $2\frac{1}{21}$
- **D.** $2\frac{1}{6}$

13. From the relation below, what is the value of **m**?

x	-1	0	1	2	3	4
↓	↓	↓	↓	↓	↓	↓
y	-2	0	**m**	4	6	8

A. 1
B. 2
C. 4
D. 5

14. Simplify $\frac{5}{9} \div \frac{1}{81}$

A. 44
B. 45
C. 46
D. 55

15. Find the inverse of y→2*x* + 3

A. $x \rightarrow \frac{y-3}{2}$
B. $x \rightarrow \frac{y+3}{2}$
C. $x \rightarrow \frac{y-3}{2}$
D. $x \rightarrow \frac{y+2}{x}$

16. A certain number is added to 3 and the result is multiply by 2, the final result is 10. Write an equation for the statement above.

A. $3 + y \times 2 = 10$
B. $3 \times y + 2 = 10$
C. $2(3 + y) = 10$
D. $2(3 \times y) = 10$

17. Arrange -1, 3, -2, -5, 4, 7, -3 and 10 in ascending order.

A. -1, -2, -3, -5, 3, 4, 7, 10
B. -5, -3, -2, -1, 10, 7, 4, 3
C. -5, -3, -2, -1, 3, 4, 7, 10
D. 10, 7, 4, 3, -1, -2, -3, -5

18. Find the image of 4 under the mapping *y*→2*x* - 3

A. 4
B. 5
C. 6
D. 11

Use the mapping below to answer questions **19** and **20**.

X	0	1	2	3	4	5………....7	
↓	↓	↓	↓	↓	↓	↓	↓
Y	2	5	8	11	14	17	R

19. Find the rule for the mapping above.

A. *y*→2*x* - 3
B. *y*→ 3*x* - 2
C. *y*→2*x* + 3
D. *y*→3*x* + 2

20. From the mapping, find the value of R.

A. 20
B. 21
C. 23
D. 24

Section B
Essay
Duration: 20 minutes

Show working **clearly** in the space provided. Full mark will **not** be awarded to correct answers without any show working.

1. Simplify $\mathbf{2\frac{3}{5} + 2\frac{1}{3} + 3\frac{2}{5}}$ **(4 marks)**

....
....
....
....
....
....
....
....
....
....

Instruction: Kofi is ***x*** years old now. Use the statement below to answer the questions **2** to **5**.

2. How old was he 5 years ago? **(1 mark)**

....
....
....

How old will he be in 10 years from now? **(1 mark)**

....
....
....
....

3. Simplify $4 \div (\frac{30}{128} \div \frac{12}{14})$. **(4 marks)**

....
....
....
....
....
....
....
....
....
....

4. Find the image of the mapping below.

x	1	2	3	4	5
↓	↓	↓	↓	↓	↓
y	2	5	10	17	26

(2 marks)

…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………

Section C
Performance Tasks
Time allowed: 20 minutes

Show working clearly in your answer sheet

Instruction: Read the information below and use it to answer questions **14** and **15** that follow.

A certain number times your age, the result is half of your age.

5. Write an equation from the statement above. **(4 marks)**

6. Calculate for the unknown number from the equation. **(2 marks)**

Instruction: Read the information below and use it to answer questions **16** to **19** that follow**.**

A class test organized for **30 students** in JHS 2 had the marks ranges from **1** to **10**.

7. Select **different marks** from **1** to **10** and record them for the 30 students. **(5 marks)**

8. Construct a frequency table using your selected marks **(6 marks)**

9. Calculate the mean mark **(4 marks)**

10. Find the modal mark of your data. **(2 marks)**

APPENDIX F

TABLE OF TEST SPECIFICATION FOR INTEGRATED SCIENCE

INITIAL POOL OF OBJECTIVE TEST ITEMS

ABILITY DETERMINATION TEST

Content	Cognitive Domains							
	Knowledge	**Comprehension**	**Application**	**Analysis**	**Synthesis**	**Evaluation**	**Total**	**Percentage**
Elements	2	2	1				**5**	**25.0%**
Metals and Non-metals	1		1				**2**	**10.0%**
Chemical compounds					1		**1**	**5.0%**
Mixtures	1	1	1				**3**	**15.0%**
Carbon Cycle		2					**2**	**10.0%**
Reproduction	1	1			1		**3**	**15.0%**
Heredity		1					**1**	**5.0%**
Photosynthesis			1				**1**	**5.0%**
Food and Nutrition		1					**1**	**5.0%**
Infectious Diseases		1					**1**	**5.0%**
Total	**5**	**9**	**4**	**0**	**2**	**0**	**20**	
Percentage	**25.0%**	**45.0%**	**20.0%**	**0%**	**10.0%**	**0%**		**100%**

APPENDIX G

AREAS OF SELECTED ITEMS

CONSTRUCTED RESPONSE ITEMS FOR INTEGRATED SCIENCE

ABILITY DETERMINATION TEST

Topic	**Question number**													
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Elements				√						√	√			
Metals and Non-metals														
Chemical compounds														
Mixtures						√						√	√	√
Carbon Cycle							√							
Reproduction	√	√	√											
Heredity					√									
Photosynthesis								√						
Food and Nutrition									√					
Infectious Diseases														

APPENDIX H

INITIAL POOL OF ITEMS FOR ABILITY DETERMINATION TEST (ADT)

INTEGRATED SCIENCE

Section A
Time allowed: 25 minutes

Instruction: Circle the correct or the best answer from the options lettered from **A** to **D.** Each correct answer selected is 1 mark

1. The chemical symbol for the element sodium is ………..
   A. N
   B. Na
   C. S
   D. Si
2. Cations are formed when an atom………..
   A. gains one or more electrons
   B. gains one or more protons.
   C. loses one or more protons.
   D. loses one or more electrons
3. Air is an example of a mixture.
   A. True
   B. False
4. Non-reactive metals are preferred for making jewellry because it is………..
   A. expensive.
   B. highly reactive with air.
   C. less reactive with air.
   D. precious.
5. Calcium is represented as ……….. in chemical formulars.
   A. C
   B. Ca
   C. Cl
   D. K
6. Which of the following activities illustrates distillation?
   A. Preparation of akpeteshie
   B. Preparation of soup.
   C. Preparation of starch.
   D. Tapping of palm wine.
7. Which one of the following is used to separate insoluble solids from liquids?
   A. Distillation.
   B. Evaporation.
   C. Filtration.
   D. Sublimation.

8. How many electrons are there in the element O^{2-} ?
   A. 6
   B. 8
   C. 10
   D. 12

9. Bronze is used to manufacture all the following **except** ………..
   A. medals.
   B. statues.
   C. trumpet.
   D. church bells.

10. The chemical formular for the compound calcium chloride is ………
   A. CaCl
   B. $CaCl^2$
   C. Ca_2Cl
   D. $CaCl_2$

11. There is a difference between number of protons in the nucleus and atomic number of an element.
   A. True
   B. False

12. The ozone layer will be protected if afforestation is always practiced.
   A. True
   B. false

13. The thick-walled muscular organ that receives the penis in human reproduction is…………
   A. cervix
   B. hymen
   C. uterus
   D. vagina

14. What is the correct order of the stages of human growth and development?
   A. Adulthood → infancy → adolescence → childhood.
   B. Childhood → infancy → adulthood → adolescence.
   C. Infancy → adulthood → adolescence → childhood.
   D. Infancy → childhood → adolescence → adulthood

15. Which of the following diseases is **not** be inherited?
   A. Albinism
   B. Baldness
   C. Hepatitis
   D. Sickle cell

16. Which of the following organisms is the main disruptor of the environment?
   A. Goat
   B. Man
   C. Mouse
   D. Tiger

17. Green plants photosynthesize because they ………..

- **A.** absorb water.
- **B.** contain chlorophyll.
- **C.** produce glucose.
- **D.** produce oxygen.

18. Vaccination is carried out in humans to …………

- **A.** enable white blood cells fight against diseases.
- **B.** fight the human body system.
- **C.** increase plasma in the body system.
- **D.** kill germs in the body system.

19. The effects of malnutrition are the cause of ……….

- ii. deficiency diseases
- iii. multiple birth
- iv. still birth
- v. stunted growth

- **A.** **I** and **II** only
- **B.** **I, III** and **IV** only
- **C.** **II, III** and **IV** only
- **D.** **I, II, III** and **IV**

20. The first life organism that is formed after fertilization is ………..

- **A.** egg.
- **B.** man.
- **C.** sperm.
- **D.** zygote.

Section B

Essay

Time allowed: 20 minutes

1. Define teenage pregnancy? **(2 marks)**

……………………………………………………………………………………
……………………………………………………………………………………
……………………………………………………………………………………
……………………………………………………………

2. State **one effect** of teenage pregnancy on the society **(2 marks)**

……………………………………………………………………………………
……………………………………………………………………………………
……………………………………………………………………………………
……………………………………………………………

3. Mention **one way** of reducing the rate of teenage pregnancy in the society. **(2 marks)**

……………………………………………………………………………………
……………………………………………………………………………………
……………………………………………………………………………………
……………………………………………………………………………………

Instruction: **Match** each of the following **description** to the correct **terms**

(6 marks)

Description	Term
4. A chemical substance that is made up of only one kind of atoms	Global warming
5. An inheritable characteristic	Photosynthesis
6. Can be separated by the processes of dissolution, filtration and evaporation	Gold
7. The rise in temperature of the atmosphere	Kwashiorkor
8. Provides food and oxygen for organisms	Air
9. The deficiency disease of protein in dieting	Sickle cell anemia
	Rice and crystals of salt

Section C
Performance Tasks
Time allowed: 25 minutes

Instruction: In the given **envelop A** are the structures of neutral atoms of elements among the first twenty elements and **three (3) polythene bags** (Metals, Semi-metals, Non-metals). Study and use any **fifteen (15)** of the structures to answer questions **10** and **11**. **Put** the rest in the envelope A for submission.

10. Identify each of your selected element's atom structure with its **chemical symbol** in the **space** provided on the cutout structure. **(6 marks)**

11. Classify the structures as **metals**, **non-metals** and **semi-metals** and put them in the three polythene bags and with their respective labells. **(6 marks)**

Instruction: You are provided with the following items.
Pins, chaff, water, sand, funnel, cotton wool, piece of magnet, **two** transparent containers, stirring stick, **four** transparent polythene bags, and an empty container labelled A.
Use the items to answer questions **12** to **14**.

12. Make a mixture and put sample in container **A**. **(4 marks)**

13. Separate the rest of the mixture to obtain the components. Put them in the polythene bags. **(5 marks)**

14. Explain the method(s) you used to separate the mixture. **(2 marks)**

APPENDIX I

PILOT TEST RESULTS

ABILITY DETERMINATION TEST – MATHEMATICS (ADT-MATHS)

GROUP LEVELS OF STUDENTS

Testees	Marks	Level
01	19	U
02	19	U
03	18	U
04	18	U
05	18	U
06	17	U
07	17	U
08	17	U
09	17	U
10	17	U
11	16	M
12	16	M
13	16	M
14	15	M
15	13	M
16	13	M
17	12	M
18	12	M
19	12	M
20	12	M
21	11	L
22	11	L
23	11	L
24	11	L
25	11	L
26	11	L
27	11	L
28	11	L
29	10	L
30	8	L

COMPTATION OF ITEM DISCRIMINATION INDEX [ADT (MATHS)]

Item 1

$\rho 1 = 0.9$ D1 = 0.4

UPPER	MIDDLE	LOWER
10	10	6
$\rho U = 1.0$	$pM = 1.0$	$\rho L = 0.6$

Item 2

$\rho 2 = 0.9$ D2 = 0.3

UPPER	MIDDLE	LOWER
10	9	7
$\rho U = 1.0$	$pM = 0.9$	$\rho L = 0.7$

Item 3

$\rho 3 = 0.5$ D3 = 0.5

UPPER	MIDDLE	LOWER
8	5	3
$\rho U = 0.8$	$pM = 0.5$	$\rho L = 0.3$

Item 4

$\rho 4 = 0.7$ D4 = 0.5

UPPER	MIDDLE	LOWER
8	9	3
$\rho U = 0.8$	$pM = 0.9$	$\rho L = 0.3$

Item 5

$\rho 5$ = 0.8		D5 = 0.1
UPPER	MIDDLE	LOWER
10	5	9
$\rho U = 1.0$	$pM = 0.5$	$\rho L = 0.9$

Item 6

$\rho 6$ = 0.7		D6 = 0.5
UPPER	MIDDLE	LOWER
8	10	3
$\rho U = 0.8$	$pM = 1.0$	$\rho L = 0.3$

Item 7

$\rho 7$ = 0.9		D7 = 0.0
UPPER	MIDDLE	LOWER
10	6	10
$\rho U = 1.0$	$pM = 0.6$	$\rho L = 1.0$

Item 8

$\rho 8$ = 0.8		D8 = 0.0
UPPER	MIDDLE	LOWER
10	5	10
$\rho U = 1.0$	$pM = 0.5$	$\rho L = 1.0$

Item 9

$\rho 9$ = 0.9		D9 = 0.0
UPPER	MIDDLE	LOWER
10	6	10
$\rho U = 1.0$	$pM = 0.6$	$\rho L = 1.0$

Item 10

$\rho 10$ = 0.6		D10 = 0.6
UPPER	MIDDLE	LOWER
8	8	2
$\rho U = 0.8$	$pM = 0.8$	$\rho L = 0.2$

Item 11

$\rho 11$ = 0.7		D11 = 0.6
UPPER	MIDDLE	LOWER
10	8	4
$\rho U = 1.0$	$pM = 0.8$	$\rho L = 0.4$

Item 12

$\rho 12$ = 0.6		D12 = 0.4
UPPER	MIDDLE	LOWER
7	7	3
$\rho U = 0.7$	$pM = 0.7$	$\rho L = 0.3$

Item 13

ρ13 = 0.9		D13 = 0.0
UPPER	MIDDLE	LOWER
10	6	10
ρU = 1.0	pM = 0.6	ρ L = 1.0

Item 14

ρ14 = 0.5		D14 = 0.6
UPPER	MIDDLE	LOWER
7	6	1
ρU = 0.7	pM = 0.6	ρ L = 0.1

Item 15

ρ15 = 0.7		D15 = 0.3
UPPER	MIDDLE	LOWER
10	4	7
ρU = 1.0	pM = 0.4	ρ L = 0.7

Item 16

ρ16 = 0.7		D16 = 0.3
UPPER	MIDDLE	LOWER
7	9	4
ρU = 0.7	pM = 0.9	ρ L = 0.4

Item 17

$\rho 17 = 0.6$		$D17 = 0.4$
UPPER	MIDDLE	LOWER
7	7	3
$\rho U = 0.7$	$pM = 0.7$	$\rho L = 0.3$

Item 18

$\rho 18 = 0.7$		$D18 = 0.4$
UPPER	MIDDLE	LOWER
10	4	6
$\rho U = 1.0$	$pM = 0.4$	$\rho L = 0.6$

Item 19

$\rho 19 = 0.6$		$D19 = 0.6$
UPPER	MIDDLE	LOWER
9	6	3
$\rho U = 0.9$	$pM = 0.6$	$\rho L = 0.3$

Item 20

$\rho 20 = 0.6$		$D20 = 0.5$
UPPER	MIDDLE	LOWER
8	7	3
$\rho U = 0.8$	$pM = 0.7$	$\rho L = 0.3$

APPENDIX J

PILOT TEST RESULTS

ABILITY DETERMINATION TEST (INTEGRATED SCIENCE)

GROUP LEVELS OF STUDENTS

Testees	Marks	Level
01	19	U
02	18	U
03	18	U
04	18	U
05	17	U
06	17	U
07	17	U
08	17	U
09	17	U
10	17	U
11	16	M
12	16	M
13	16	M
14	16	M
15	16	M
16	13	M
17	13	M
18	13	M
19	13	M
20	13	M
21	12	L
22	12	L
23	12	L
24	11	L
25	11	L
26	11	L
27	10	L
28	9	L
29	7	L
30	5	L

COMPUTATION OF ITEM DISCRIMINATION INDEX FOR ADT (INTEGRATED SCIENCE)

Item 1

$\rho 1$ = 0.9 D1 = 0.3

UPPER	MIDDLE	LOWER
10	9	7
ρU = 1.0	pM = 0.9	ρ L = 0.7

Item 2

$\rho 2$ = 0.6 D2 = 0.4

UPPER	MIDDLE	LOWER
8	5	4
ρU = 0.8	pM = 0.5	ρ L = 0.4

Item 3

$\rho 3$ = 1.0 D3 = 0.1

UPPER	MIDDLE	LOWER
10	10	9
ρU = 1.0	ρ M = 1.0	ρ L = 0.9

Item 4

$\rho 4$ = 0.6 D4 = 0.4

UPPER	MIDDLE	LOWER
8	7	4
ρU = 0.8	pM = 0.7	ρ L = 0.4

Item 5

$\rho 5 = 1.0$ D5 = 0.0

UPPER	MIDDLE	LOWER
10	10	10
$\rho U = 1.0$	ρ M = 1.0	ρ L = 1.0

Item 6

$\rho 6$ = 0.7 D6 = 0.5

UPPER	MIDDLE	LOWER
9	7	4
$\rho U = 0.9$	$p M = 0.7$	ρ L = 0.4

Item 7

$\rho 7$ = 0.6 D7 = 0.4

UPPER	MIDDLE	LOWER
7	8	3
$\rho U = 0.7$	$p M = 0.8$	ρ L = 0.3

Item 8

$\rho 8$ = 0.4 D8 = 0.6

UPPER	MIDDLE	LOWER
7	5	1
$\rho U = 0.7$	$p M = 0.5$	ρ L = 0.1

Item 9

$\rho 9 = 0.5$ D9 = 0.6

UPPER	MIDDLE	LOWER
8	5	2
$\rho U = 0.8$	$pM = 0.5$	$\rho L = 0.2$

Item 10

$\rho 10 = 0.6$ D10 = 0.6

UPPER	MIDDLE	LOWER
9	5	3
$\rho U = 0.9$	$pM = 0.5$	$\rho L = 0.3$

Item 11

$\rho 11 = 0.9$ D11 = 0.2

UPPER	MIDDLE	LOWER
10	10	8
$\rho U = 1.0$	$\rho M = 1.0$	$\rho L = 0.8$

Item 12

$\rho 12 = 0.8$ D12 = 0.3

UPPER	MIDDLE	LOWER
8	10	5
$\rho U = 0.8$	$pM = 1.0$	$\rho L = 0.5$

Item 13

$\rho 13$ = 0.7 D13 = 0.5

UPPER	MIDDLE	LOWER
9	8	4
ρU = 0.9	pM = 0.8	ρ L = 0.4

Item 14

$\rho 14$ = 0.5 D14 = 0.5

UPPER	MIDDLE	LOWER
8	4	3
ρU = 0.8	pM = 0.4	ρ L = 0.3

Item 15

$\rho 15$ = 0.6 D15 = 0.3

UPPER	MIDDLE	LOWER
8	5	5
ρU = 0.8	pM = 0.5	ρ L = 0.5

Item 16

$\rho 16$ = 0.9 D16 = 0.3

UPPER	MIDDLE	LOWER
10	10	7
ρU = 1.0	pM = 1.0	ρ L = 0.7

Item 17

$\rho 17 = 0.7$ D17 = 0.4

UPPER	MIDDLE	LOWER
9	6	5
$\rho U = 0.9$	$pM = 0.6$	$\rho L = 0.5$

Item 18

$\rho 18 = 0.6$ D18 = 0.3

UPPER	MIDDLE	LOWER
8	4	5
$\rho U = 0.8$	$pM = 0.4$	$\rho L = 0.5$

Item 19

$\rho 19 = 0.6$ D19 = 0.4

UPPER	MIDDLE	LOWER
7	8	3
$\rho U = 0.7$	$pM = 0.8$	$\rho L = 0.3$

Item 20

$\rho 20 = 0.9$ D20 = 0.2

UPPER	MIDDLE	LOWER
10	10	8
$\rho U = 1.0$	$pM = 1.0$	$\rho L = 0.8$

APPENDIX K

ACCEPTED ITEMS

TABLE OF TEST SPECIFICATION FOR MATHEMATICS

OBJECTIVE TEST ITEMS

ABILITY DETERMINATION TEST

Content	Cognitive Domains							
	Knowledge	**Comprehension**	**Application**	**Analysis**	**Synthesis**	**Evaluation**	**Total**	**Percentage**
Statistics	1	2	1				**4**	**26.7%**
Rational numbers		1	3				**4**	**26.7%**
Mapping			1	2		1	**4**	**26.7%**
Equation and inequalities	1		1		1		**3**	**20.0%**
Total	**2**	**3**	**6**	**2**	**1**	**1**	**15**	
Percentage	**13.3%**	**20.0%**	**40’0%**	**13.3%**	**6.7%**	**6.7%**		**100%**

