RELATIONSHIP BETWEEN MATHEMATICAL COMMUNICATION SKILLS AND MATHEMATICS PERFORMANCE OF SECONDARY SCHOOL STUDENTS IN KUTIGI EDUCATIONAL ZONE, NIGER STATE

BY

IDRIS, Abdullahi
MTech/SSTE/2018/8442

DEPARTMENT OF SCIENCE EDUCATION
SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION
FEDERAL UNIVERSITY OF TECHNOLOGY MINNA, NIGER STATE.

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ABSTRACT

This study investigated the relationship between Mathematical communication skills and Mathematics performance of secondary school students in Kutigi Educational Zone of Niger State. Six research questions and hypotheses were used for the study. A correlational research design was adopted for the study. The sample of the study was made up of 269 (179 males and 90 females) students drawn from the target population of 858 students. The research instrument used was Mathematical Communication Skills Test (MCST). The instrument was validated by experts from Department of Science Education, Federal University of Technology Minna and a secondary school Mathematics Teacher. The reliability of instrument five (5) constructs were 0.82, 0.74, 0.81, 0.70 and 0.71 respectively with the average reliability of 0.76 using PPMC coefficients. Students Promotion Examination Scores of Mathematics was used as their Mathematics Performance. Research questions were answered using Mean and Standard deviation with Scatterplots while hypotheses were tested using PPMC at 0.05 level of significance. The results indicated that Mathematical Communication Skills of the secondary school students were low. Also, the Mathematical Communication Skills studied were contributors to Mathematics performance of secondary school students. Similarly, there was positive relationship between Gender and Mathematical Communication Skills of secondary school students. The study recommended that mathematics teachers should adopt a good measure to strengthen these Mathematical communication skills during teaching and learning process to enhance students' performance in Mathematics.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the study

Mathematics is all around us in everything we do. It is the building block for everything in our daily activities, including mobile devices, computers, software, architecture (ancient and modern), art, money, engineering, social sciences, education, medicine and even sports. Since the beginning of recorded history, Mathematics has been at the front line of every civilized society (Elaine & Jonathan, 2021).

Mathematics is defined in Wikipedia (2019) as a subject developed from counting, calculation, measurement, and the systematic study of the shapes and motions of physical objects; Mathematics seeks and uses patterns to formulate new conjectures and resolve the truth with falsity conjectures via Mathematical proof. That is, when Mathematical structures are good models of natural phenomena, then mathematical reasoning can provide insight or prediction about nature through abstraction and logic. Awodu and Ojo (2013) defined mathematics as an intrinsic component of science that serves as a universal language and indispensable source of intellectual tools. This language can describe and analyze anything in the universe since it touches every aspect of life.

Mathematics's important role in education is derived from cultural, utilitarian and interdisciplinary values that the subject seeks to teach. Mathematics is so vital to the extent that all the beautiful things that are done by computers today, using computer programmes, are done ultimately using just two symbols that are equivalent to the numerals 1 and 0 of Mathematics. Odual (2013) stated that the Federal Government of Nigeria has made mathematics a core and compulsory subject in the curriculum of primary and secondary schools and a prerequisite to gaining admission into any tertiary

institution in the country due to its importance attached to technological development. Puspa *et al*. (2019) suggested that Mathematics should be taught to understand students since all fields of study require appropriate Mathematical skills that provide powerful, concise, and clear communication mediums needed to present information in various ways. Moreover, Mathematics improves the ability of logical thinking, precision, spatial awareness and gives satisfaction to the effort to solve challenging problems.

Despite the relevance and usefulness of Mathematics in realizing national development and aspiration, students' performance in secondary schools Mathematics is still unsteady and has caused a lot of concern for many years to parents, other stakeholders and most especially to Mathematics educators (Abdullahi, 2016). The trends of performance of students in Mathematics for 2015 – 2020 show that only 38 to 40% of the candidates who sat for the mathematics examinations in West African Examination Council (WAEC) obtained a credit pass and above (WAEC Head of National Office report, 2015 - 2020) see Appendix A. This shows that the student's performance in Mathematics is still low, thereby questioning issue of quality education among stakeholders in Mathematics and members of the public in Niger state.

Bhairab (2017) defines mathematics performance as the competence shown by the students in Mathematics over time. Performance is the act of something done successfully, especially with efforts or skills; it is the end product of learning experiences, what students have gained from what they have learnt (Odual, 2013). Hence, performance has to do with results obtained in a subject or subjects in a teacher-made test, examination, or standardised examination over time.