APPENDIX L

ACCEPTED ITEMS

TABLE OF TEST SPECIFICATION FOR INTEGRATED SCIENCE

OBJECTIVE TEST ITEMS

ABILITY DETERMINATION TEST

Content	**Cognitive Domains**							
	Knowledge	**Comprehension**	**Application**	**Analysis**	**Synthesis**	**Evaluation**	**Total**	**Percentage**
Elements	1	1	1				**3**	**20.0%**
Metals and Non-metals	1		1				**2**	**13.3%**
Chemical compounds					1		**1**	**6.7%**
Mixtures		1	1				**2**	**13.3%**
Carbon Cycle		1					**1**	**6.7%**
Reproduction	1				1		**2**	**13.3%**
Heredity		1					**1**	**6.7%**
Photosynthesis			1				**1**	**6.7%**
Food and Nutrition		1					**1**	**6.7%**
Infectious Diseases		1					**1**	**6.7%**
Total	**3**	**6**	**4**	**0**	**2**	**0**	**15**	
Percentage	**20%**	**40%**	**26.7%**	**0%**	**13.3%**	**0%**		**100%**

APPENDIX M

ACCEPTED ITEMS OF ABILITY DETERMINATION TEST

AHANTA WEST M/A JUNIOR HIGH SCHOOLS EXAMINATION
SUBJECT: MATHEMATICS & INTEGRATED SCIENCE
CLASS: J H S TWO
MAIN TEST
ABILITY DETERMINATION TEST (ADT)

Name…………………………………………………………..

Code………………………………………….

Date: January, 2020.

Duration: 2 hour 25 minutes

This test is in **three Sections**. **Section A** is an objective test, **Section B** is made up of essay questions and **Section C** is performance tasks. You are required to spend **25 minutes** to answer all the questions in **Section A** and **20 minutes** each for **Sections B** and **C.**

Read the **instructions** carefully before your start each section.

Section A

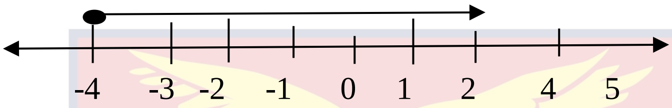
Objective test
Time allowed: 25 minutes

Instruction: Circle the correct or the best answer from the options lettered from **A** to **D**. Each correct answer selected is 1 mark. Use the spaces at the right hand side to do any calculation.

Use the data below to answer questions **1** to **4**.
Ages of pupils in years: **1, 2, 1, 3, 2, 3, 4, 2, 5, 2.**

1. Find the model age.
   A. 1 year
   B. 2 years
   C. 3 years
   D. 4 years
2. Determine the mean age.
   A. 1.5 years
   B. 2.0 years
   C. 2.5 years
   D. 3.0 years
3. Calculate the median age.
   A. 2.0 years
   B. 2.5 years
   C. 4.0 years
   D. 5.0 years
4. What is the range?
   A. 1
   B. 2
   C. 4
   D. 5
5. Subtract $2\frac{1}{5}$ from $3\frac{2}{3}$
   A. $1\frac{7}{15}$
   B. $2\frac{5}{6}$
   C. $4\frac{5}{12}$
   D. $7\frac{1}{15}$
6. Simplify 5x-3=3x+7
   A. -5
   B. 2
   C. 5
   D. 6
7. Find the inverse of y→2x + 3
   A. $x \to \frac{y-3}{2}$
   B. $x \to \frac{y+3}{2}$
   C. $x \to \frac{y-3}{2}$
   D. $x \to \frac{y+2}{x}$

8. A certain number is added to **3** and the result is multiply by **2**, the final result is **10**. Write an equation for the statement above.
   - **A.** $3 + y \times 2 = 10$
   - **B.** $3 \times y + 2 = 10$
   - **C.** $2(3 + y) = 10$
   - **D.** $2(3 \times y) = 10$
9. Find the image of **4** under the mapping $\boldsymbol{y \rightarrow 2x - 3}$
   - **A.** 4
   - **B.** 5
   - **C.** 6
   - **D.** 11
10. The numberline below indicates…………



   - **A.** $X < -4$
   - **B.** $X > -4$
   - **C.** $X \geq -4$
   - **D.** $X \geq 4$
11. Simplify $\frac{3}{7} + \frac{2}{3}$
   - **A.** $1\frac{1}{21}$
   - **B.** $1\frac{2}{21}$
   - **C.** $2\frac{1}{21}$
   - **D.** $2\frac{1}{6}$
12. Arrange -1, 3, -2, -5, 4, 7, -3 and 10 in ascending order.
   - **A.** -1, -2, -3, -5, 3, 4, 7, 10
   - **B.** -5, -3, -2, -1, 10, 7, 4, 3
   - **C.** -5, -3, -2, -1, 3, 4, 7, 10
   - **D.** 10, 7, 4, 3, -1, -2, -3, -5

Use the mapping below to answer questions 13 and 14.

X	0	1	2	3	4	5……….	7
↓	↓	↓	↓	↓	↓	↓	↓
Y	2	5	8	11	14	17	R

13. Find the rule for the mapping above.
   - **A.** $y \rightarrow 2x - 3$
   - **B.** $y \rightarrow 3x - 2$
   - **C.** $y \rightarrow 2x + 3$
   - **D.** $y \rightarrow 3x + 2$
14. From the mapping, find the value of **R**.
   - **A.** 20
   - **B.** 21
   - **C.** 23
   - **D.** 24

15. Simplify $\frac{5}{9} \div \frac{1}{81}$

A. 44
B. 45
C. 46
D. 55

Section B
Essay
Time allowed: 20 minutes

Show working clearly in the space provided. Full mark will not be awarded to correct answers without any show working.

1. Simplify $2\frac{3}{5} + 2\frac{1}{3} + 3\frac{2}{5}$ **(4 marks)**

....
....
....
....

Instruction: Kofi is x years old now. Use the statement below to answer the questions **2** and **3**.

2. How old was he 5 years ago? **(1 mark)**

....
....

3. How old will he be in 10 years from now? **(1 mark)**

....
....
....

4. Simplify $4 \div (\frac{30}{128} \div \frac{12}{14})$. **(4 marks)**

....
....
....
....
....
....
....
....
....

5. Find the image of the mapping below.

X	1	2	3	4	5
↓	↓	↓	↓	↓	↓
Y	2	5	10	17	26

(2 marks)

…………………………………………………………………………………
…………………………………………………………………………………
…………………………………………………………………………………
…………………………………………………………………………………

Section C
Performance Tasks
23 Marks
Time allowed: 20 minutes
Show working clearly in your answer sheet

Instruction: Read the information below and use it to answer questions **6** and **7** that follow.

A certain number times your age, the result is half of your age.

6. Write an equation from the statement above. **(4 marks)**
7. Calculate for the unknown number from the equation. **(2 marks)**

Instruction: Read the information below and use it to answer questions **8** to **11** that follow.

A class test organized for 30 students in JHS 2 had the marks ranges from **1** to **10.**

8. Select different marks from 1 to 10 and record them for the 30 students. **(5 marks)**

9. Construct a frequency table using your selected marks **(6 marks)**
10. Calculate the mean mark **(4 marks)**
11. Find the modal mark of your data. **(2 marks)**

ACCEPTED ITEMS FOR ABILITY DETERMINATION TEST

(INTEGRATED SCIENCE)

Section A
Time allowed 20 minutes

Instruction: Circle the correct or the best answer from the options lettered from **A** to **D**. Each correct answer selected is 1 mark

1. The chemical symbol for the element sodium is ………..
   A. N
   B. Na
   C. S
   D. Si

2. The ozone layer will be protected if afforestation is always practiced.
   A. True
   B. false

3. Which of the following activities illustrates distillation?
   A. Preparation of akpeteshie
   B. Preparation of soup.
   C. Preparation of starch.
   D. Tapping of palm wine

4. The thick-walled muscular organ that receives the penis in human reproduction is…………
   A. cervix
   B. hymen
   C. uterus
   D. vagina

5. Green plants photosynthesize because they ………..
   A. absorb water.
   B. contain chlorophyll.
   C. produce glucose.
   D. produce oxygen.

6. Cations are formed when an atom………..
   A. gains one or more electrons
   B. gains one or more protons.
   C. loses one or more protons.
   D. loses one or more electrons

7. Non-reactive metals are preferred for making jewellry because it is………..
   A. expensive.
   B. highly reactive with air.
   C. less reactive with air.
   D. precious.

8. One of the following is used to separate insoluble solids from liquids.
   A. Distillation.
   B. Evaporation.
   C. Filtration.
   D. Sublimation.

9. The chemical formular for the compound calcium chloride is ………
- **A.** CaCl
- **B.** $CaCl^2$
- **C.** Ca_2Cl
- **D.** $CaCl_2$

10. Which of the following diseases is **not** be inherited?
- **A.** Albinism
- **B.** Baldness
- **C.** Hepatitis
- **D.** Sickle cell

11. Vaccination is carried out in humans to ………….
- **A.** enable white blood cells fight against diseases.
- **B.** fight the human body system.
- **C.** increase plasma in the body system.
- **D.** kill germs in the body system.

12. The effects of malnutrition are the cause of ……….
- **I.** deficiency diseases
- **II.** multiple birth
- **III.** still birth
- **IV.** stunted growth
- **A. I** and **II** only
- **B. I, III** and **IV** only
- **C. II, III** and **IV** only
- **D. I, II, III** and **IV**

13. Bronze is used to manufacture all the following **except** ………..
- **A.** medals.
- **B.** statues.
- **C.** trumpet.
- **D.** church bells.

14. What is the correct order of the stages of human growth and development?
- **A.** Adulthood → infancy → adolescence → childhood.
- **B.** Childhood → infancy → adulthood → adolescence.
- **C.** Infancy → adulthood → adolescence → childhood.
- **D.** Infancy → childhood → adolescence → adulthood

15. How many electrons are there in the element O^{2-} ?
- **A.** 6
- **B.** 8
- **C.** 10
- **D.** 12

Section B
Essay
Time allowed: 20 minutes

1. Define teenage pregnancy? **(2 marks)**

……………………………………………………………………………………
……………………………………………………………………………………
……………………………………………………………………………………
………………………………………………………………

2. State **one effect** of teenage pregnancy on the society **(2 marks)**

……………………………………………………………………………………
……………………………………………………………………………………

3. Mention **one way** of reducing the rate of teenage pregnancy in the society. **(2 marks)**

……………………………………………………………………………………
……………………………………………………………………………………

Instruction: **Match** each of the following **description** to the correct **terms** **(6 marks)**

Description	**Term**
4. A chemical substance that is made up of only one kind of atoms	Global warming
5. An inheritable characteristic	Photosynthesis
6. Can be separated by the processes of dissolution, filtration and evaporation	Gold
7. The rise in temperature of the atmosphere	Kwashiorkor
8. Provides food and oxygen for organisms	Air
9. The deficiency disease of protein in dieting	Sickle cell anemia
	Rice and crystals of salt

Section C
Performance Tasks
(23 marks)
Time allowed: 25 minutes

Instruction: In the given **envelop A** are the structures of neutral atoms of elements among the first twenty elements and **three (3) polythene bags** (Metals, Semi-metals, Non-metals). Study and use any **fifteen (15)** of the structures to answer questions **10** and **11**. Put the rest in the envelope A for submission.

10. Identify each of your selected element's atom structure with its **chemical symbol** in the space provided on the cutout structure. **(6 marks)**

11. Classify the structures as **metals**, **non-metals** and **semi-metals** and put them in the three polythene bags and with their respective labells. **(6 marks)**

Instruction: You are provided with the following items.
Pins, chaff, water, sand, funnel, cotton wool, piece of magnet, **two** transparent containers, stirring stick, **four** transparent polythene bags, and an empty container labelled **A**.
Use the items to answer questions **12** to **14**.

12. Make a mixture and put sample in container **A**. **(4 marks)**

13. Separate the rest of the mixture to obtain the components. Put them in the polythene bags. **(5 marks)**

14. Explain the method(s) you used to separate the mixture. **(2 marks)**

APPENDIX N

PILOT TEST RESULTS

TABLE OF TEST SPECIFICATION FOR MATHEMATICS

INITIAL POOL OF OBJECTIVE TEST ITEMS

MAIN TESTS (TRADITIONAL ASSESSMENT)

Content	**Cognitive Domains**							
	Knowledge	**Comprehension**	**Application**	**Analysis**	**Synthesis**	**Evaluation**	**Total**	**Percentage**
Statistics	2	2	4				**8**	**26.7%**
Rational numbers	2	4	2	2			**10**	**33.3%**
Mapping		1		1		1	**3**	**10.0%**
Equation and inequalities	4	2	2	1			**9**	**30.0%**
Total	**8**	**9**	**8**	**4**	**0**	**1**	**30**	
Percentage	**26.7%**	**30.0%**	**26.7%**	**13.3%**	**0%**	**3.3%**		**100%**

APPENDIX O

AREAS OF SELECTED ITEMS

CONSTRUCTED RESPONSE ITEMS (ESSAY AND PERFORMAMCE) FOR MATHEMATICS

MAIN TESTS

Topic	Question number					
	1	2	3	4	5	6
Statistics	√	√	√	√		
Rational Numbers					√	√
Mapping						
Equations and inequalities						

APPENDIX P

INITIAL POOL OF ITEMS FOR TRADITIONAL ASSESSMENT

(MATHEMATICS)

Section A
Time allowed: 45 minutes

Instruction: **Circle** the correct or the best answer from the options lettered from **A** to **D**. Each correct answer selected is 1 mark. Use the spaces at the right hand side to do any calculation.

1. Kofi is 9 years and Ama is 12 years. What is the total age of the two guys?
   A. 11 years
   B. 20 years
   C. 21 years
   D. 31 years
2. A mapping is defined by $y \longrightarrow x^{2}$. What is the image of 4 under the mapping?
   A. 2
   B. 8
   C. 6
   D. 16
3. If the operation * is defined as $m*n = mn$. Evaluate 4*5
   A. -1
   B. 1
   C. 9
   D. 20

The marks obtained by 13 candidates in a test are **5, 7, 2, 9, 10, 11, 2, 12, 2, 9, 3, 18** and **2**.
Use their information to answer question **4** to **7**

4. What is the mode?
   A. 2
   B. 5
   C. 9
   D. 18
5. Find the mean mark.
   A. 2
   B. 5
   C. 7
   D. 9
6. Find the range mark.
   A. 9
   B. 16
   C. 17
   D. 18

7. Determine the median mark.
A. 2
B. 5
C. 7
D. 13

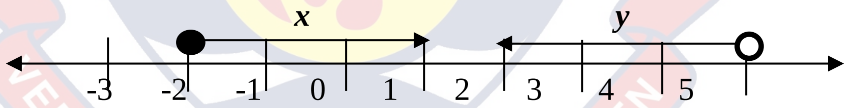
8. Solve $3x + 2 \leq 8$
A. $x \leq 2$
B. $x \geq 2$
C. $x < 2$
D. $x > 2$

9. Arrange 3, -5, 0, 0.5 from lowest to the highest
A. -5, 0, 0.5, 3
B. 0, 0.5, -5, 3
C. 0, 0.5, 3, -5
D. 3, 0.5, 0, -5

10. Simplify $\frac{2}{3} \div \frac{1}{6}$
A. 1
B. 2
C. 3
D. 4

11. If $\frac{3}{15}$ is equivalent to $\frac{45}{x}$, find the value of x.
A. 135
B. 150
C. 225
D. 325

Use the inequality to answer questions **12** and **13**

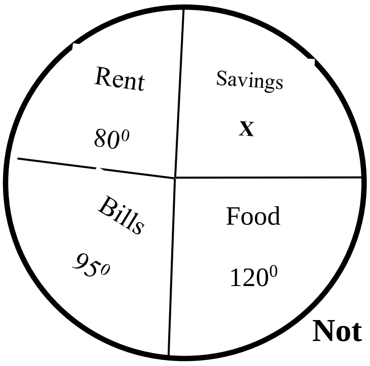


12. What is the value of x?
A. $x \leq -2$
B. $x \geq -2$
C. $x < -2$
D. $x \leq 2$

13. Find the value of y.
A. $y \leq 5$
B. $y \geq 5$
C. $y < 5$
D. $y > 5$

14. If $x \in \{1, 2, 3, 4, 5\}$. Find the truth set of $2x + 1 < 7$
A. {1, 2, }
B. {2}
C. {2, 3}
D. {3}

The pie chart shows how Kwaku spends his monthly salary. Used the chart to answer question **15** to **17**



Not drawn to scale

15. Find the value of **X**

A. 65^0
B. 75^0
C. 85^0
D. 100^0

16. If Kwaku earns GH₵6300.00 a month. How much of his earnings does he spend on food?

A. GH₵140.00
B. GH₵157.50
C. GH ₵210.00
D. GH ₵350.00

17. Determine the percentage of money spent on rent by Kweku.

A. 20%
B. 22%
C. 23%
D. 32%

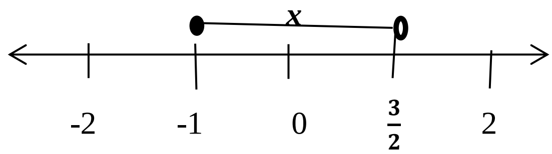
18. Solve 3(2 – 3) + 7

A. -15
B. -4
C. 4
D. 15

19. Find the value of x in $3\boldsymbol{x} = 5(\boldsymbol{x} - 2)$

A. $-3\frac{1}{2}$
B. $-3\frac{1}{3}$
C. $3\frac{1}{3}$
D. $3\frac{1}{2}$

20. Illustrate *x* on the numberline.



A. $-1 \leq \boldsymbol{x} < -1$

B. $-1 \leq \boldsymbol{x} \leq \frac{3}{2}$

C. $-1 \leq \boldsymbol{x} < \frac{3}{2}$

D. $-1 < \boldsymbol{x} < \frac{3}{2}$

21. Find the sum of $\sqrt{16}$ and $\sqrt{25}$

A. 4
B. 5
C. 9
D. 41

22. Simplify $\frac{1}{2} - \frac{1}{4} + \frac{1}{8}$

A. $\frac{1}{8}$

B. $\frac{1}{6}$

C. $\frac{5}{8}$

D. $\frac{3}{8}$

23. Compare $\frac{-2}{5}$ and $\frac{-1}{3}$

A. $\frac{-2}{5} < \frac{-1}{3}$

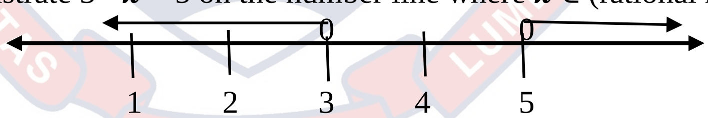
B. $\frac{-2}{5} < \frac{-1}{3}$

C. $\frac{-2}{5} \leq \frac{-1}{3}$

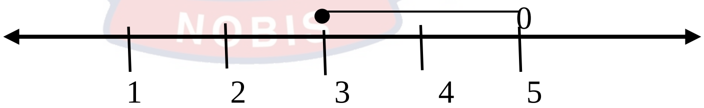
D. $\frac{-2}{5} \geq \frac{-1}{3}$

24. Illustrate $3 < \boldsymbol{x} < 5$ on the number line where $\boldsymbol{x} \in$ (rational numbers)

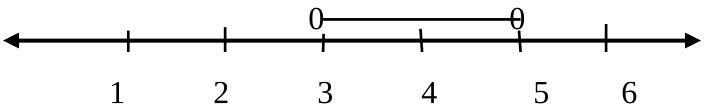
A.



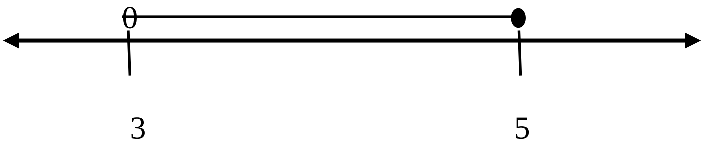
B.



C.



D.



25. The following are the ages in years of members of a group: **8, 11, 8, 10, 6, 7, 3*x*, 11** and **11**. If the mean age of the group members is **9** years, find the value of $\boldsymbol{x}$.

- **A.** 3
- **B.** 4
- **C.** 9
- **D.** 72

26. Find x in terms of y = m x +c

- **A.** $x \longrightarrow$ my + c
- **B.** $x \longrightarrow$ yc + m
- **C.** $x \longrightarrow \frac{y+c}{m}$
- **D.** $x \longrightarrow \frac{y-c}{m}$

27. Deduce the rule for the mapping below

-3	-2	-1	0	1	2	x
↓	↓	↓	↓	↓	↓	↓
-4	-1	2	5	8	11	y

- **A.** y = 2x + 5
- **B.** y = 3x + 5
- **C.** y = 3x – 5
- **D.** y = 3−2 x

28. Simplify $\frac{2}{3}$ - $\frac{1}{2}$ ÷ $\frac{1}{6}$

- **A.** $\frac{1}{6}$
- **B.** $\frac{1}{7}$
- **C.** 1
- **D.** $\frac{7}{1}$

29. Arrange the following fractions from the lowest to the highest $\frac{3}{4}$, $\frac{2}{3}$, $\frac{3}{5}$,

- **A.** $\frac{3}{5}, \frac{3}{4}, \frac{2}{3}$
- **B.** $\frac{3}{5}, \frac{2}{3}, \frac{3}{4}$
- **C.** $\frac{3}{4}, \frac{3}{5}, \frac{2}{3}$
- **D.** $\frac{2}{3}, \frac{3}{4}, \frac{3}{5}$

30. Find x if $\frac{1}{x}$ + $\frac{1}{3}$ = 1

- **A.** $\frac{2}{3}$
- **B.** $\frac{3}{2}$
- **C.** $1\frac{2}{3}$
- **D.** $2\frac{1}{3}$

SECTION B
ESSAY
Time allowed: 15 Minutes
Show working clearly.
Full mark will not be awarded to correct answers without any show working.

INSTRUCTION: The table below shows the distribution of marks scored by class six pupils in a test. Use it to answer the question **1** to **4**.

Marks	0	1	2	3	4	5
Frequency	1	2	6	9	8	4

1. How many pupils took the test? **(1 mark)**
2. What is the mode of the test? **(1 mark)**
3. Draw a bar chart for the distribution. **(4 marks)**
4. Calculate for the number of pupils that pass the test, if the pass mark is **3**. **(2 marks)**

5. Evaluate $\frac{1}{3}$ (x-1) - $\frac{1}{2}$ (x-3) = 1 $\frac{1}{4}$ **(2 marks)**

APPENDIX Q

AHANTA WEST M/A JUNIOR HIGH SCHOOLS EXAMINATION

SUBJECT: MATHEMATICS
CLASS: J H S TWO
MAIN TEST: PERFORMANCE TASKS (PAM)
(30 marks)
ANSWER ALL QUESTIONS
Time allowed: 30 minutes
Show working clearly when necessary

Instructions: In the given **polythene bag** are the ages (in years) of children taken from their parents during immunization period. Use the collected ages to answer the question **1** to **4** on your answer sheet.

1. How many children were immunised? **(3 marks)**
2. Which age of children were immunised most? **(3 mark)**
3. Draw a bar chart to picture the ages of the pupils. **(12 marks)**
4. If children below the ages of 3 are to be given only one injection; sort for the children who were given more than one injection in **envelop A**. **(6 marks)**

Instruction: Use the statement below to answer questions **5** and **6**. Show working clearly to obtain full marks

In a discussion, 1 (one) was deducted from Yaw's age and the results was multiplied by $\frac{1}{3}$. Again 3 was deducted from Yaw's age and result was also multiplied by - $\frac{1}{2}$. Finally the results were put together to get $1\frac{1}{4}$.

5. Write a mathematical statement for the issue above. **(3 marks)**
6. Using your mathematical statement, find the age of Yaw. **(3 marks)**

APPENDIX R

PILOT TEST RESULTS

TRADITIONAL ASSESSMENT MATHS

GROUP LEVELS OF STUDENTS

Testees	Marks	Level
01	26	U
02	24	U
03	24	U
04	23	U
05	22	U
06	21	U
07	21	U
08	21	U
09	21	U
10	21	U
11	19	M
12	19	M
13	19	M
14	19	M
15	19	M
16	19	M
17	19	M
18	18	M
19	18	M
20	18	M
21	17	L
22	17	L
23	17	L
24	17	L
25	17	L
26	17	L
27	16	L
28	15	L
29	7	L
30	5	L

ITEM ANALYSIS OF INITIAL POOL OF TRADITIONAL ASSESSMET MATHEMATICS ITEMS

Item 1

$\rho 1$ = 0.9 D1 = 0.0

UPPER	MIDDLE	LOWER
10	7	10
ρU = 1.0	pM = 0.7	ρ L = 1.0

Item 2

$\rho 2$ = 0.8 D2 = 0.1

UPPER	MIDDLE	LOWER
10	6	9
ρU = 1.0	pM = 0.6	ρ L = 0.9

Item 3

$\rho 3$ = 0.8 D3 = -0.1

UPPER	MIDDLE	LOWER
9	6	8
ρU = 0.9	pM = 0.6	ρ L = 0.8

Item 4

$\rho 4$ = 0.9 D4 = 0.3

UPPER	MIDDLE	LOWER
10	9	7
ρU = 1.0	pM = 0.9	ρ L = 0.7

Item 5

$\rho 5 = 0.6$ D5 = 0.4

UPPER	MIDDLE	LOWER
8	6	4
ρU = 0.8	pM = 0.6	ρ L = 0.4

Item 6

$\rho 6 = 0.6$ D6 = 0.5

UPPER	MIDDLE	LOWER
8	7	3
ρU = 0.8	pM = 0.7	ρ L = 0.3

Item 7

$\rho 7 = 0.5$ D7 = 0.4

UPPER	MIDDLE	LOWER
8	4	4
ρU = 0.8	pM = 0.4	ρ L = 0.4

Item 8

$\rho 8 = 0.8$ D8 = 0.0

UPPER	MIDDLE	LOWER
9	6	9
ρU = 0.9	pM = 0.6	ρ L = 0.9

Item 9

$\rho 9 = 0.6$		D9 = 0.4
UPPER	MIDDLE	LOWER
8	7	4
$\rho U = 0.8$	$pM = 0.7$	$\rho L = 0.4$

Item 10

$\rho 10 = 0.7$		D10 = 0.1
UPPER	MIDDLE	LOWER
9	4	8
$\rho U = 0.9$	$pM = 0.4$	$\rho L = 0.8$

Item 11

$\rho 11 = 0.6$		D11 = 0.5
UPPER	MIDDLE	LOWER
7	9	2
$\rho U = 0.7$	$pM = 0.9$	$\rho L = 0.2$

Item 12

$\rho 12 = 0.6$		D12 = -0.1
UPPER	MIDDLE	LOWER
8	6	9
$\rho U = 0.8$	$pM = 0.6$	$\rho L = 0.9$

Item 13

$\rho 13$ = 0.8		D13 = 0.1
UPPER	MIDDLE	LOWER
9	6	8
$\rho U = 0.9$	$pM = 0.6$	$\rho L = 0.8$

Item 14

$\rho 14$ = 0.7		D14 = 0.3
UPPER	MIDDLE	LOWER
8	8	5
$\rho U = 0.8$	$pM = 0.8$	$\rho L = 0.5$

Item 15

$\rho 15$ = 0.6		D15 = 0.4
UPPER	MIDDLE	LOWER
8	6	4
$\rho U = 0.8$	$pM = 0.6$	$\rho L = 0.4$

Item 16

$\rho 16$ = 0.5		D16 = 0.4
UPPER	MIDDLE	LOWER
6	6	2
$\rho U = 0.6$	$pM = 0.6$	$\rho L = 0.2$

Item 17

ρ17 = 0.6		D17 = 0.4
UPPER	MIDDLE	LOWER
8	6	4
ρU = 0.8	pM = 0.8	ρ L = 0.4

Item 18

ρ18 = 0.8		D18 = -0.2
UPPER	MIDDLE	LOWER
8	6	10
ρU = 0.8	pM = 0.6	ρ L = 1.0

Item 19

ρ19 = 0.8		D19 = 0.0
UPPER	MIDDLE	LOWER
9	6	9
ρU = 0.9	pM = 0.6	ρ L = 0.9

Item 20

ρ20 = 0.5		D20 = 0.4
UPPER	MIDDLE	LOWER
7	6	3
ρU = 0.7	pM = 0.6	ρ L = 0.3

Item 21

$\rho 21 = 0.9$ D21 = 0.0

UPPER	MIDDLE	LOWER
10	6	10
$\boldsymbol{\rho}$U = 1.0	*p*M = 0.6	$\boldsymbol{\rho}$ L = 1.0

Item 22

$\rho 22 = 0.5$ D22 = 0.3

UPPER	MIDDLE	LOWER
5	7	2
$\boldsymbol{\rho}$U = 0.5	*p*M = 0.7	$\boldsymbol{\rho}$ L = 0.2

Item 23

$\rho 23 = 0.4$ D23 = 0.5

UPPER	MIDDLE	LOWER
8	2	3
$\boldsymbol{\rho}$U = 0.8	*p*M = 0.2	$\boldsymbol{\rho}$ L = 0.3

Item 24

$\rho 24 = 0.6$ D24 = 0.4

UPPER	MIDDLE	LOWER
8	7	4
$\boldsymbol{\rho}$U = 0.8	*p*M = 0.7	$\boldsymbol{\rho}$ L = 0.4

Item 25

$\rho 25 = 0.5$		D25 = 0.5
UPPER	MIDDLE	LOWER
8	5	3
$\rho U = 0.8$	$pM = 0.5$	$\rho L = 0.3$

Item 26

$\rho 26 = 0.4$		D26 = 0.4
UPPER	MIDDLE	LOWER
5	6	1
$\rho U = 0.5$	$pM = 0.6$	$\rho L = 0.1$

Item 27

$\rho 27 = 0.6$		D27 = 0.4
UPPER	MIDDLE	LOWER
7	7	3
$\rho U = 0.7$	$pM = 0.7$	$\rho L = 0.3$

Item 28

$\rho 28 = 0.5$		D28 = 0.3
UPPER	MIDDLE	LOWER
6	6	3
$\rho U = 0.6$	$pM = 0.6$	$\rho L = 0.3$

Item 29

ρ29 = 0.6 D29 = 0.3

UPPER	MIDDLE	LOWER
8	6	5
ρU = 0.8	pM = 0.6	ρ L = 0.5

Item 30

ρ30 = 0.6 D30 = 0.3

UPPER	MIDDLE	LOWER
7	6	4
ρU = 0.7	pM = 0.6	ρ L = 0.4

APPENDIX S

ACCEPTED ITEMS

TABLE OF TEST SPECIFICATION FOR MATHEMATICS

OBJECTIVE TEST ITEMS

MAIN TESTS (TAM)

Content	**Cognitive Domains**							
	Knowledge	**Comprehension**	**Application**	**Analysis**	**Synthesis**	**Evaluation**	**Total**	**Percentage**
Statistics	2	2	4				**8**	**40%**
Rational numbers	1	2	1	2			**6**	**30%**
Mapping				1		1	**2**	**10%**
Equation and inequalities	2		1	1			**4**	**20%**
Total	**5**	**4**	**6**	**4**	**0**	**1**	**20**	
Percentage	**25%**	**20%**	**30%**	**20%**	**0%**	**5%**		**100%**

APPENDIX T

ACCEPTED ITEMS FOR TRADITIONAL ASSESSEMENT

AHANTA WEST M/A JUNIOR HIGH SCHOOLS
EXAMINATION
SUBJECT: MATHEMATICS
CLASS: J H S TWO
MAIN TEST
TRADITIONAL ASSESSMENT

Name……………………………………………………………..
Code………………………………………….
Date: January, 2020.
Duration: 45 minutes

This test is in **two Sections**. **Section A** is an objective test while **Section B** is made up of essay questions. You are required to spend **30 minutes** to answer all the questions in in **Section A** and **15 minutes** for **Section B**.

Read the **instructions** carefully before your start each section.

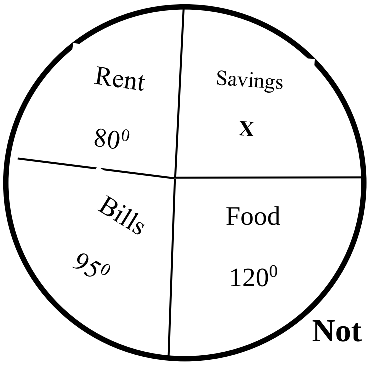
Section A
Objective Test
Time allowed: 30 minutes

Instruction: Circle the correct or the best answer from the options lettered from **A** to **D**. Each correct answer selected is 1 mark. Use the spaces to do any calculation.

The marks obtained by 13 candidates in a test are **5, 7, 2, 9, 10, 11, 2, 12, 2, 9, 3, 18** and **2**.
Use their information to answer question **1** to **4**

1. What is the mode?
   A. 2
   B. 5
   C. 9
   D. 18
2. Find the mean mark.
   A. 2
   B. 5
   C. 7
   D. 9
3. Find the range mark.
   A. 9
   B. 16
   C. 17
   D. 18
4. Determine the median mark.
   A. 2
   B. 5
   C. 7
   D. 13
5. If $x \in \{1, 2, 3, 4, 5\}$. Find the truth set of $2x + 1 < 7$
   A. {1, 2, }
   B. {2}
   C. {2, 3}
   D. {3}
6. Arrange 3, -5, 0, 0.5 from lowest to the highest
   A. -5, 0, 0.5, 3
   B. 0, 0.5, -5, 3
   C. 0, 0.5, 3, -5
   D. 3, 0.5, 0, -5
7. If $\frac{3}{15}$ is equivalent to $\frac{45}{x}$, find the value of x.
   A. 135
   B. 150
   C. 225
   D. 325

The pie chart shows how Kwaku spends his monthly salary. Used the chart to answer question **8** to **10**



Not drawn to scale

8. Find the value of **X**

A. 65^0
B. 75^0
C. 85^0
D. 100^0

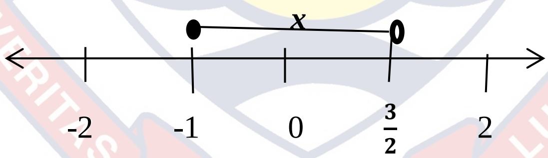
9. If Kwaku earns GH₵6300.00 a month. How much of his earnings does he spend on food?

A. GH₵140.00
B. GH₵157.50
C. GH ₵210.00
D. GH ₵350.00

10. Determine the percentage of money spent on rent by Kweku.

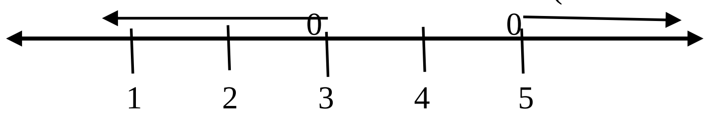
A. 20%
B. 22%
C. 23%
D. 32%

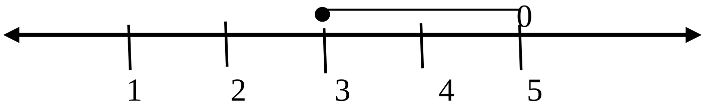
11. Illustrate x on the numberline.