Various researchers have identified numerous factors as being responsible for students' low performance in Mathematics. Such factors are students' attitude toward learning

mathematics, teachers' attitude to teaching mathematics, use of instructional materials, and teaching methods (Abdullahi, 2016). Students' characteristics, instructional/classroom characteristics, teachers' characteristics, societal factors and school factors are findings of (Ajogbeje and Ojo, 2016). Socio-economic status, gender, prior Mathematics achievement, parental support, peer influence, students' perception of good classroom assessment, school and class climate, attitude toward mathematics, and parental support (Henry *et al*., 2015). School factors, overcrowding and Mathematical abilities (Odual, 2013).

Sutama *et al.* (2019) stated that the weakness of students in Mathematical communication skills had been linked to students answering questions through the examples given by the teacher. Since, some teachers are more concerned with the correct answers than how students can think logically about Mathematics, communicate ideas orally or in writing, or learn to take responsibility for their opinions. Communication takes place in every aspect of life, both within and outside the school environment. In the school environment, communication is widely used in the teaching and learning process. Septiana *et al.* (2018) defined communication as a process of transmitting information, idea, emotion and ability through symbols, words, pictures and numbers. Every student needs good communication skill to be able to solve various problems related to Mathematics. According to Lomibao *et al.* (2016), communication skills are the students' ability to express their ideas, describe, and discuss Mathematical concepts coherently and clearly. Also, the students can explain and justify action in procedure and process both orally and in writing. Strayer and Brown (2012) pointed out that learning can be promoted through good interactions and communication. Likewise, when students are encouraged to interact with others, they can communicate, construct individual understanding, symbolizing and concept formation.

Symbolizing and Communicating in Mathematics classrooms relate to how students attribute meaning to Mathematical symbols and how they become Mathematical symbol users (Puspa *et al.,* 2019). Furthermore, communication in Mathematics involves making use of the process of reading, writing, speaking, listening and thinking as one communicates with one's self, other people, computer, books, and other aids to the storage, retrieval and use of the collected Mathematical knowledge of the world (Sammons 2018). Hence, teachers require good Mathematical communication skills to be able to lead students to solve Mathematics problems. Mathematical communication skills have been defined by Septiana *et al.* (2018) as the ability of a person to write a Mathematical statement, reason or provide an explanation of each Mathematical argument used to solve the Mathematics problem using terms, tables, diagrams, notations, or Mathematics formula properly and check or evaluate another Mathematical thought.

Febry *et al.* (2017) list out Mathematical communication skills to include; the use of Mathematical language that is realized in the form of oral, written, or visual; the use of Mathematical representations that are discovered in the form of written or visual; and clarity of presentation, namely interpreting Mathematical ideas, using the Mathematical terms or notations to represent Mathematical ideas, as well as describe the relationships or Mathematical approach. Hence, the skills required to communicate mathematically effectively are problem-solving, reasoning, connecting and representing, among other skills.

Principles and Standards for School Mathematics, published by the National Council of Teachers of Mathematics (NCTM) in 2014, outline the essential skills of a high-quality school Mathematics communication, including problem-solving, reasoning and proof, communication, connections, and representation. Clever (2020) referred to Problem-solving skills as the ability to solve problems effectively and timely without any

impediments. It involves identifying and defining the problem, generating alternative solutions, evaluating and selecting the best alternative, and implementing the selected key. Since we face problems all the time, some of which are more complex than the others, either big problems or small ones, this skill can help solve it effectively.

National Council of Teachers of Mathematics (NCTM) cited in Sammons (2018) stated that, where good problem solvers monitor and reflects on the process of mathematical problem-solving and adjust their use of strategies as needed, such reflective skills are much more likely to develop in a classroom environment that supports them. For example, if T = {prime numbers} and M = {odd numbers} are subsets of $\mu = \{x: 0 < x \leq 10$, and x is an integer$\}$, find $(T^I \text{ n } M^I)$, the student is expected to list out the parameters then solve the given problem as follows; $\mu = \{1,2,3,4,5,6,7,8,9,10\}$ $T = \{2,3,5,7\}$ $M = \{1,3,5,7,9\}$ $T^1 = \{1,4,6,8,9,10\}$ $M^1 = \{2,4,6,8,10\}$ $T^1 \cap M^1 = \{4,6,8,10\}$. The venn diagram can also be used to represent the information to ease the problem-solving as shown in the appendix. This standard requires that teachers to establish a learning environment in which students develop the habit of reflection through conversation, beginning in the early grades.

Another skill considered in this study was reasoning skills. Gulumser (2013) stated that reasoning skills is the ability to understand the logic behind Mathematical rules, generalization and solutions; and the ability to go beyond memorization of Mathematical formulas. According to Gunhan (2014), secondary school students must evaluate conjectures and assertions, reason deductively and inductively by formulating Mathematical assertions, and develop and maintain their reasoning skills. Gurbuz and Erdem (2016) also opined that reasoning includes abilities like following and assessing chains of arguments, knowing what a proof is and how it differs from other kinds of sense, uncovering the basic ideas in a given line of view, and devising formal and informal

discussions. For example, the foot of a ladder is 6m from the base of an electric pole. The top of the ladder rest against the pole at a point 8m above the ground. How long is the ladder? To answer this, the Pythagoras theorem can be used to find the length (L) of the ladder. From Pythagoras theorem, $\text{hypotenuse}^2 = \text{opposite}^2 + \text{adjacent}^2$; hypotenuse = L, opposite = 8m adjacent = 6m therefore, length of the ladder, $L^2 = 8^2 + 6^2 \rightarrow L = \sqrt{100} = 10$m. The students are expected to represent the information in a triangle, then proof the length of the ladder using Pythagoras theorem. Also for the student to be able communicate effectively in Mathematics the student must have ability to connect or relate concepts in Mathematics with each other.

Haji *et al.* (2017) referred to connection skills as the ability to link between components in Mathematics, the Mathematics to other disciplines, and between Mathematics to everyday life. Haji et al further opined that since Mathematics is a science that includes a lot of relations between concepts, there is the need for the links between the concept of relationship with the concept of function, the linking of the addition operations with multiplication operations on numbers, the linking of the concept of the derivative function with the concept of profit and loss in the economic field as well as the linking of the concept of the exponential growth of bacteria. For example, H varies directly as p and inversely as the square of y. If H = 1, p = 8 and y = 2, find H in terms of p and y? The student should be able relates the concepts to solve this problem as $H \propto \frac{p}{y^2}$; $H = \frac{kp}{y^2}$ (k is the proportionality constant), if H = 1, P =8, y = 2 then $1 = \frac{k \text{ x } 8}{2^2} \rightarrow 1 = \frac{8k}{4} \rightarrow 1 = 2k \rightarrow k = \frac{1}{2}$ Substituting $k = \frac{1}{2}$ in $H = \frac{kp}{y^2}$ yield $H = \frac{p}{2y^2}$.

Ndiung and Fransiskus (2018) opined that to build a coherent curriculum and foster connections, the big ideas from one topic must be built on in others so that students are allowed to use familiar concepts in new settings. Students cannot also escape using tables,

graphs, diagrams and figures in Mathematics for them to be able to achieve better in Mathematics since they are expected to have the skill of representation. Representation skills are the ability to express Mathematical ideas or concepts through the use of multiple tools such as words, tables, drawings or tangible materials (Arman, 2019). Aflich *et al.* (2018) claimed that the representation in the form of words, graphs, tables, and statements is a learning approach that provides an opportunity to present students' ideas in learning Mathematical concepts without any restrictions.

Arman (2019) pointed out that Mathematical representation makes the concepts and relationships clearer and solid, helps the student to understand the components of knowledge more comprehensively and in detail by identifying the common mathematical elements of the different situations of concepts, in addition to helping them to focus on the basic characteristics of Mathematical concepts and to use them to solve life problems. For example, the following scores are obtained by students in a test: 8, 18, 10, 14, 18, 11, 13, 14, 13, 17, 15, 8, 16, 13. Find the mode and mean of the distribution? This can be solved as follows: since mode is the number that appears the most. Therefore, the mode of the dataset is 13. Whereas, Mean = $\frac{\Sigma x}{n}$ $=\frac{8+8+10+11+13+13+13+14+14+15+16+17+18+18}{14} = \frac{288}{14}$ = 13.4. this can also be answered by representing the information on the table as shown in the appendix. Also, in consideration in this study is the Mathematical communication skills of secondary school students based on gender.

Gender is a moderating variable which is taken into consideration in this study. Some researchers put male and female discrepancy in Mathematics performance in favour of males performing better than their female counterparts to be as a result of the female belief towards Mathematics. Mawaddah *et* al. (2018) opines that psychologically males and females are different; females are more interested

in real life issues, whereas males are more interested in abstract aspects. They further states that the difference between males and females in learning Mathematics is that males are superior in reasoning, whereas females are superior in accuracy, precision, carefulness, and thoughtfulness.