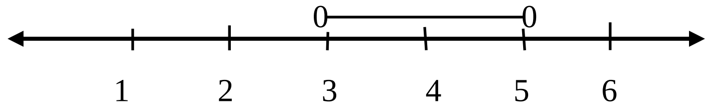


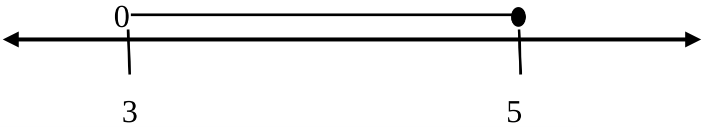
A. $-1 \leq x < -1$
B. $-1 \leq x \leq \frac{3}{2}$
C. $-1 \leq x < \frac{3}{2}$
D. $-1 < x < \frac{3}{2}$

12. Illustrate 3< x < 5 on the number line where $x \in$ (rational numbers)

A.


B.


C.


D.


13. Deduce the rule for the mapping below

-3	-2	-1	0	1	2	x
↓	↓	↓	↓	↓	↓	↓
-4	-1	2	5	8	11	y

A. y = 2x + 5
B. y = 3x + 5
C. y = 3x – 5
D. y = 3−2 x

14. Arrange the following fractions from the lowest to the highest $\frac{3}{4}$, $\frac{2}{3}$, $\frac{3}{5}$

A. $\frac{3}{5}, \frac{3}{4}, \frac{2}{3}$
B. $\frac{3}{5}, \frac{2}{3}, \frac{3}{4}$
C. $\frac{3}{4}, \frac{3}{5}, \frac{2}{3}$
D. $\frac{2}{3}, \frac{3}{4}, \frac{3}{5}$

15. Find x if $\frac{1}{x} + \frac{1}{3} = 1$

A. $\frac{2}{3}$
B. $\frac{3}{2}$
C. $1\frac{2}{3}$
D. $2\frac{1}{3}$

16. Simplify $\frac{1}{2} - \frac{1}{4} + \frac{1}{8}$

A. $\frac{1}{8}$
B. $\frac{1}{6}$
C. $\frac{5}{8}$
D. $\frac{3}{8}$

17. The following are the ages in years of members of a group**: 8, 11, 8, 10, 6, 7, 3*x*, 11** and **11**. If the mean age of the group members is **9** years, find the value of ***x***.

A. 3
B. 4
C. 9
D. 72

18. Simplify $\frac{2}{3} - \frac{1}{2} \div \frac{1}{6}$

A. $\frac{1}{6}$
B. $\frac{1}{7}$
C. 1
D. $\frac{7}{1}$

19. Compare $\frac{-2}{5}$ and $\frac{-1}{3}$

A. $\frac{-2}{5} < \frac{-1}{3}$
B. $\frac{-2}{5} < \frac{-1}{3}$
C. $\frac{-2}{5} \leq \frac{-1}{3}$
D. $\frac{-2}{5} \geq \frac{-1}{3}$

20. Find x in terms of $y = mx + c$

A. $x \longrightarrow my + c$
B. $x \longrightarrow yc + m$
C. $x \longrightarrow \frac{y+c}{m}$
D. $x \longrightarrow \frac{y-c}{m}$
E.

SECTION B
(ESSAY)

Time allowed: 15 Minutes

Show working clearly.

Full mark will not be awarded to correct answers without any show working.

INSTRUCTION: The table below shows the distribution of marks scored by class six pupils in a test. Use it to answer the question 1 to 4.

Marks	0	1	2	3	4	5
Frequency	1	2	6	9	8	4

1. How many pupils took the test? **(1 mark)**
2. What is the mode of the test? **(1 mark)**
3. Draw a bar chart for the distribution. **(4 marks)**
4. Calculate for the number of pupils that pass the test, if the pass mark is **3**. **(2 marks)**
5. Evaluate $\frac{1}{3}(x-1) - \frac{1}{2}(x-3) = 1\frac{1}{4}$ **(2 marks)**

APPENDIX U

TABLE OF TEST SPECIFICATION FOR INTEGRATED SCIENCE

INITIAL POOL OF OBJECTIVE TEST ITEMS

MAIN TEST (PILOTING)

Content	**Cognitive Domains**							
	Knowledge	**Comprehension**	**Application**	**Analysis**	**Synthesis**	**Evaluation**	**Total**	**Percentage**
Elements		2	1				**3**	**10.0%**
Metals and Non-metals	1	3	1				**5**	**16.7%**
Chemical compounds		2					**2**	**6.7%**
Mixtures	1	2	1				**4**	**13.3%**
Carbon Cycle		1			1		**2**	**6.7%**
Reproduction	1				2	1	**4**	**13.3%**
Heredity	1						**1**	**3.3%**
Photosynthesis	1	2	1		2		**6**	**20.0%**
Food and Nutrition	1	1					**2**	**6.7%**
Infectious Diseases		1					**1**	**3.3%**
Total	**6**	**14**	**4**	**0**	**5**	**1**	**30**	
Percentage	**20.0%**	**46.7%**	**13.3%**	**0.0%**	**16.7%**	**3.3%**		**100.0%**

APPENDIX V

AREAS OF SELECTED ITEMS

CONSTRUCTED RESPONSE ITEMS (ESSAY AND PERFORMAMCE) FOR INTEGRATED SCIENCE

MAIN TESTS

TOPIC	Question number						
	1	2	3	4	5	6	7
Elements							
Metals and Non-metals							
Chemical compounds							
Mixtures				√	√	√	√
Carbon Cycle							
Reproduction	√	√	√	√			
Heredity							
Photosynthesis							
Food and Nutrition							
Infectious Diseases							

APPENDIX W

INITIAL POOL OF ITEMS FOR TRADITIONAL ASSESSMENT

INTEGRATED SCIENCE (TAIS)

PILOTING
Section A
Duration: 35 minutes

Instruction: **Circle** the correct or the best answer from the options lettered from **A** to **D**. Each correct answer selected is 1 mark

1. The movable and charged sub-atomic particle in the atom is the ………..
- **A.** electron
- **B.** neutron
- **C.** nucleus
- **D.** proton

2. Which of the following is a semi-metal?
- **A.** Carbon
- **B.** Chlorine
- **C.** Sodium
- **D.** Sulphur

3. The **main** purpose for which plants in ecosystem photosynthesize is to produce ………..
- **A.** glucose.
- **B.** wood.
- **C.** water.
- **D.** air.

4. Which of the following factors contributes to teenage pregnancy?

I. Broken homes
II. Indiscriminate sex
III. Curiosity
IV. Peer influence

- **A.** **I** and **IV** only
- **B.** **I** and **III** only
- **C.** **I, II,** and **III** only
- **D.** **I, II, III** and **IV**

5. Glucose and carbohydrate are similar.
- **A.** True
- **B.** False

6. Rusting occurs in iron substances.
- **A.** True
- **B.** False

7. How many elements are in the compound H_2SO_4?
- **A.** 2
- **B.** 3
- **C.** 4
- **D.** 6

8. The face of a child resembles that of the mother due to the ………..
   - **A.** development of the child in the mother's womb.
   - **B.** mother's breast feeding process given to the child.
   - **C.** mother's love for the child.
   - **D.** transfer of characteristics.
9. The chemical substance present in the egg albumen is ……….
   - **A.** carbohydrates.
   - **B.** fats.
   - **C.** protein.
   - **D.** vitamins.
10. The equation: carbon (IV) oxide + water $\xrightarrow[\text{Light}]{\text{chlorophyll}}$ glucose + oxygen represents……...
    - **A.** breathing.
    - **B.** diffusion.
    - **C.** photosynthesis.
    - **D.** respiration.
11. Leafs are heated in alcohol before testing tem the presence of starch. The purpose of this is to ………… in the leaf.
    - **A.** increase the surface area of cells
    - **B.** kill the living cells
    - **C.** remove the green pigment
    - **D.** soften the cells
12. All the following are compounds **except** ………..
    - **A.** alloy.
    - **B.** chalk.
    - **C.** salt.
    - **D.** water.
13. Which of the following have the highest density?
    - **A.** Calcium.
    - **B.** Chlorine.
    - **C.** Neon.
    - **D.** Sulphur.
14. Which of the following is the **best** way of preventing cholera in Ghana?
    - **A.** Drinking treated water.
    - **B.** Keeping the environment clean.
    - **C.** Using antibiotic drugs.
    - **D.** Washing hands regularly.
15. The **best** reason for re-planting of trees in the ecosystem is for the trees to………..
    - **A.** be used for building of houses.
    - **B.** be used for producing furniture.
    - **C.** provide shades for living-organisms.
    - **D.** remove carbon atoms in the atmosphere.

16. Non-metals are used for manufacturing handles of electric pressing irons because they ………..

A. are good conductors of heat.
B. are good conductors of heat and electricity.
C. are poor conductors of heat and electricity.
D. do react with air and moisture.

17. When a suspension is filtered the liquid that separates out into a container forms the ………….
A. filtrate.
B. residue.
C. sediment.
D. solution.

18. An electrically neutral atom has ………

A. different number of protons and electrons.
B. equal number of protons and electrons.
C. equal number of protons and neutrons.
D. the ability to produce electricity.

19. Which of the following are used for photosynthesis
I. Carbon dioxide
II. Light energy
III. Soil water
A. **I** and **II** only**.**
B. **II** and **III** only**.**
C. **I** and **III** only**.**
D. **I, II** and **III**.

20. The **best** solvent to dissolve oil paint is ………..
A. alcohol.
B. cooling oil.
C. turpentine.
D. water.

21. The producers of sex gametes in the human reproductive system are
I. epididymis
II. ovary
III. penis
IV. testis
A. **I** and **II** only**.**
B. **I, II** and **III** only**.**
C. **II** and **IV** only**.**
D. **I, II, III** and **IV.**

22. All the following methods of separating mixtures require the application of heat **except**…………
A. distillation.
B. evaporation.
C. filtration.
D. sublimation.

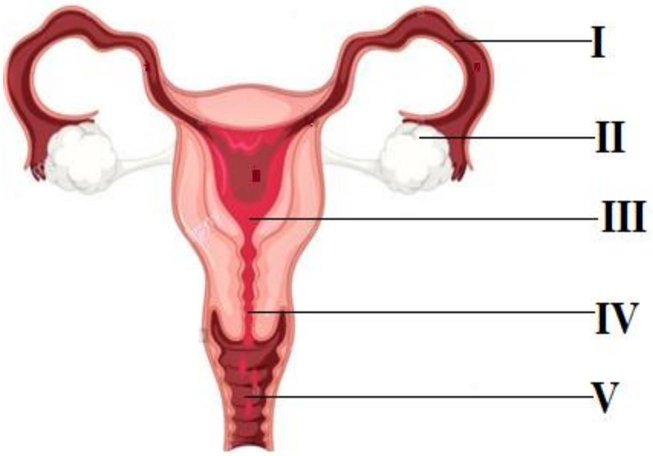
23. Which of the following substances is the **main product** of photosynthesis?
    - **A.** Carbon dioxide
    - **B.** Glucose
    - **C.** Oxygen
    - **D.** Water
24. An elements atom has **9** protons and **10** elections. Which element is it?
    - **A.** Fluorine
    - **B.** Hydrogen
    - **C.** Neon
    - **D.** Potassium
25. The testes in the male hang outside the body because the ……….. for maximum sperm production.
    - **A.** scrotal sac lives outside the body
    - **B.** temperature inside the body is too high
    - **C.** temperature inside the body is too low
    - **D.** testes must hung outside to support the penis
26. Plants add carbon dioxide to the carbon cycle through ………..
    - **A.** absorption.
    - **B.** photosynthesis.
    - **C.** respiration.
    - **D.** transpiration.
27. The food manufactured by a plant is distributed to all parts of the plant by………. cells.
    - **A.** guard
    - **B.** phloem
    - **C.** stomata
    - **D.** xylem
28. A mixture of soluble and insoluble solids can be separated by……… ……. and ………
    - **A.** dissolution, evaporation, filtration.
    - **B.** dissolution, filtration, evaporation.
    - **C.** evaporation, dissolution, filtration.
    - **D.** filtration, dissolution, evaporation.
29. The process of fertilization in human starts with the movement of sperms from the vagina to ……….., ………. and ends at the …………
    - **A.** cervix, fallopian tube, hymen.
    - **B.** cervix, womb, fallopian tube.
    - **C.** ovaries, fallopian tube, womb.
    - **D.** womb, cervix, fallopian tube.
30. Water reacts with iron metal to produce iron ………..
    - **A.** chloride.
    - **B.** hydride.
    - **C.** oxide.
    - **D.** Water.

SECTION B

ESSAY

Time allowed: 15 minutes

The diagram below represents a system in the human being. Study it carefully and use it to answer question 1 to 3 below it.



1. Identify the labeled parts. **(2.5 marks)**
2. What does the figure represents? **(0.5 mark)**
3. State the role of the parts labeled **I, III,** and **V**. **(3 marks)**
4. What is a mixture? **(1 mark)**
5. Describe each of the following.
   - **i.** Liquid-solid mixture. **(1 mark)**
   - **ii.** Solid-solid mixture. **(1 mark)**
6. State the method you will use to separate each of the mixtures in 5 (i and ii) above? **(1 mark)**

APPENDIX X

AHANTA WEST M/A JUNIOR HIGH SCHOOLS EXAMINATION

SUBJECT: INTEGRATED SCIENCE
CLASS: J H S TWO
MAIN TEST (PAIS)
PERFORMANCE TASKS: (30 marks)
ANSWER ALL QUESTIONS
Time allowed: 30 minutes

Instruction: The envelope labelled **A** is given to you and a **polythene bag**. The envelope contains the **pictures** of the portions of a structure in a human while the polythene bag contains the **activities** that take place in the human. Use the contents to answer question **1** to **4**.

1. Study the pictures carefully. **Arrange** and **paste** the pictures in an order on the answer sheet to obtain the exact picture of the structure. **(5 marks)**
2. Name the system you have arranged. **(1 mark)**
3. In the polythene bag are the activities that take place in the human. **Paste** any three of the activities at the exact **place** that each activity happens in the system. **(3 marks)**
4. What are your **reasons** for pasting the activities at those places in (3) above? **(6 marks)**

Instruction: You are provided with the following items.
Piece of magnet, **two** empty containers (**A** and **B**), **four** polythene bags, water, sand, chaff, pins, funnel, cotton wool, **two** transparent cups, a stirring stick, and a plate. Use the items to answer question **5** to **7**.

5. Form two different types of mixtures with any three (water, sand, chaff, pins) of the items and put samples of the mixtures in containers **A** and **B**. **(5 mark**s)
6. Name the type of mixtures (**according to the states of matter**) you formed in (5) above on the sheet pasted on the containers **A** and **B**. **(2 marks)**
7. Separate the rest of your two mixtures and put the components in the 4 polythene bags. **(8 marks)**

APPENDIX Y

PILOT RESULT FOR INTEGRATED SCIENCE

TRADITIONAL ASSESSMENT

GROUP LEVELS OF STUDENTS

Testees	Marks	Level
01	25	U
02	23	U
03	23	U
04	22	U
05	21	U
06	21	U
07	20	U
08	20	U
09	20	U
10	20	U
11	19	M
12	19	M
13	19	M
14	19	M
15	19	M
16	17	M
17	17	M
18	16	M
19	16	M
20	16	M
21	15	L
22	15	L
23	15	L
24	14	L
25	14	L
26	14	L
27	14	L
28	14	L
29	14	L
30	13	L

ITEM ANALYSIS FOR INITIAL POOL OF ITEMS OF TRADITIONAL ASSESSMENT INTEGRATED SCIENCE

Item 1

$\rho 1$ = 0.5 D1 = 0.5

UPPER	MIDDLE	LOWER
7	7	2
ρU = 0.7	pM = 0.7	ρ L = 0.2

Item 2

$\rho 2$ = 0.8 D2 = 0.0

UPPER	MIDDLE	LOWER
9	7	9
ρU = 0.9	pM = 0.7	ρ L = 0.9

Item 3

$\rho 3$ = 0.4 D3 = 0.5

UPPER	MIDDLE	LOWER
6	5	1
ρU = 0.6	pM = 0.5	ρ L = 0.1

Item 4

$\rho 4$ = 0.5 D4 = 0.4

UPPER	MIDDLE	LOWER
6	6	2
ρU = 0.6	pM = 0.6	ρ L = 0.2

Item 5

$\rho 5$ = 0.5		D5 = 0.3
UPPER	MIDDLE	LOWER
6	5	3
ρU = 0.6	pM = 0.5	ρ L = 0.3

Item 6

$\rho 6$ = 0.8		D6 = -0.1
UPPER	MIDDLE	LOWER
8	7	9
ρU = 0.8	pM = 0.7	ρ L = 0.9

Item 7

$\rho 7$ = 0.6		D7 = 0.5
UPPER	MIDDLE	LOWER
8	8	3
ρU = 0.8	pM = 0.8	ρ L = 0.3

Item 8

$\rho 8$ = 0.5		D8 = 0.4
UPPER	MIDDLE	LOWER
7	4	3
ρU = 0.7	pM = 0.4	ρ L = 0.3

Item 9

$\rho 9 = 0.6$ D9 = 0.3

UPPER	MIDDLE	LOWER
8	6	5
$\rho U = 0.8$	$pM = 0.6$	$\rho L = 0.5$

Item 10

$\rho 10 = 0.7$ D10 = 0.0

UPPER	MIDDLE	LOWER
8	5	8
$\rho U = 0.8$	$pM = 0.5$	$\rho L = 0.8$

Item 11

$\rho 11 = 0.5$ D11 = 0.6

UPPER	MIDDLE	LOWER
8	5	2
$\rho U = 0.8$	$pM = 0.5$	$\rho L = 0.2$

Item 12

$\rho 12 = 0.5$ D12 = 0.5

UPPER	MIDDLE	LOWER
7	5	2
$\rho U = 0.7$	$pM = 0.5$	$\rho L = 0.2$

Item 13

$\rho 13 = 0.6$		D13 = 0.3
UPPER	MIDDLE	LOWER
7	8	4
$\rho U = 0.7$	$pM = 0.8$	$\rho L = 0.4$

Item 14

$\rho 14 = 0.7$		D14 = 0.4
UPPER	MIDDLE	LOWER
9	6	5
$\rho U = 0.9$	$pM = 0.6$	$\rho L = 0.5$

Item 15

$\rho 15 = 0.7$		D15 = 0.4
UPPER	MIDDLE	LOWER
8	8	4
$\rho U = 0.8$	$pM = 0.8$	$\rho L = 0.4$

Item 16

$\rho 16 = 0.7$		D16 = 0.3
UPPER	MIDDLE	LOWER
9	5	6
$\rho U = 0.9$	$pM = 0.5$	$\rho L = 0.6$

Item 17

ρ17 = 0.7		D17 = -0.3
UPPER	MIDDLE	LOWER
6	6	9
ρU = 0.6	pM = 0.6	ρ L = 0.9

Item 18

ρ18 = 0.6		D18 = 0.0
UPPER	MIDDLE	LOWER
7	5	7
ρU = 0.7	pM = 0.5	ρ L = 0.7

Item 19

ρ19 = 0.5		D19 = 0.5
UPPER	MIDDLE	LOWER
7	7	2
ρU = 0.7	pM = 0.7	ρ L = 0.2

Item 20

ρ20 = 0.6		D20 = 0.4
UPPER	MIDDLE	LOWER
7	7	3
ρU = 0.7	pM = 0.7	ρ L = 0.3

Item 21

ρ21 = 0.5 D21 = 0.5

UPPER	MIDDLE	LOWER
7	7	2
ρU = 0.7	*p*M = 0.7	ρ L = 0.2

Item 22

ρ22 = 0.4 D22 = 0.3

UPPER	MIDDLE	LOWER
6	4	3
ρU = 0.6	*p*M = 0.4	ρ L = 0.3

Item 23

ρ23 = 0.7 D23 = - 0.2

UPPER	MIDDLE	LOWER
7	5	9
ρU = 0.7	*p*M = 0.5	ρ L = 0.9

Item 24

ρ24 = 0.5 D24 = 0.3

UPPER	MIDDLE	LOWER
6	6	3
ρU = 0.6	*p*M = 0.6	ρ L = 0.3

Item 25

$\rho 25$ = 0.8 D25 = 0.1

UPPER	MIDDLE	LOWER
9	6	8
$\boldsymbol{\rho}$U = 0.9	*p*M = 0.6	$\boldsymbol{\rho}$ L = 0.8

Item 26

$\rho 26$ = 0.7 D26 = 0.1

UPPER	MIDDLE	LOWER
8	7	7
$\boldsymbol{\rho}$U = 0.8	*p*M = 0.7	$\boldsymbol{\rho}$ L = 0.7

Item 27

$\rho 27$ = 0.7 D27 = - 0.2

UPPER	MIDDLE	LOWER
7	5	9
$\boldsymbol{\rho}$U = 0.7	*p*M = 0.5	$\boldsymbol{\rho}$ L = 0.9

Item 28

$\rho 28$ = 0.5 D28 = 0.3

UPPER	MIDDLE	LOWER
6	6	3
$\boldsymbol{\rho}$U = 0.6	*p*M = 0.6	$\boldsymbol{\rho}$ L = 0.3

Item 29

$\rho29 = 0.5$ D29 = 0.4

UPPER	MIDDLE	LOWER
7	6	3
ρU = 0.7	pM = 0.6	ρ L = 0.3

Item 30

$\rho30 = 0.7$ D30 = - 0.1

UPPER	MIDDLE	LOWER
6	7	7
ρU = 0.6	pM = 0.7	ρ L = 0.7

APPENDIX Z

ACCEPTED ITEMS

TABLE OF TEST SPECIFICATION FOR INTEGRATED SCIENCE

OBJECTIVE TEST ITEMS

MAIN TEST (TAIS)

Content	Cognitive Domains							
	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation	Total	Percentage
Elements		1		1			**2**	**10%**
Metals and Non-metals		2					**2**	**10%**
Chemical compounds		2					**2**	**10%**
Mixtures			3				**3**	**15%**
Carbon Cycle		1					**1**	**5%**
Reproduction	1				2		**3**	**15%**
Heredity	1						**1**	**5%**
Photosynthesis	1	1			1		**3**	**15%**
Food and Nutrition	1	1					**2**	**10%**
Infectious Diseases		1					**1**	**5%**
Total	**4**	**9**	**3**	**1**	**3**	**0**	**20**	
Percentage	**20%**	**45%**	**15%**	**5%**	**15%**	**0%**		**100%**

APPENDIX AA

ACCEPTED ITEMS

AHANTA WEST M/A JUNIOR HIGH SCHOOLS EXAMINATION
SUBJECT: INTEGRATED SCIENCE
CLASS: J H S TWO
MAIN TEST (TAIS)
TRADITIONAL ASSESSMENT

Name………………………………………………………………..
Code………………………………………….
Date: January, 2020.
Duration: 40 minutes

This test is in two Sections. **Section A** is an objective test while **Section B** is made up of essay questions. You are required to spend **25 minutes** to answer all the questions in in **Section A** and **15 minutes** for **Section B**.
Read the **instructions** carefully before your start each section.

Section A
Objective Test
Time allowed: 25 minutes

Instruction: **Circle** the correct or the best answer from the options lettered from **A** to **D**. Each correct answer selected is 1 mark

1. Which of the following is the **best** way of preventing cholera in Ghana?
   - **A.** Drinking treated water.
   - **B.** Keeping the environment clean.
   - **C.** Using antibiotic drugs.
   - **D.** Washing hands regularly.
2. The **best** reason for re-planting of trees in the ecosystem is for the trees to………..
   - **A.** be used for building of houses.
   - **B.** be used for producing furniture.
   - **C.** provide shades for living-organisms.
   - **D.** remove carbon atoms in the atmosphere.
3. Non-metals are used for manufacturing handles of electric pressing irons because they ………..
   - **A.** are good conductors of heat.
   - **B.** are good conductors of heat and electricity.
   - **C.** are poor conductors of heat and electricity.
   - **D.** do react with air and moisture.
4. How many elements are in the compound H_2SO_4?
   - **A.** 2
   - **B.** 3
   - **C.** 4
   - **D.** 6
5. The chemical substance present in the egg albumen is ……….
   - **A.** carbohydrates.
   - **B.** fats.
   - **C.** protein.
   - **D.** vitamins.
6. Which of the following have the highest density?
   - **A.** Calcium.
   - **B.** Chlorine.
   - **C.** Neon.
   - **D.** Sulphur.
7. The **best** solvent to dissolve oil paint is ………..
   - **A.** alcohol.
   - **B.** cooling oil.
   - **C.** turpentine.
   - **D.** water.
8. The movable and charged sub-atomic particle in the atom is the ………..
   - **A.** electron
   - **B.** neutron
   - **C.** nucleus
   - **D.** proton

9. Which of the following factors contributes to teenage pregnancy?

I. Broken homes
II. Indiscriminate sex
III. Curiosity
IV. Peer influence

A. **I** and **IV** only
B. **I** and **III** only
C. **I, II,** and **III** only
D. **I, II, III** and **IV**

10. Glucose and carbohydrate are similar.

A. True
B. False

11. The face of a child resembles that of the mother due to the ………..

A. development of the child in the mother's womb.
B. mother's breast feeding process given to the child.
C. mother's love for the child.
D. transfer of characteristics.

12. Leafs are heated in alcohol before testing tem the presence of starch. The purpose of this is to ……….. in the leaf.

A. increase the surface area of cells
B. kill the living cells
C. remove the green pigment
D. soften the cells

13. All the following are compounds **except** ………..

A. alloy.
B. chalk.
C. salt.
D. water.

14. Which of the following are used for photosynthesis

I. Carbon dioxide
II. Light energy
III. Soil water

A. **I** and **II** only.
B. **II** and **III** only.
C. **I** and **III** only.
D. **I, II** and **III**.

15. The producers of sex gametes in the human reproductive system are

I. epididymis
II. ovary
III. penis
IV. testis

A. **I** and **II** only.
B. **I, II** and **III** only.
C. **II** and **IV** only.
D. **I, II, III** and **IV.**

16. An elements atom has **9** protons and **10** elections. Which element is it?

A. Fluorine
B. Hydrogen
C. Neon
D. Potassium

17. A mixture of soluble and insoluble solids can be separated by……….., ……….. and ………..

A. dissolution, evaporation, filtration.
B. dissolution, filtration, evaporation.
C. evaporation, dissolution, filtration.
D. filtration, dissolution, evaporation.

18. The process of fertilization in human starts with the movement of sperms from the vagina to ……….., ………. and ends at the …………

A. cervix, fallopian tube, hymen.
B. cervix, womb, fallopian tube.
C. ovaries, fallopian tube, womb.
D. womb, cervix, fallopian tube.

19. The **main** purpose for which plants in ecosystem photosynthesize is to produce ………..

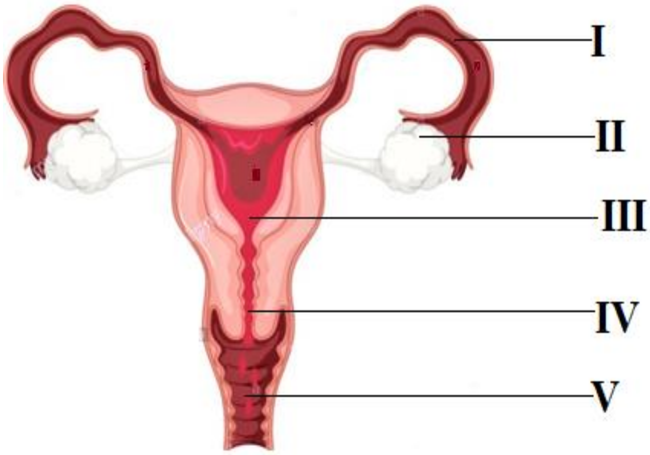
A. glucose.
B. wood.
C. water.
D. air.

20. All the following methods of separating mixtures require the application of heat **except………….**

A. distillation.
B. evaporation.
C. filtration.
D. sublimation.

SECTION B
ESSAY
Time allowed: 15 minutes

The diagram below represents a system in the human being. Study it carefully and use it to answer question 1 to 3 below it.



7. Identify the labeled parts. **(2.5 marks)**
8. What does the figure represents? **(0.5 mark)**
9. Mention the role of the parts labeled **I, III,** and **V**. **(3 marks)**
10. What is a mixture? **(1 mark)**
11. Describe each of the following.

    iii. Liquid-solid mixture. **(1 mark)**

    iv. Solid-solid mixture. **(1 mark)**

12. State the method you will use to separate each of the mixtures in 5 (i and ii) above? **(1 mark)**

APPENDIX AB

AHANTA WEST M/A JUNIOR HIGH SCHOOLS'

EXAMINATION
SUBJECT: MATHEMATICS
CLASS: J H S TWO
MAIN TEST (MIM)
MIXED ITEMS (TRADITIONAL AND PERFORMANCE ASSESSMENT)

Name…………………………………………………………….
Code………………………………………….
Date: January, 2020
Duration: 1 hour 15 minutes

This test has **three Sections**: Objective tests, Essay questions and Performance tasks. You are required to spend **30, 15** and **30 minutes** to answer all the questions in **Sections A, B** and **C** respectively.
Instructions are provided at each section to **guide** you. Read the **instructions** carefully before your start work.

Section A
Objective Tests
Time allowed: 30 minutes

Instruction: **Circle** the correct or the best answer from the options lettered from **A** to **D**. Each correct answer selected is 1 mark. Use the space provided to do any calculations

The marks obtained by 13 candidates in a test are **5, 7, 3, 9, 10, 11, 3, 12, 3, 9, 4, 13** and **3.**
Use their information to answer questions **1** to **4**

1. What is the most occurring mark?
- **A.** 3
- **B.** 7
- **C.** 9
- **D.** 13

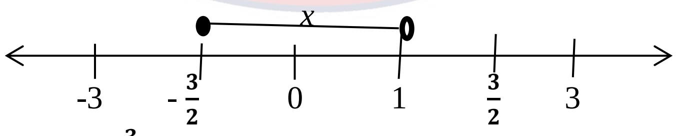
2. Find the average mark.
- **A.** 3
- **B.** 4
- **C.** 7
- **D.** 11

3. Find the difference between the lowest and highest marks.
- **A.** 9
- **B.** 10
- **C.** 16
- **D.** 39

4. Determine the middle mark.
- **A.** 4
- **B.** 5
- **C.** 7
- **D.** 9

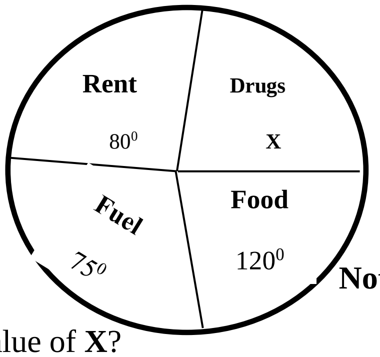
5. Order 0.6, 0, 4, and -7 from lowest to the highest
- **A.** -7, 0, 0.6, 4
- **B.** 0, 0.6, -7, 4
- **C.** 0, 0.6, 4, -7
- **D.** 4, 0.6, 0, -7

6. Illustrate *x* on the numberline.



- **A.** $-\frac{3}{2} \leq x < -1$
- **B.** $-\frac{3}{2} \leq x \leq 1$
- **C.** $-\frac{3}{2} \leq x < 1$
- **D.** $-\frac{3}{2} < x < 1$

The pie chart shows how Mrs Adu spends the house keeping money. Used the chart to answer question **7** to **9**



Not drawn to scale

7. What is the value of **X**?

A. 55^0
B. 75^0
C. 85^0
D. 95^0

8. If the house keeping money is GH₵1,200.00 for a week. How much of this does she spent on food?

A. GH₵110.00
B. GH₵180.00
C. GH ₵240.00
D. GH ₵400.00

9. Find the percentage of money spent on food.

A. 23%
B. 24%
C. 33%
D. 34%

10. The following are the weights in grams of empty tins: **6, 13, 8, 5 m, 6, 7, 12, 9** and **10**. If the mean weight is **9** grams, find the value of **m**.

A. 2
B. 3
C. 9
D. 81

11. Re-write $\frac{1}{5} - \frac{1}{10} + \frac{1}{2}$ in the simplest form.

A. $\frac{1}{5}$
B. $\frac{2}{5}$
C. $\frac{3}{5}$
D. $\frac{1}{6}$

12. If $\frac{75}{n}$ similar to $\frac{5}{15}$, find the value of n.

A. 225
B. 235
C. 325
D. 335

13. Compare $\frac{-1}{4}$ and $\frac{-3}{5}$

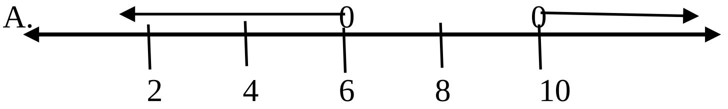
A. $\frac{-1}{4} < \frac{-3}{5}$

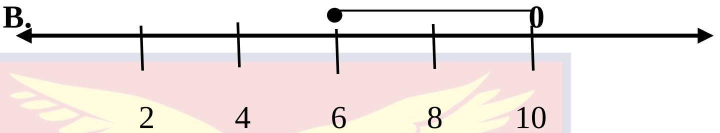
B. $\frac{-1}{4} > \frac{-3}{5}$

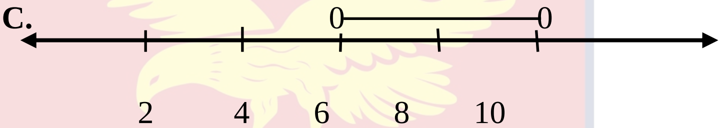
C. $\frac{-i}{4} \leq \frac{-3}{5}$

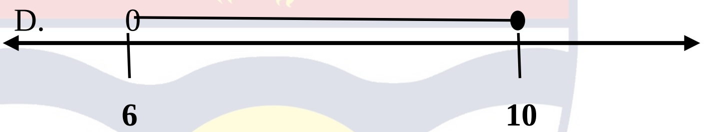
D. $\frac{-1}{4} \geq \frac{-3}{5}$

14. Draw $10 > \boldsymbol{v} > 6$ on the number line where $\boldsymbol{v} \in$ (rational numbers)

A.


B.


C.


D.


15. Find $\boldsymbol{q}$ in terms of $y = m\boldsymbol{q} + c$

A. $\boldsymbol{q} \longrightarrow my + c$

B. $\boldsymbol{q} \longrightarrow cy + m$

C. $\boldsymbol{q} \longrightarrow \frac{y-c}{m}$

D. $\boldsymbol{q} \longrightarrow \frac{y+c}{m}$

16. Determine the rule for the relation below

-3	-2	-1	0	1	2	x
↓	↓	↓	↓	↓	↓	↓
-7	-4	-1	2	5	8	y

A. $y = 2\boldsymbol{x} - 2$

B. $y = 3\boldsymbol{x} - 2$

C. $y = 2\boldsymbol{x} + 2$

D. $y = 3x + 2$

17. Make $-\frac{4}{6} + \frac{1}{2} \div \frac{1}{12}$ simpler

A. $-\frac{1}{6}$

B. -2

C. $\frac{1}{6}$

D. 2

18. If $\boldsymbol{x} \in \{2, 4, 6, 8, 10\}$. Find the truth set of $2 + 6\boldsymbol{x} < 14$

A. {2}
B. {2, 4}
C. {2, 6}
D. {4}

19. Order the following fractions from the lowest to the highest $\frac{1}{3}$, $\frac{3}{5}$, $\frac{2}{9}$

A. $\frac{3}{5}, \frac{2}{9}, \frac{1}{3}$
B. $\frac{3}{5}, \frac{1}{3}, \frac{2}{9}$
C. $\frac{2}{9}, \frac{3}{5}, \frac{1}{3}$
D. $\frac{1}{3}, \frac{2}{9}, \frac{3}{5}$

20. What is the value of *y*, if $\frac{1}{y} + \frac{1}{4} = 1$

A. $\frac{3}{4}$
B. $\frac{4}{3}$
C. $1\frac{2}{3}$
D. $1\frac{3}{4}$

Section B
Essay
Time allowed: 15 minutes

Instruction: Read information below carefully and use it to answer question **21** to **24.**

The table below shows the distribution of marks scored by JHS three students in a Mathematics class test. Use it to answer the questions below.

Marks	1	2	3	4	5	6
Frequency	2	3	5	9	7	4

21. How many pupils took the class test? **(1 mark)**
22. What is the mode of the class test? **(1 mark)**
23. Draw a bar chart on a graph sheet to show the distribution of the class test scores. **(4 marks)**
24. Calculate for the number of pupils that pass the class test if the pass mark is **3**. **(2 marks)**

25. Evaluate $\frac{1}{5}(x+2) - \frac{1}{3}(x-4) = 2\frac{1}{4}$ **(2 marks)**

Section C

Performance tasks
Time allowed: 30 minutes

Instruction: Read the information below carefully and use it to answer question **26** to **29**.