Moreover, opportunities to communicate play an essential role in Mathematics performance. Based on this background, this study examine the relationship between Mathematical communication skills and Mathematics performance of secondary school students in Kutigi Educational Zone of Niger State.

1.2 Statement of the research problem

There are some abstract concepts in Mathematics that students need to understand to enable them communicate effectively in Mathematics. Despite the effort made by the Niger state government to revamp the quality of education in the state by adopting certain interventions such as seminars, workshops and conferences to boost the teachers' quality of instructional delivery to students and in helping them perform better in their academic pursuit, observations and reports from examining bodies revealed that a high percentage of secondary school students failed Mathematics examinations and the failure often generated much concern especially, to parents, teachers, students and other stakeholders (Abdullahi, 2016).

Several factors such as: teachers' attitude to teaching of Mathematics; students attitude towards Mathematics; methods of teaching Mathematics; use of instructional materials; socio-economic status; gender; prior knowledge in Mathematics; parental support; peer influence; students' perception of good classroom assessment; school and class climate; and overcrowding among others had been identified by various researchers as being responsible for low performance in Mathematics (Odual 2013; Henry et al., 2015 and

Abdullahi, 2016). Little or no attention has been given to Mathematical communication skills of students, whereas communication plays significant role in learning Mathematics.

To the best of researcher's knowledge, no attention has been given to Mathematical Communication Skills in relation to Mathematics performance of secondary school students in Niger State. Because, most of the reviews that related to present study are done based on personality and some outside the geogrphical location of present study. However, this study examines the relationship between Mathematical communication skills and Mathematics performance of secondary school students in Kutigi Educational Zone of Niger State.

1.3 Aim and objectives of the study

The aim of this study was to examine the relationship between Mathematical communication skills and Mathematics performance of secondary school students in Kutigi Educational Zone of Niger State. Specifically, the study sets out to achieve the following objectives:

1. to determine the relationship between Mathematical communication skills and Mathematics performance of secondary school students in Kutigi Educational Zone of Niger State;
2. to find out the relationship between problem-solving skills and Mathematics performance of secondary school students in Kutigi Educational Zone of Niger State;
3. to find out the relationship between proofs and reasoning skills and Mathematics performance of secondary school students in Kutigi Educational Zone of Niger State;
4. to find out the relationship between connection skills and Mathematics performance of secondary school students in Kutigi Educational Zone of Niger State;

5. to determine the relationship between representation skills and Mathematics performance of secondary school students in Kutigi Educational Zone of Niger State; and
6. to determine the relationship between gender and Mathematical communication skills of secondary school students in Kutigi Educational Zone of Niger State.

1.4 Research questions

From the objectives of the study, six research questions were raised to guide the study.

1. What is the relationship between Mathematical communication skills and Mathematics performance of secondary school students in Kutigi Educational Zone of Niger State?
2. What is the relationship between problem-solving skills and Mathematics performance of secondary school students in Kutigi Educational Zone of Niger State?
3. What is the relationship between proofs and reasoning skills and Mathematics performance of secondary school students in Kutigi Educational Zone of Niger State?
4. What is the relationship between connection/relation skills and Mathematics performance of secondary school students in Kutigi Educational Zone of Niger State?
5. What is the relationship between representation skills and Mathematics performance of secondary school students in Kutigi Educational Zone of Niger State?
6. What is the relationship between gender and Mathematical communication skills of secondary school students in Kutigi Educational Zone of Niger State?

1.5 Research hypotheses

Six null hypotheses were also formulated based on the raised research questions and tested at 0.05 significance level.

H_{O1}: There is no significant relationship between Mathematical communication skills and Mathematics performance of secondary school students in Kutigi Educational Zone of Niger State

H_{O2}: There is no significant relationship between problem-solving skills and Mathematics performance of secondary school students in Kutigi Educational Zone of Niger State

H_{O3}: There is no significant relationship between proofs and reasoning skills and Mathematics performance of secondary school students in Kutigi Educational Zone of Niger State

H_{O4}: There is no significant relationship between connection skills and Mathematics performance of secondary school students in Kutigi Educational Zone of Niger State

H_{O5}: There is no significant relationship between representation skills and Mathematics performance of secondary school students in Kutigi Educational Zone of Niger State

H_{O6}: There is no significant relationship between Gender and Mathematical communication skills of secondary school students in Kutigi Educational Zone of Niger State

1.6 Significance of the study

The secondary school students and teachers, curriculum planners, future researchers and government would benefit from the result of this study.