In the given polythene bag are the lengths of sticks Kofi used to fence a garden. Use the lengths in meters (m) to answer the questions below on your answer sheet.

26. How many sticks were used to fence the garden? **(3 marks)**
27. Which length of sticks was used most? **(3 marks)**
28. Draw a bar chart to picture the lengths of sticks used. **(12 marks)**
29. If sticks of **4m** and above are to be used to start the fencing, **sort** for the number of sticks that Kofi used to begin the fencing in the envelope labeled **A**. **(6 marks)**

Instruction: Read the information below carefully and use it to answer questions **30** and **31**.

In a discussion, 2 was added to Ama's height and the results was multiplied by $\frac{1}{5}$. Again 4 was added to Ama's height and the result was also multiplied by - $\frac{1}{3}$. Finally the results were put together to get $2\frac{1}{4}$.

30. Write a mathematical statement for the issue above. **(3 marks)**
31. From the mathematical statement find the height of Ama. **(3 marks)**

APPENDIX AC

AHANTA WEST M/A JUNIOR HIGH SCHOOLS EXAMINATION

SUBJECT: INTEGRATED SCIENCE
CLASS: J H S TWO
MAIN TEST (MIIS)
MIXED ITEMS (TRADITIONAL AND PERFORMANCE ASSESSMENT)

Name…………………………………………………………………..
Code…………………………………………….
Date: January, 2020.
Duration: 1 hour 10 minutes

This test is **Three Sections** (**A, B,** and **C**): Objective Tests, Essay Questions and Performance tasks. You are required to **spend 25, 15** and **30 minutes** to answer all the questions in **Section A, B** and **C** respectively.

Instructions are provided to **guide** you in each section. Read the **instructions** carefully before your start work.

Section A
Objective test items
Time allowed: 25 minutes

Instruction: **Circle** the correct or the best answer from the options lettered from **A** to **D**. Each correct answer selected is 1 mark

1. The sub-atomic particle that moves to form ion is the ……….
   - **A.** electron.
   - **B.** neutron.
   - **C.** nucleus.
   - **D.** proton.
2. The basic form of carbohydrate is glucose.
   - **A.** True
   - **B.** False
3. The compound H_2SO_4 contains ………. elements.
   - **A.** 2.
   - **B.** 3.
   - **C.** 4.
   - **D.** 6.
4. The denser element among these is ……….
   - **A.** Calcium
   - **B.** Chlorine
   - **C.** Neon
   - **D.** Sulphur
5. Afforestation should be encouraged because the trees ………...
   - **A.** are used for construction of buildings.
   - **B.** are used to produce tables and chairs.
   - **C.** give shades when the sun shine is high.
   - **D.** remove carbon atom through photosynthesis.
6. The movement of sperms in the woman before fertilization starts from the vagina to the ……….., ……….. and ends at the ………..
   - **A.** cervix, oviduct, hymen.
   - **B.** cervix, uterus, oviduct.
   - **C.** ovaries, oviduct, uterus.
   - **D.** uterus, cervix, oviduct.
7. Many people resemble their mothers because of the ……….
   - **A.** breast feeding they got from their mothers.
   - **B.** development of them in the womb of the mothers.
   - **C.** love of their mothers towards them.
   - **D.** passing on of traits from mothers to them.
8. Electrical wires are covered with non-metals because they ………..
   - **A.** allow electricity and heat to pass through them.
   - **B.** allow heat to pass through them.
   - **C.** are reactive with air and water.
   - **D.** do not allow electricity and heat to pass through them.

9. The atomic number of an element is **9** but the atom has **10** electrons. Which element is it?
- **A.** Fluorine.
- **B.** Hydrogen
- **C.** Neon.
- **D.** Potassium

10. The oil painting brush is **best** washed with …………
- **A.** alcohol.
- **B.** cooling oil.
- **C.** hot soapy water.
- **D.** turpentine.

11. Teenage pregnancies are rampant because of the increase rate of ……….. in the society.

I. anxiousness to know
II. bad advice from peers
III. breakages in marriages
IV. multiple sex partners
- **A.** **I** and **IV** only
- **B.** **I** and **III** only
- **C.** **I, II,** and **III** only
- **D.** **I, II, III** and **IV**

12. The egg albumen is rich in ………..
- **A.** fat.
- **B.** protein.
- **C.** starch.
- **D.** vitamin.

13. The materials that plants use to prepare food are

I. carbon dioxide
II. sunlight energy
III. water
- **A.** **I** and **II** only
- **B.** **I** and **III** only
- **C.** **II** and **III** only
- **D.** **I, II** and **III**

14. The female and male sex gametes are produce by the …………

I. epididymis
II. ovaries
III. penis
IV. testes
- **A.** **I** and **II** only
- **B.** **I, II** and **III** only
- **C.** **II** and **IV** only
- **D.** **I, II, III** and **IV**

15. Which of the following methods will **not** require heat to separate mixtures?
- **A.** Crystallization
- **B.** Sieving
- **C.** Simple distillation
- **D.** Sublimation

16. The main product of photosynthesis is ………..
- **A.** air.
- **B.** carbohydrate.
- **C.** fire wood.
- **D.** water.

17. The purpose of putting a leaf in warm alcohol is to ……….
- **A.** kill the cells.
- **B.** make the leaf wide.
- **C.** remove chlorophyll.
- **D.** soften the leaf.

18. An example of a mixture is ………..
- **A.** alloy.
- **B.** chalk.
- **C.** salt.
- **D.** Water

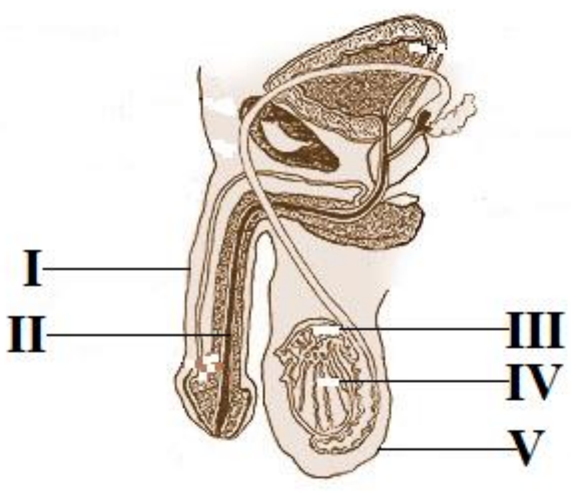
19. A mixture of salt and sand can be separated by ……….., ……….. and …………....
- **A.** dissolution, evaporation, filtration.
- **B.** dissolution, filtration, evaporation.
- **C.** evaporation, dissolution, filtration.
- **D.** filtration, dissolution, evaporation.

20. Cholera is **best** reduced in the country when we …………
- **A.** practice good sanitary.
- **B.** use treated water always.
- **C.** use recommended drugs.
- **D.** wash hands with soap always.

Section B
Essay
Time Allowed: 15 Minutes

Instruction: Read the information carefully and use it to answer question **21** to **23** as demanded.

The figure below is the structure of a system in the human. Study it carefully and answer the questions that follow.



21. Name the labelled parts. **(2.5 marks)**
22. Identify the figure. **(0.5 mark)**
23. State the function of the parts labeled **I, IV** and **V**. **(3 marks)**
24. Why is air said to be a mixture? **(1 mark)**
25. Describe and give an example each of the following.

i. **Liquid-liquid mixture**

(1 mark)

ii. **Liquid-gas mixture.**

(1 mark)

26. Mention **one** method will you use to separate **each** of the mixtures in **25** (**i** and **ii**) above? **(1 mark)**

Section C

Performance Tasks
Time Allowed: 30 Minutes

Instruction: Read the information below carefully.
The envelope labelled **A** is given to you and a polythene bag. The envelope contains the pictures of the portions of a structure in a human while in the polythene bag are the processes that take place in the human system. Use the contents to answer questions **27** to **30**.

27. Study them carefully. **Arrange** and **paste** them on the answer sheet to get the exact picture of the system. **(5 marks)**
28. Identify the system you developed. **(1 mark)**

In the polythene bag are the **processes** that occur in the human system.

29. **Paste** any **three** of the processes at exact site of occurrence in the system. **(3 marks)**
30. Give a **reason** for your selection of site for **each** process pasted. **(6 marks)**

Instruction: You are provided with the following items.
Water, sand, oil, chaff, funnel, cotton wool, piece of sieve, **two** transparent cups, **two** empty containers (**A** and **B**), **four** polythene bags, and a stirring stick. Use the items to answer questions **31** to **33.**

31. Make **two different types** of mixtures using any three (**water, sand, chaff** and **oil**) of the items and put some in containers **A** and **B**. **(5 marks)**

32. **Identify** the type of mixtures (**using the states of matter**) you made in (**27**) above on the sheet pasted on the `containers **A** and **B**. **(2 marks)**
33. **Separate** your two mixtures and put the components in the **four** polythene bags**.** **(8 marks)**

APPENDIX AD

SCORING KEYS

ABILITY DETERMINATION TEST (MATHEMATICS)

Section A (Objective Test Items)

ITEM NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
KEY	B	C	A	C	C	A	A	C	B	C	C	B	B	B	A	C	C	B	D	B

Section B

1. Simplify $\mathbf{2\frac{3}{5} + 2\frac{1}{3} + 3\frac{2}{5}}$

$2\frac{3}{5} + 2\frac{1}{3} + 3\frac{2}{5}$

$\frac{13}{5} + \frac{7}{3} + \frac{17}{5}$ -- **B2**

$\frac{3(13)+5(7)+3(17)}{15}$

$\frac{39+35+51}{15}$ ---**B2**

$\frac{125}{15}$

$= 8\frac{1}{15}$ --**A2**

Kofi is x years old now

2. How old was he 5 years ago?

Since Kofi is x years

$(x - 5)$ years--**B3**

3. How old will he be in 10 years from now?

$(x + 10)$ years--**B3**

Section C (Performance Item)

A certain number times your age, the result is half of your age.

4. Deduce an equation from the statement above.

If the age of the student is Z, and that certain number is y, then

$Z\times y = \frac{1}{2}\times Z$--**B4**

5. Calculate for the unknown number.

If Z =10 years, $10\times y = 12\times 10$

$10y = 120$

$\frac{10y}{10} = \frac{120}{10}$

$y = 12$--------------------------------**B2**

A class test organized for **30 students** in JHS 2 had the marks ranges from **1** to **10**.

6. Select different marks from 1 to 10 and record them for the 30 students.

Ability to record 6 different marks at a time --------------- **B1**
» (6 × 5 = 30 records for **5 marks**)

7. Construct a frequency table using your selected marks

Drawing of frequency table with four (4) columns indicating Marks (*x*), Tally, Frequency (*f*) and *fx*. ---**B2**
Accurate presentation and computation of information in each column of the table---**B4**

8. Calculate for the mean mark

Accurate presentation of mean formular $\frac{\varepsilon f x}{\varepsilon f}$ -------------------------**B1**
Accurate input of exact computed information in mean formular and computation--**B2**
Correct answer for mean---**B1**

9. Find the modal mark of your data.

Correct mode ---**B2**

ABILITY DETERMINATION TEST (INTEGRATED SCIENCE)

Section A (Objective Test Items)

ITEM NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
KEY	B	D	A	C	B	A	C	C	C	D	A	A	D	D	C	B	B	A	B	D

Section B (Essay)

1. What is teenage pregnancy?

The pregnancy that occurs in a teenage girl of ages between 12 to 19 years. --**2 marks**

2. State **one effect** of teenage pregnancy on the society.

Any **one** of the effects below or relevant idea for **2 marks**

a. Increase in population
b. Increase streetizism
c. High rate of illiteracy in the society
d. High rate of burden on the families of teenage parents
e. Cause of early parenthood
f. Cause of underweight babies
g. Increase the rate of sexual transmitted infections
h. Increase the rate of poverty
i. Children may grow to become crime committers in the society
j. Children may also become teenage parents in the future
k. Children may suffer from higher rates of abuse and neglect in the society
l. Abandoned babies

3. Mention **one way** of reducing the rate of teenage pregnancy in the society**.**

Any **one** of the effects below or relevant idea for **2 marks**

a. Educating the public on the effects on teenage pregnancy and sexual behaviours
b. Good parental care to wards
c. Making good friends
d. Practicing safe sex
e. Abstinence from sexual intercourse
f. Avoid watching pornographic media.

Instruction: Match the following **description** to the correct **terms (6 marks)**

Description		Term
4. A chemical substance that is made up of only one kind of atoms		Global warming
5. An inheritable characteristic		Photosynthesis
6. Can be separated by the processes of dissolution, filtration and evaporation		Gold
7. The rise in temperature of the atmosphere		Kwashiorkor
8. Provides food and oxygen for organisms		Air
9. The deficiency disease of protein in dieting		Sickle cell anemia
		Rice and crystals of salt

Section C (Performance item)

10. Identify **each** of your selected element's atom structure with its **chemical symbol** in the **space** provided on the cutout structure.

Ability to identify any five structures with correct **chemical symbols------ B2** » (5×3=15 for the **6 marks**)

Number of electrons on a structure	Chemical symbol
1	H
2	He
3	Li
4	Be
5	B
6	C
7	N
8	O
9	F
10	Ne
11	Na
12	Mg
13	Al
14	Si
15	P
16	S

17	Cl
18	Ar
19	K
20	Ca

11. Classify them as **metals**, **non-metals** and **semi-metals** in the three polythene bags with metals, non-metal and semi-metals in them.
(6 marks)

Ability to classify any five structures accurately------------------------- **B2**
» (5×3=15 for the **6 marks**)

Metals	**Semi-metals**	**Non-metals**
Li	B	H
Be	C	He
Na	Si	N
Mg		O
Al		F
K		Ne
Ca		P
		S
		Cl
		Ar

12. Make a mixture, put some in container **A** and close it.
13. Separate the rest of the mixture to obtain the components.

1. Mixture	**2. Methods of Separation**
Water and chaff Water and sand Water and pins	• Filtration
Pins and chaff Pins and sand Pins and water	• Magnetization
Chaff and pins Chaff and sand	• Winnowing
Pins, chaff and water Pins, sand and water	• Magnetization and filtration
Chaff, sand and water	• Decantation and filtration
Pins, chaff, sand and water	• Decantation, filtration and magnetization

Scoring key (Piloting)
Traditional assessment Mathematics (TAM)
Section A

ITEM NUMBER	KEY	ITEM NUMBER	KEY	ITEM NUMBER	KEY
1	C	11	C	21	C
2	D	12	B	22	D
3	D	13	C	23	B
4	A	14	A	24	D
5	C	15	B	25	A
6	B	16	C	26	D
7	B	17	B	27	B
8	A	18	C	28	C
9	A	19	C	29	B
10	D	20	C	30	B

SECTION B AND PERFORMANCE ITEMS

INSTRUCTION: The table below shows the distribution of marks scored by class six pupils in a test. Use it to answer the questions **1** to **4** below.

Marks	0	1	2	3	4	5
Frequency	1	2	6	9	8	4

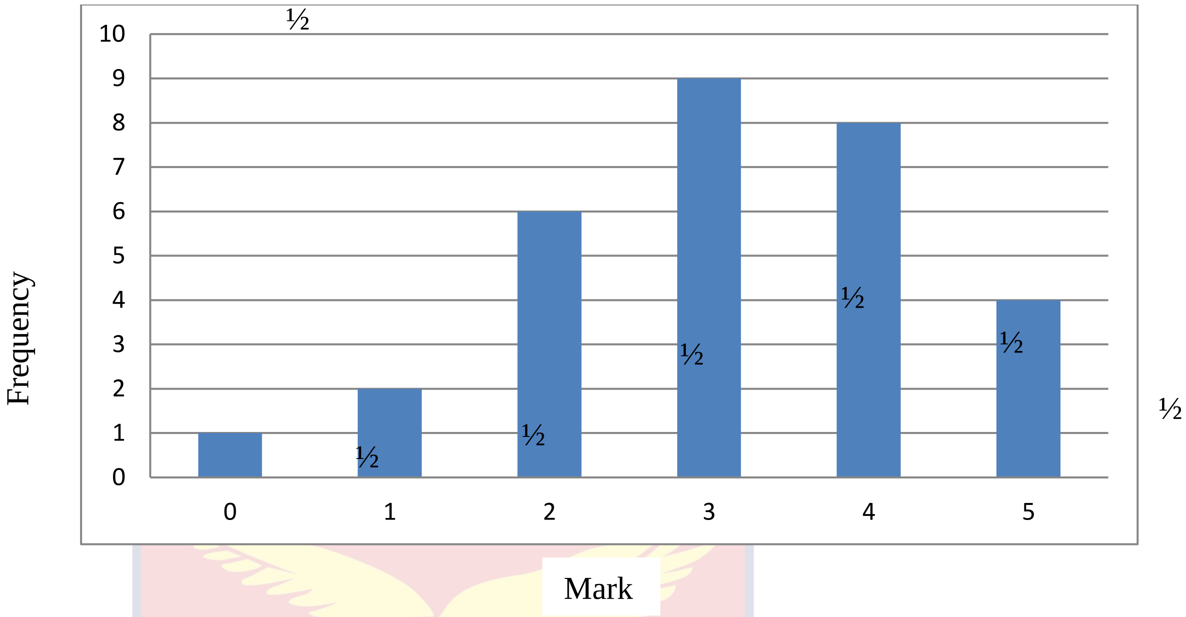
1. How many pupils took the test?

   30 pupils---**B1**

2. What is the mode of the test?

   3--- **B1**

3. Draw a bar chart for the distribution. **(4 marks)**



4. Calculate for the fraction of pupils that pass the test if the pass mark is 3.

Total number of pupils who pass the test 9+8+4 = 21-------------**B1**

$\frac{21}{30}$ ------------------------**B1**

5. $\frac{1}{3}(x-1) - \frac{1}{2}(x-3) = 1\frac{1}{4}$

$\frac{1}{3}(x-1) - \frac{1}{2}(x - 3) = \frac{5}{4}$

$12 \times \frac{1}{3}(x-1) + 12 \times - {}^{1}/_{2}(x-3) = 12 \times \frac{5}{4}$

$4(x-1) - 6(x-3) = 15$---------------------------------**B1**

$-2x + 14 = 15$

$-2x + 14 - 14 = 15 - 14$

$\frac{2x}{-2} = \frac{1}{-2}$

$x = -\frac{1}{2}$----------------------**B1**

Scoring key (Piloting)
Traditional assessment Integrated Science (TAIS)
Section A

ITEM NUMBER	KEY	ITEM NUMBER	KEY	ITEM NUMBER	KEY
1	A	11	C	21	C
2	A	12	A	22	C
3	A	13	A	23	C
4	D	14	A	24	A
5	A	15	D	25	B
6	A	16	C	26	C
7	B	17	A	27	B
8	D	18	B	28	B
9	C	19	D	29	B
10	C	20	C	30	C

SECTION B (ESSAY)

INSTRUCTION: The diagram below represents a system in the human being. Study it carefully and use it to answer questions 1 to 3 below it.

1. Identify the labeled parts.

I--------Fallopian tube/oviduct
II-------Ovary
III-------Womb/ uterus
IV-------Cervix
V-------Vagina 0.5 mark for each (0.5 × 5 = **2.5**)

2. What does the figure represents?

The female reproductive system of human ---------------------------- **0.5 mark**

3. State the role of the parts labeled **I, III,** and **V**.

I------The site for fertilization
II----The place where the baby develops/ A place for implantation
V----- Receives the penis and semen during sexual intercourse.
1 mark for each (1×3 = **3 marks**)

4. What is a mixture?

A mixture is a physical combination of two or substances. -------- (**1 mark**)

5. Describe each of the following.

b. Liquid-solid mixture.

A mixture formed from the combination of two or more solid substances. -------
(1 mark)

c. Solid-solid mixture.

A mixture formed from the combination of two or more solid and liquid substances. --- **(1 mark)**

6. State the method you will use to separate each of the mixtures in **5** (i and ii) above?

i. Solid-solid mixture

(Any of the methods among magnetization, winnowing, sieving and handpicking) **(0.5 mark)**

ii. Solid-liquid mixture

(Any of the methods among magnetization, filtration, decantation, evaporation) **(0.5 mark)**

PERFORMANCE TASKS (PAIS): (30 marks)

Instruction: The envelope labelled **A** is given to you. It contains the **pictures** of the portions of a structure in a human and a **polythene bag** (activities that take place in the human). Use the content of the envelope to answer questions **1** to **4**.

1. Study the pictures carefully, arrange and paste them on the answer sheet to obtain the exact picture of the structure.
Ability to arrange any four portions accurately--------------**3 marks**
Ability to arrange a perfect picture--------------------------**2 marks**

2. Name the system you have arranged.
The female reproductive system of human ------------------**1 mark**

In the polybag are the **activities** that take place in the human**.**

3. **Paste** any **three** of the activities at the exact **place** that each activity happens in the system you have arranged.
Any one correct pasting at the exact site of occurrence------------**1 mark**
» (3 ×1=3 pasting for **3 marks**)

4. What are your **reasons** for pasting each of the activities at those places in (**3**) above?
For every one reason --**2 marks**
» (3 ×1=3 reasons for **6 marks**)

Process	**8. Site of occurrence**	**9. Reason for selected site**
Fertilization	Fallopian tube/Oviduct	The place where the male and female sex gametes join to form a zygote

Ovulation	Ovary	The ovary releases the ova/eggs
Birth	Cervix	The site which opens only when the baby is ready to be born
Implantation and development of baby	Womb/Uterus	The place where the baby stays to develop.
Sexual intercourse	Vagina	Receives penis and semen during sexual intercourse

Instruction: The following items are given to you.
Piece of magnet, **two** empty containers (**A** and **B**), **four** polythene bags, water, sand, chaff, pins, funnel, cotton wool, **two** transparent cups, a stirring stick, and a plate. Use the items to answer questions **5** to **7**.

5. Form **two different types** of mixtures with any **three** of the items and put samples in containers **A** and **B**. **(5 marks)**

6. Name the **type of mixtures (**according to the states of matter**)** you formed in (6) above on the sheet pasted on the containers **A** and **B**. **(2 marks)**

7. Separate your two mixtures and put the components in the **4** polythene bags**.** **(8 marks)**

6. Mixture	**7. Type of mixture**	**8. Separation**
Water and chaff Water and sand Chaff, sand and water	Liquid-solid	Filtration
Pins, chaff and water Pins, sand and water Pins, chaff, sand and water		Filtration and magnetization
Chaff and sand	Solid-solid	Winnowing
Chaff and pins		Magnetization / winnowing
Pins and sand		Magnetization

Scoring key

Mixed items/Final Test Mathematics (MIM/FTM)

Section A

Item Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
KEY	A	C	B	C	A	C	C	D	C	A	C	A	B	C	C	D	B	A	C	B

Section B and C

Essay and Performance tasks

Instruction: Read information below carefully and use it to answer question **21** to **24.**

The table below shows the distribution of marks scored by JHS three students in a Mathematics class test. Use it to answer the questions below.

Marks	1	2	3	4	5	6
Frequency	2	3	5	9	7	4

21. How many pupils took the class test?

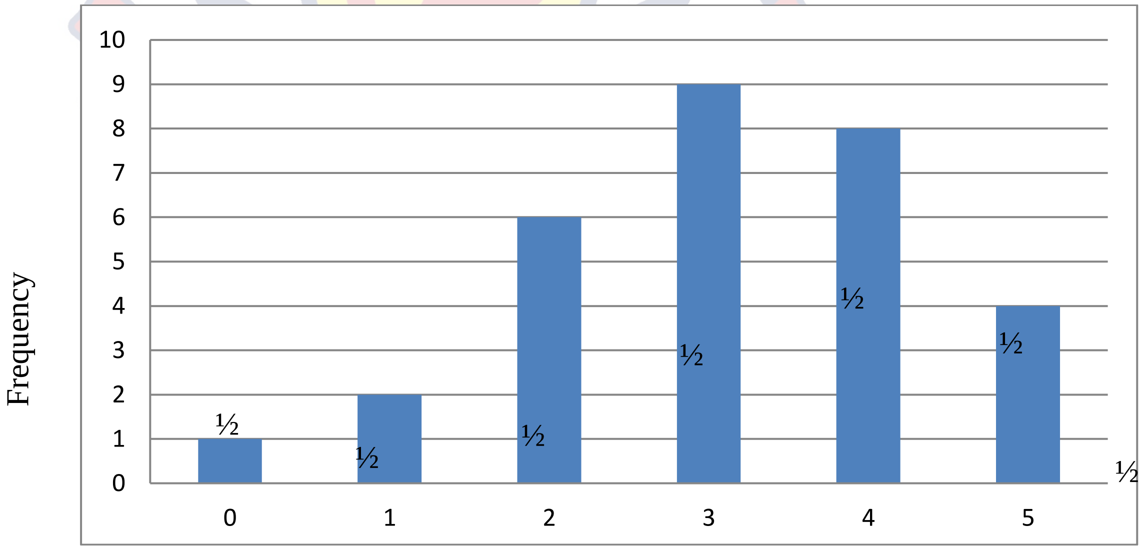
30 pupils---**B1**

22. What is the mode of the class test?

3-- **B1**

23. Draw a bar chart on a graph sheet to show the distribution of the class test scores.

Drawing a bar chart for the distribution.



Mark

24. Calculate for the fraction of pupils that pass the test if the pass mark is 3.

Total number of pupils who pass the test 5+9+7+4 = 25-------------**B1**

$\frac{25}{30} = \frac{5}{6}$ ------------------------**B1**

25. Evaluate $\frac{1}{5}$ (x+2) - $\frac{1}{3}$ (x- 4) = 2 $\frac{1}{4}$

$$\frac{1}{5}(x+2) - \frac{1}{3}(x - 4) = \frac{9}{4}$$

$$60 \text{ x } \frac{1}{5}(x+2) + 60 \text{ x } - {}^{1}/_{3}\ (x-4) = 60 \text{ x } \frac{9}{4}$$

$12(x+2) -20 (x-4) = 135$---------------------------------**B1**

$$12 x - 20x + 24+80 = 135$$

$$-8x + 104 = 135$$

$$\frac{-8x}{-8} = \frac{31}{-8}$$

$x = -\frac{31}{8} = -3\frac{6}{8}$------------------------**B1**

.Scoring key

Mixed items/Final Test Integrated Science (MIIS/FTIS)

Section A

Item Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
KEY	A	A	B	A	D	B	D	D	A	D	D	B	D	C	B	B	C	A	B	A

SECTION B (ESSAY)

INSTRUCTION: The diagram below represents a system in the human being. Study it carefully and use it to answer questions **1** to **3** below it.

21. Name the labeled parts.

I--------Penis
II-------Urethra
III-------Epididymis
IV-------Testis
V-------Scrotum 0.5 mark for each (0.5 × 5 = **2.5**)

22. Identify the figure.

The male reproductive system of human ---------------------------- **0.5 mark**

23. State the function of the parts labeled **I, IV** and **V**.

I------To penetrate the vagina and release sperms
IV----It produces sperms
V----- Covers the testis and give it protection
1 mark for each (1×3 = **3 marks**)

24. Why is air said to be a mixture?
Air is a physical combination of two or gases. -------- **(1 mark)**

25. Describe each of the following.

i. Liquid-liquid mixture.

A mixture formed from the combination of two or more liquid substances. (**1 mark**)

ii. Liquid-gas mixture.

A mixture formed from the combination of two or more liquid and gas substances. **(1 mark)**

26. Mention one method will you use to separate each of the mixtures in **25** (**i** and **ii**) above?

iii. Liquid-liquid mixture

(Any of the methods among distillation, decantation, using separation funnel and chromatography)---**(0.5 mark)**

iv. Liquid-gas mixture
(The method of fractional distillation)---------------------------------**(0.5 mark)**

PERFORMANCE TASKS (PAIS): (30 marks)

Instruction: The envelope labelled **A** is given to you. It contains the **pictures** of the portions of a structure in a human and a **polythene bag** (that take place in the human). Use the content of the envelope to answer questions **1** to **4** activities.

27. Study them carefully. **Arrange** and **paste** them on the answer sheet to get the exact picture of the system.
Ability to arrange a perfect picture-------------------------- **2 marks**

Ability to arrange any four portions accurately--------------**3 marks**

28. Identify the system you developed.
The male reproductive system of human ------------------**1 mark**

In the polythene bag are the **processes** that occur in the human system.

29. **Paste** any **three** of the processes at exact site of occurrence in the system.
Any one correct pasting at the exact site of occurrence------------**1 mark**
» (3 ×1=3 pasting for **3 marks**)

30. Give a **reason** for your selection of site for **each** process pasted.
For every one reason --**2 marks**
» (3 ×1=3 reasons for **6 marks**)

Process	Site of occurrence	Reason for selected site
Sperm storage	Epididymis	The place where the sperms are stored for some time
Urinating	Urethra	The passage or path for urine
Testes protection	Scrotum	The organ which gives protection to the testes
Sperms production	Testis	The place/site where the sperms are produced
Sexual intercourse	Penis	Penetrates vagina to release semen during sexual intercourse

Instruction: You are provided with the following items.
Water, sand, oil, chaff, funnel, cotton wool, piece of sieve, **two** transparent cups, **two** empty containers (**A** and **B**), **four** polythene bags, and a stirring stick. Use the items to answer questions **31** to **33.**

31. Make **two different types** of mixtures using any **three** (water, sand, chaff and oil) of the items and put some in containers **A** and **B.** **(5 marks)**

32. Identify the type of mixtures (**using the states of matter**) you made in (**27**) above on the sheet pasted on the `containers **A** and **B**. **(2 marks)**

33. Separate your two mixtures and put the components in the **four** polythene bags**.** **(8 marks)**

31. Mixture	32. Type of mixture	33. Separation
Water and chaff, Water and sand, Chaff, sand and water, Chaff and oil, Oil, chaff and water, Oil, sand and water, Oil, water, sand and chaff	Liquid-solid	Filtration, decantation
Chaff and sand	Solid-solid	Winnowing
Oil and water	Liquid-liquid	Decantation or using separating funnel

APPENDIX AE

GROUP LEVELS OF TESTEES

TESTEE	MARK	GROUP
RE001	100	U
RE002	100	U
RE003	99	U
RE004	99	U
RE005	97	U
SD006	97	U
RE007	96	U
RE008	94	U
RE009	92	U
SD010	92	U
RE011	91	U
RE012	90	U
RE013	90	U
RE014	88	U
RE015	88	U
SD016	87	U
RE017	87	U
RE018	86	U
RE019	86	U
AB020	86	U
RE021	85	U
BE022	84	U
RE023	83	U
RE024	83	U
RE025	82	U
RE026	82	U
RE027	82	U
RE028	81	U
AB029	81	U
RE030	81	U
BE031	80	U
RE032	80	U
RE033	80	U
BS034	80	U
RE035	79	U
RE036	79	U
SD037	77	U
RE038	77	U
RE039	76	U
BE040	76	U
BE041	76	U
BE042	76	U
BE043	75	U
RE044	75	U
RE045	75	U

SD046	75	U
BE047	74	U
AB048	74	U
BR049	73	U
SD050	73	U
RE051	73	U
RE052	73	U
AB053	73	U
RE054	73	U
RE055	72	U
RE056	72	U
RE057	72	U
SD058	72	U
RE059	71	U
BE060	70	U
BE061	70	U
RE062	70	U
BO063	70	U
SD064	70	U
HI065	69	U
SD066	69	U
RE067	69	U
RE068	69	U
SD069	69	U
SD070	68	U
RE071	68	U
BR072	68	U
AK073	68	U
SD074	68	U
BE075	67	U
SD076	67	U
RE077	67	U
RE078	67	U
AB079	67	U
AB080	67	U
BO081	67	U
SD082	67	U
SD083	67	U
SD084	67	U
RE085	66	U
SD086	66	U
BE087	65	U
RE088	65	U
RE089	65	U
RE090	65	U
BS091	65	U
SD092	65	U
SD093	65	U
BE094	64	U
RE095	64	U

RE096	64	U
RE097	64	U
AB098	64	U
AB099	64	U
AB100	64	U
SD101	64	U
RE102	63	U
RE103	63	U
AB104	63	U
AB105	63	U
AB106	63	U
BO107	63	U
RE108	63	U
RE109	63	U
BE110	62	U
EW111	62	U
BE112	61	U
EW113	61	U
EW114	61	U
BO115	61	U
SD116	61	U
AB117	61	U
RE118	61	M
GY119	61	M
SD120	60	M
BE121	60	M
BR122	60	M
AB123	60	M
RE124	60	M
HI125	59	M
BR126	59	M
BO127	59	M
AB128	59	M
AB129	59	M
BO130	59	M
BS131	59	M
BR132	58	M
HI133	58	M
BE134	58	M
AB135	58	M
BS136	58	M
BS137	58	M
SD138	58	M
BS139	57	M
AB140	57	M
AB141	57	M
BR142	57	M
BE143	57	M
SD144	57	M
SD145	56	M

SD146	56	M
RE147	56	M
RE148	56	M
RE149	56	M
RE150	56	M
RE151	56	M
SD152	56	M
AB153	56	M
EW154	56	M
BR155	56	M
BR156	55	M
BR157	55	M
BR158	55	M
BE159	55	M
BR160	55	M
EW161	55	M
AB162	55	M
BO163	55	M
BO164	55	M
RE165	55	M
GY166	55	M
BS167	55	M
AB168	54	M
AB169	54	M
AB170	54	M
AB171	54	M
BE172	54	M
BE173	54	M
HI174	54	M
HI175	54	M
BR176	54	M
RE177	54	M
GY178	54	M
PC179	54	M
BS180	54	M
BS181	54	M
SD182	54	M
AB183	53	M
AB184	53	M
GY185	53	M
BO186	53	M
BO187	53	M
BO188	53	M
BO189	53	M
BE190	53	M
BR191	53	M
BS192	53	M
SD193	52	M
BE194	52	M
BR195	52	M

BR196	52	M
RE197	52	M
AB198	52	M
PC199	52	M
AB200	52	M
AB201	52	M
RE202	52	M
BO203	52	M
SD204	52	M
BE205	51	M
BE206	51	M
BE207	51	M
BR208	51	M
BR209	51	M
HI210	51	M
RE211	51	M
GY212	51	M
AB213	51	M
AB214	51	M
AB215	51	M
AB216	51	M
BO217	51	M
SD218	51	M
HI219	50	M
BE220	50	M
BE221	50	M
BE222	50	M
BE223	50	M
BR224	50	M
RE225	50	M
BO226	50	M
AK227	50	M
AB228	50	M
AB229	50	M
AB230	50	M
RE231	50	M
BE232	49	M
HI233	49	M
HI234	49	M
HI235	49	M
RE236	49	M
BS237	49	M
BO238	49	M
EW239	49	M
EW240	49	M
AK241	49	M
AK242	49	M
BS243	49	M
SD244	49	M
SD245	49	M

SD246	49	M
BO247	48	M
BE248	48	M
BE249	48	M
AB250	48	M
AB251	48	M
AB252	48	M
EW253	48	M
EW254	48	M
GY255	48	M
GY256	47	M
AB257	47	M
BE258	47	M
BE259	47	M
BE260	47	M
BE261	47	M
BO262	47	M
BE263	47	M
BR264	47	M
HI265	47	M
BR266	47	M
GY267	47	M
SD268	46	M
GY269	46	M
HI270	46	M
HI271	46	M
HI272	46	M
BE273	46	M
BE274	46	M
BE275	46	M
BE276	46	M
BE277	46	M
AB278	46	M
AB279	46	M
BO280	46	M
BO281	46	M
AK282	46	M
SD283	46	M
BE284	45	M
HI285	45	M
BR286	45	M
AB287	45	M
AB288	45	M
AB289	45	M
AB290	45	M
GY291	45	M
BS292	45	M
EW293	44	M
EW294	44	M
AB295	44	M

PC296	44	M
PC297	44	M
PC298	44	M
AK299	44	M
AB300	44	M
BO301	44	M
GY302	44	M
BS303	44	M
BE304	44	M
BE305	44	M
BE306	44	M
BE307	44	M
BE308	44	M
BE309	44	M
HI310	44	M
HI311	44	M
BE312	43	M
BE313	43	M
BE314	43	M
BE315	43	M
PC316	43	M
HI317	43	M
HI318	43	L
EW319	43	L
EW320	43	L
AB321	43	L
GY322	43	L
GY323	43	L
SD324	43	L
HI325	42	L
BR326	42	L
GY327	42	L
BE328	42	L
GY329	42	L
AN330	42	L
EW331	42	L
EW332	42	L
BO333	42	L
BO334	42	L
SD335	42	L
BS336	41	L
BE337	41	L
BE338	41	L
BE339	41	L
AB340	41	L
AB341	41	L
AK342	41	L
BO343	41	L
EW344	41	L
SD345	41	L