Findings of this study would be of benefit to secondary school students by enabling them to organize their Mathematical thinking and communicate with their peers and their teachers effectively in Mathematics. It will arouse their interest and facilitate their performance in Mathematics.

It is important that as an educator one is able to understand the students' knowledge of a Mathematical concept. Findings of the study will help the teachers to check the students' weak areas and adjust in improving the quality of their instruction in line with the planned professional practices expected, so as to make expressing their Mathematics ideas easier.

The outcome of the study will serve as a guide to curriculum planners in planning the curriculum that will suit the abilities, level, characteristics, and needs of the learners and provide future researchers with proper research evidence in researching this area.

The government of Nigeria would also use the findings of this study as a guide in ensuring that the Ministry of Education carries out adequate supervision and evaluation of secondary schools, so that duties delegated to teachers are effectively and efficiently managed as expected. It will also enable the government to organize in-service training programmes for Mathematics teachers through workshops, seminars, and conferences to equip them with more new skills to improve their quality of instructional delivery.

1.7 Scope of the study

The geographical location of this study was Kutigi Educational Zone which comprises of Lavun, Edati and Mokwa local government areas of Niger State. The study was delimited to Senior Secondary School two (SS 2) students who have almost covered the senior

secondary school Mathematics syllabus in Kutigi Educational Zone. The content of the study covers Mathematics syllabus related to number and numeration, algebraic process, geometry, probability and statistics as contained in the Senior Secondary School two (SS 2) Mathematics curriculum. Mathematical Communication Skills is the independent variable; Mathematics performance is the dependent variable while Students Gender was considered moderating variables under study. Test was the instrument used for this study with Students Promotion examination scores also, this study last for the period of six (6) weeks.

1.8 Operational definition of terms

Skills: ability to understand, interpret, and express Mathematical situations in written form.

Problem solving skill: ability of the students to apply mathematics concepts, rules and clarifies mathematics concepts in details

Proof and reasoning skill: ability of the students to go beyond memorization of formulas in solving Mathematics problems

Communication skills: ability of the students to use operatonal signs, symbols, terminology ind solving mathematics problems.

Connection skill: ability of the students to relate Mathematics concepts with each others and real life situation

Representation skill: ability of the students to represent information in the tables, graphs, diagrams among others

Mathematics performance: Mathematics Promotion Examination Scores of secondary school students