GY346	41	L
BE347	41	L
BE348	40	L
HI349	40	L
HI350	40	L
AK351	40	L
PC352	40	L
PC353	40	L
EW354	40	L
EW355	40	L
EW356	40	L
BO357	40	L
BR358	39	L
BE359	39	L
BR360	39	L
AK361	39	L
AB362	39	L
AB363	39	L
PC364	39	L
PC365	39	L
PC366	39	L
GY367	39	L
GY368	38	L
AK369	38	L
AK370	38	L
BE371	38	L
BR372	38	L
AK373	38	L
PC374	38	L
PC375	38	L
GY376	38	L
GY377	38	L
BS378	38	L
HI379	37	L
PC380	37	L
AK381	37	L
AB382	37	L
GY383	37	L
GY384	37	L
BS385	37	L
SD386	37	L
GY387	36	L
AK388	36	L
AK389	36	L
AK390	36	L
EW391	36	L
EW392	36	L
BE393	36	L
EW394	35	L
EW395	35	L

BE396	35	L
HI397	35	L
AK398	35	L
AK399	35	L
AK400	35	L
PC401	34	L
HI402	34	L
HI403	34	L
HI404	34	L
AK405	34	L
AB406	33	L
EW407	33	L
EW408	33	L
EW409	33	L
AK410	33	L
AK411	33	L
AB412	33	L
PC413	33	L
GY414	33	L
BS415	33	L
BS416	33	L
HI417	32	L
EW418	32	L
PC419	32	L
PC420	32	L
AK421	32	L
EW422	31	L
PC423	31	L
AK424	31	L
AK425	30	L
AK426	30	L
AK427	29	L
AK428	28	L
SD429	28	L
AK430	27	L
GY431	26	L
EW432	22	L
PC433	20	L
BE434	20	L

APPENDIX AF

RELIABILITIES OF TEST COMPONENTS

KUDER-RICHSON COFFIECIENT RELIABILITIES OF OBJECTIVE TEST ITEMS

COMPUTATION OF STANDARD DEVIATION AND VARIANCE OF OBJECTIVE TESTS SECTIONS

Descriptive Statistics

	N	Std. Deviation	Variance	Skewness	
	Statistic	Statistic	Statistic	Statistic	Std. Error
ADTMATHSOBJESCTIVES	30	2.66631	7.109	-.449	.427
ADTINTEGRATED SCIENCEOBJECTIVES	30	2.96338	8.782	-.213	.427
TAMOBJECTIVES	30	3.33580	11.128	-.235	.427
TAISOBJECTIVES	30	3.67283	13.490	-.270	.427
MIM/FTMOBJECTIVES	30	4.91584	24.166	-.532	.427
MIIS/FTISOBJECTIVES	30	4.85052	23.528	-.604	.427
Valid N	30				

(*Source*, *SPSS V23*)

$KR_{20} = \frac{n}{n-1}(1 - \frac{\Sigma pq}{\delta})$

Where **n** is the number of items in the test

pq *is* the item variance ***(See Appendix 9, 11, 13, 15, 16 and 17 for ADT (MATHEMATIS), ADT (INTEGRATED SCIENCE), TAM, TAIS, MIM and MIIS respectively)*** and

δ is the variance of the test.

SECTION A OF ADT (MATHEMATICS)

$KR_{20} = \frac{15}{15-1}(1 - \frac{3.14}{7.11})$

KR_{20} = 1.0714(1- 0.4416)

KR_{20} = 1.0714(0.5584)

KR_{20} = 0.60

SECTION A OF ADT (INTEGRATED SCIENCE)

$KR_{20} = \frac{15}{15-1}(1 - \frac{3.30}{8.78})$

KR_{20} = 1.0714(1- 0.3759)

KR_{20} = 1.0714(0.6241)

KR_{20} = 0.67

SECTION A OF TAM

$KR_{20} = \frac{20}{20-1}(1 - \frac{4.70}{11.13})$

KR_{20} = 1.0526(1- 0.4224)

KR_{20} = 1.0526(0.5776)

KR_{20} = 0.61

SECTION A OF TAIS

$KR_{20} = \frac{20}{20-1}(1 - \frac{4.28}{13.49})$

KR_{20} = 1.0526(1- 0.3173)

KR_{20} = 1.0526(0.6827)

KR_{20} = 0.72

SECTION A OF MIM/FTM

$KR_{20} = \frac{20}{20-1}(1 - \frac{4.50}{24.17})$

KR_{20} = 1.0526(1- 0.1862)

KR_{20} = 1.0526(0.8138)

$KR_{20} = 0.86$

SECTION A OF MIIS/FTIS

$KR_{20} = \frac{20}{20-1}(1 - \frac{4.3}{23.53})$

$KR_{20} = 1.0526(1- 0.1827)$

$KR_{20} = 1.0526(0.8173)$

$KR_{20} = 0.86$

INTER-RATER CORRELATION RELIABILITY

ADT (MATHEMATICS) SECTION B

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.942	.949	2

(*Source, SPSS V23*)

ADT (MATHEMATICS) SECTION C

Reliability Statistics		
Cronbach's Alpha	**Cronbach's Alpha Based on Standardized Items**	**N of Items**
.978	**.983**	**2**

(*Source, SPSS V23*)

ADT (INTEGRATED SCIENCE) SECTION B

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.970	.975	2

(*Source, SPSS V23*)

ADT (INTEGRATED SCIENCE) SECTION C

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.959	.962	2

(*Source, SPSS V23*)

TAM SECTION B

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.942	.943	2

(*Source, SPSS V23*)

TAIS SECTION B

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.934	.934	2

(*Source, SPSS V23*)

PAM

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.967	.975	2

(*Source, SPSS V23*)

PAIS

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.945	.946	2

(*Source*, *SPSS V23*)

MIM/FTM SECTION B

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.977	.978	2

(*Source*, *SPSS V23*)

MIM/FTM SECTION C

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.983	.984	2

(*Source*, *SPSS V23*)

MIIS/FTIS SECTION B

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.901	.912	2

(*Source*, *SPSS V23*)

MIIS/FTIS SECTION C

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.957	.959	2

(*Source*, *SPSS V23*)

APPENDIX AG

RELIABILITY OF THE MAIN STUDY

Reliability Statistics	
Cronbach's Alpha	N of Items
.795	6

(*Source, SPSS V23*)

APPENDIX AH

SUMMARY OF THE ITEM ANALYSIS FOR SECTION A OF MATHEMATICS ADT

Item	Difficulty level (*p*)	Discrimination Index (D)
1	0.9	0.4
2	0.9	0.3
3	0.5	0.5
4	0.7	0.5
5	0.8	0.1***
6	0.7	0.5
7	0.9	0.0***
8	0.8	0.2***
9	0.9	0.0***
10	0.6	0.6
11	0.7	0.6
12	0.6	0.4
13	0.9	0.0***
14	0.5	0.6
15	0.7	0.3
16	0.7	0.3
17	0.6	0.4
18	0.7	0.4
19	0.6	0.6
20	0.6	0.5

APPENDIX AI

ACCEPTED ITEMS FOR MATHEMATICS ADT

New Item	Old Item	Number of students who correctly answered the item	Difficulty level (Proportion Correct) $p = \frac{R}{T}$	q = 1-p	Item Variance (pq)	Discrimination Index (D)
1	1	26	0.9	0.1	0.09	0.4
2	2	26	0.9	0.1	0.09	0.3
3	3	16	0.5	0.5	0.25	0.5
4	4	20	0.7	0.3	0.21	0.5
5	6	21	0.7	0.3	0.21	0.5
6	11	22	0.7	0.3	0.21	0.6
7	15	21	0.7	0.3	0.21	0.3
8	16	20	0.7	0.3	0.21	0.3
9	18	20	0.7	0.3	0.21	0.4
10	10	18	0.6	0.4	0.24	0.6
11	12	17	0.6	0.4	0.24	0.4
12	17	17	0.6	0.4	0.24	0.4
13	19	18	0.6	0.4	0.24	0.6
14	20	18	0.6	0.4	0.24	0.5
15	14	14	0.5	0.5	0.25	0.6
Total			**10.0**		**3.14**	

APPENDIX AJ

SUMMARY OF THE ITEM ANALYSIS FOR SECTION A OF INTEGRATED SCIENCE ADT

Item	Difficulty level (*p*)	Discrimination Index (D)
1	0.9	0.3
2	0.6	0.4
3	1.0	0.1***
4	0.6	0.4
5	1.0	0.0***
6	0.7	0.5
7	0.6	0.4
8	0.4	0.6
9	0.5	0.6
10	0.6	0.6
11	0.9	0.2 ***
12	0.8	0.3
13	0.7	0.5
14	0.5	0.5
15	0.6	0.3
16	0.9	0.1***
17	0.7	0.3
18	0.6	0.3
19	0.6	0.4
20	0.9	0.2***

APPENDIX AK

ACCEPTED ITEMS FOR INTEGRATED SCIENCE ACHIEVEMENT DETERMINATION TEST (PART II)

New item Number	Old Item Number	Number of students who correctly answered the item	Difficulty level (Proportion Correct) $p = \frac{R}{T}$	q = 1-*p*	Item Variance	Discrimination Index (D)
1	1	26	0.9	0.1	0.09	0.3
2	12	23	0.8	0.2	0.16	0.3
3	6	20	0.7	0.3	0.21	0.5
4	13	21	0.7	0.3	0.21	0.5
5	17	20	0.7	0.3	0.21	0.3
6	2	17	0.6	0.4	0.24	0.4
7	4	19	0.6	0.4	0.24	0.4
8	7	18	0.6	0.4	0.24	0.4
9	10	17	0.6	0.4	0.24	0.6
10	15	18	0.6	0.4	0.24	0.3
11	18	17	0.6	0.4	0.24	0.3
12	19	18	0.6	0.4	0.24	0.4
13	9	15	0.5	0.5	0.25	0.6
14	14	15	0.5	0.5	0.25	0.5
15	8	13	0.4	0.6	0.24	0.6
Total			**9.4**		**3.30**	

APPENDIX AL

SUMMARY OF THE ITEM ANALYSIS MATHEMATICS TRADITIONAL ASSESSMENT SECTION A

Item	Difficulty level	Discrimination Index
1	0.9	0.0***
2	0.8	0.1***
3	0.8	-0.1***
4	0.9	0.3
5	0.6	0.4
6	0.6	0.5
7	0.5	0.4
8	0.8	0.0***
9	0.6	0.4
10	0.7	0.1***
11	0.6	0.5
12	0.8	-0.1***
13	0.8	0.1***
14	0.8	0.3
15	0.6	0.4
16	0.5	0.4
17	0.6	0.4
18	0.8	-0.2***
19	0.8	0.0***
20	0.5	0.4
21	0.9	0.0***
22	0.5	0.3
23	0.4	0.5
24	0.6	0.4
25	0.5	0.5
26	0.4	0.3
27	0.6	0.4
28	0.5	0.3
29	0.6	0.3
30	0.6	0.3

APPENDIX AM

ACCEPTED ITEMS FOR MATHEMATICS TRADITIONAL ASSESSMENT SECTION A

New Item	Old Item	Number of students who correctly answered the item	Difficulty level (Proportion Correct) $p = \frac{R}{T}$	q = 1-p	Item Variance (pq)	Discrimination Index (D)
1	4	26	0.9	0.1	0.09	0.3
2	5	18	0.6	0.4	0.24	0.4
3	6	18	0.6	0.4	0.24	0.3
4	7	16	0.5	0.5	0.25	0.4
5	14	21	0.7	0.3	0.21	0.3
6	9	19	0.6	0.4	0.24	0.4
7	11	18	0.6	0.4	0.24	0.5
8	15	18	0.6	0.4	0.24	0.4
9	16	14	0.5	0.5	0.25	0.4
10	17	18	0.6	0.4	0.24	0.4
11	20	16	0.5	0.4	0.24	0.4
12	24	19	0.6	0.4	0.24	0.4
13	27	17	0.6	0.4	0.24	0.4
14	29	19	0.6	0.4	0.24	0.3
15	30	17	0.6	0.4	0.24	0.3
16	22	14	0.5	0.5	0.25	0.3
17	25	16	0.5	0.5	0.25	0.5
18	28	15	0.5	0.5	0.25	0.3
19	23	13	0.4	0.6	0.24	0.5
20	26	12	0.4	0.6	0.24	0.4
Total			**11.5**		**4.7**	

APPENDIX AN

SUMMARY OF THE ITEM ANALYSIS FOR SECTION A OF TRADITIONAL ASSESSMENT INTEGRATED SCIENCE

Item	Difficulty level (*p*)	Discrimination Index (D)
1	0.5	0.5
2	0.8	0.0***
3	0.4	0.4
4	0.5	0.4
5	0.5	0.3
6	0.8	- 0.1***
7	0.6	0.5
8	0.5	0.4
9	0.6	0.3
10	0.7	0.0***
11	0.5	0.6
12	0.5	0.5
13	0.6	0.3
14	0.7	0.4
15	0.7	0.4
16	0.7	0.3
17	0.7	-0.3***
18	0.6	0.0***
19	0.5	0.5
20	0.6	0.4
21	0.5	0.5
22	0.4	0.3
23	0.7	- 0.2***
24	0.5	0.3
25	0.8	0.1***
26	0.7	0.1***
27	0.7	-0.2***
28	0.5	0.3
29	0.5	0.4
30	0.7	-0.1***

APPENDIX AO

ACCEPTED ITEMS FOR INTEGRATED SCIENCE TRADITIONAL ASSESSMENT

New Item	Old Item	Number of students who correctly answered the item	Difficulty level (Proportion Correct) $p = \frac{R}{T}$	q = 1-p	Item Variance (pq)	Discrimination Index (D)
1	14	20	0.7	0.3	0.21	0.4
2	15	20	0.7	0.3	0.21	0.4
3	16	20	0.7	0.3	0.21	0.3
4	7	19	0.6	0.4	0.24	0.5
5	9	19	0.6	0.4	0.24	0.3
6	13	19	0.6	0.4	0.24	0.3
7	20	18	0.6	0.4	0.24	0.4
8	1	14	0.5	0.5	0.25	0.5
9	4	14	0.5	0.5	0.25	0.4
10	5	14	0.5	0.5	0.25	0.3
11	8	14	0.5	0.5	0.25	0.4
12	11	15	0.5	0.5	0.25	0.6
13	12	14	0.5	0.5	0.25	0.5
14	19	16	0.5	0.5	0.25	0.5
15	21	16	0.5	0.5	0.25	0.5
16	24	15	0.5	0.5	0.25	0.3
17	28	15	0.5	0.5	0.25	0.3
18	29	16	0.5	0.5	0.25	0.4
19	3	12	0.4	0.6	0.24	0.4
20	22	13	0.4	0.6	0.24	0.3
Total			**10.8**		**4.28**	

APPENDIX AP

ITEM DIFFICULTY INDEX FOR SECTION A OF MATHEMATICS MIXED ITEMS AND FINAL TEST

New Item	Old Item	Number of students who correctly answered the item	Difficulty level (Proportion Correct) $p = \frac{R}{T}$	q = 1-p	Item Variance (pq)
1	1	28	0.9	0.1	0.09
2	2	25	0.8	0.2	0.16
3	3	19	0.6	0.4	0.24
4	4	17	0.6	0.4	0.24
5	5	22	0.7	0.3	0.21
6	6	21	0.7	0.3	0.21
7	7	20	0.7	0.3	0.21
8	8	19	0.6	0.4	0.24
9	9	16	0.5	0.5	0.25
10	14	21	0.7	0.3	0.21
11	10	19	0.6	0.4	0.24
12	11	17	0.6	0.4	0.24
13	12	18	0.6	0.4	0.24
14	13	18	0.6	0.4	0.24
15	15	19	0.6	0.4	0.24
16	17	19	0.6	0.4	0.24
17	18	17	0.6	0.4	0.24
18	16	16	0.5	0.5	0.25
19	19	14	0.5	0.5	0.25
20	20	15	0.5	0.5	0.25
Total			**12.5**		**4.5**

APPENDIX AQ

ITEM DIFFICULTY INDEX FOR SECTION A OF INTEGRATED SCIENCE MIXED ITEMS AND FINAL TEST

New Item	Old Item	Number of students who correctly answered the item	Difficulty level (Proportion Correct) $p = \frac{R}{T}$	q = 1-p	Item Variance (pq)
1	1	25	0.8	0.2	0.16
2	2	24	0.8	0.2	0.16
3	3	24	0.8	0.2	0.16
4	5	23	0.8	0.2	0.16
5	6	24	0.8	0.2	0.16
6	15	23	0.8	0.2	0.16
7	4	22	0.7	0.3	0.21
8	7	21	0.7	0.3	0.21
9	14	22	0.7	0.3	0.21
10	8	19	0.6	0.4	0.24
11	9	18	0.6	0.4	0.24
12	10	18	0.6	0.4	0.24
13	11	19	0.6	0.4	0.24
14	12	19	0.6	0.4	0.24
15	13	19	0.6	0.4	0.24
16	16	19	0.6	0.4	0.24
17	17	17	0.6	0.4	0.24
18	18	18	0.6	0.4	0.24
19	19	15	0.5	0.5	0.25
20	20	15	0.5	0.5	0.25
Total			**13.3**		**4.3**

APPENDIX AR

ETHICAL CLARANCE

UNIVERSITY OF CAPE COAST
COLLEGE OF EDUCATION STUDIES
ETHICAL REVIEW BOARD

UNIVERSITY POST OFFICE
CAPE COAST, GHANA

Our Ref: CES-ERB/ucc.edu/v5/21-57

Date: 17th June, 2021

Your Ref: ....

Chairman, CES-ERB
Prof. J. A. Omotosho
jomotosho@ucc.edu.gh
0243784739

Vice-Chairman, CES-ERB
Prof. K. Edjah
kedjah@ucc.edu.gh
0244742357

Secretary, CES-ERB
Prof. Linda Dzama Forde
lforde@ucc.edu.gh
0244786680

Dear Sir/Madam,

ETHICAL REQUIREMENTS CLEARANCE FOR RESEARCH STUDY

The bearer, Patience Langee, Reg. No. EF/MEP/18/5005 is an M.Phil. / ~~Ph.D.~~ student in the Department of Education and Psychology in the College of Education Studies, University of Cape Coast, Cape Coast, Ghana. ~~He~~/ She wishes to undertake a research study on the topic:

A comparative study of high and low ability junior high school students' achievement in Mathematics and Science using traditional and performance assessment in Ahanta West Municipality.

The Ethical Review Board (ERB) of the College of Education Studies (CES) has assessed ~~his~~/her proposal and confirm that the proposal satisfies the College's ethical requirements for the conduct of the study.

In view of the above, the researcher has been cleared and given approval to commence ~~his~~/her study. The ERB would be grateful if you would give ~~him~~/her the necessary assistance to facilitate the conduct of the said research.

Thank you.
Yours faithfully,

Prof. Linda Dzama Forde
(Secretary, CES-ERB)