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Conceptual Framework

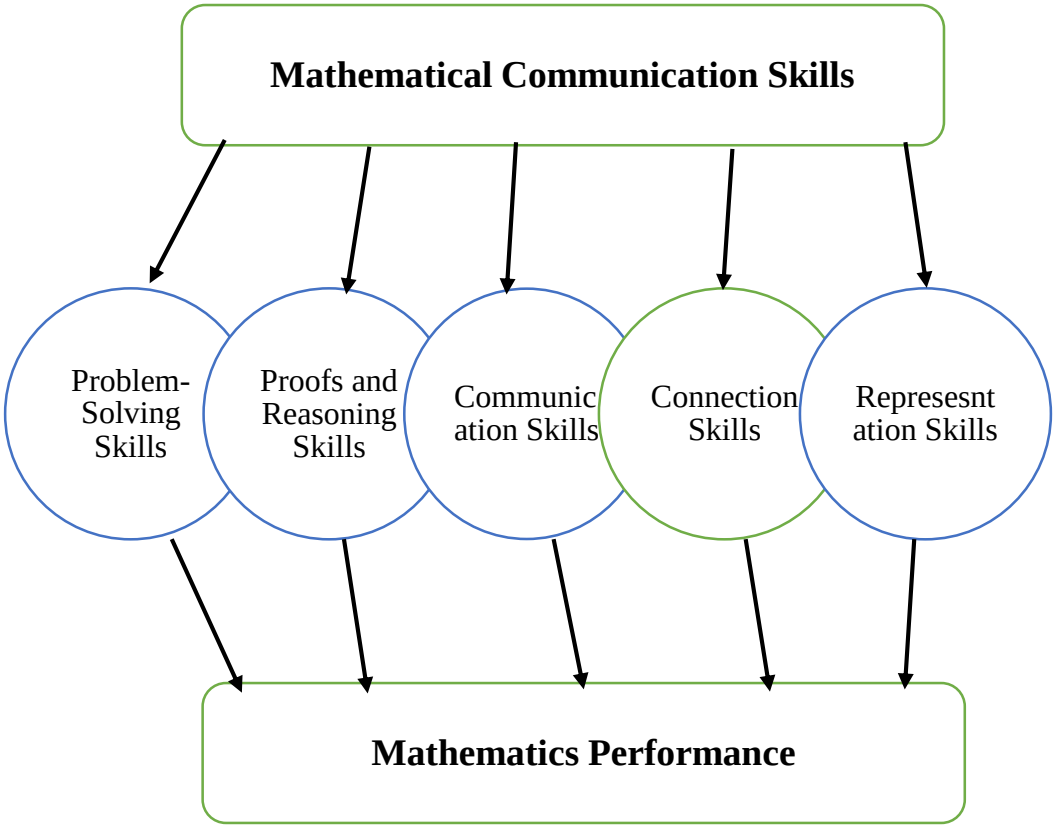


Figure 2.1: showing conceptual framework of the relationship between Mathematical communication skills and Mathematics performance.

Source: Developed by researcher

2.1.1 Concept and nature of mathematics

The need for Mathematics arose base on the society, that is, the more complex a society, the more the Mathematical needs. According to Nwoke and Nnaji (2011), Mathematics is developed through the use of abstraction and logical reasoning, from counting, calculation, measurement and the study of the shapes and motion of physical objects. Mathematics is described as a language in which every symbol and every combination

has precise meaning which can be determined by application of logical rules; it is the science that deals with the logic of shape, quantity and arrangement and use in even the most primitive of cultures (Abdullahi, 2016). Mathematics is one of the school subjects that any nation needs for industrial and technological advancement, useful for most vocation and higher specialized courses of learning (Charles-Ogan and Otikor, 2016). They further stated that Mathematics is an excellent vehicle for the development and improvement of a person's intellectual competence in logical reasoning, spatial visualization, analysis and abstract thought. Hence, students who study Mathematics develop problem-solving skills, reasoning skills, communication skills, connection skills and representation skills, through the learning and application of Mathematics.

2.1.2 Nature and objectives of senior secondary school mathematics curriculum in Nigeria

The inclusion of Mathematics as a core subject in the Secondary School curriculum is because of the significant function it has to perform in the achievement of the objectives of the secondary school education, such as promoting science and technology, provision of trained manpower in the applied sciences, technology and commerce, and the acquisition of appropriate skills, abilities and competence both mental and physical, as equipment for the individual to live on and contribute to the development of his society (Federal Republic of Nigeria (FRN), 2014). Abdullahi (2016) defined curriculum as an educational programme of the school with attention on the elements of programme of studies, experiences, services and hidden curriculum. The emphasis on all experience which is likely to influence the overall development of learner should be considered while developing the curriculum. In the Process and Standard for School Mathematics (PSSM's) curriculum section, the National Council of Teachers Mathematics as cite in Daniel *et al* (2014) promotes a coherent curriculum, in which an orderly and logical progression

increases students' understanding of Mathematics and avoids wasting time with unnecessary repetition as well as acknowledge that the relative importance of some specific topics changes over time. For example, a basic understanding of iteration is important to students who are learning computer programming, and is almost absent from 19th century textbooks. Similarly, older American Mathematics textbooks included lessons that are no longer considered important, such as rules for calculating the number of bushels of hay that could be stored in a bin of stated dimensions, because this skill was useful to farmers at that time. Hence, they proposed that Mathematics taught in modern classrooms should provide the skills that are most important to the students' lives and careers.

As was emphasized by Nigerian Educational Research Development Council (NERDC) in the work of Shittu (2015), the content of the general Mathematics curriculum is grouped into six sections namely, Number and Numeration, Algebraic Processes, Mensuration, Plane Geometry, Trigonometry, and Statistics but recently reviewed to five content areas with each section occurring every year of the three Senior Secondary School programme. He further cited NERDC that, in recent years the Mathematics curriculum from primary to the secondary school in Nigeria has witnessed several changes in terms of contents, performance objectives, activities, methods and materials among others to make it more relevant or adaptable to changes occurring every now and then in the society. One of such recent changes is the shift away from the 6-3-3-4 system of education, that is, six years of primary school, three years of junior secondary school, three years of senior secondary school and four years of university education. This change led to the development of 9-year basic and senior secondary education Mathematics curricular that was published in 2007 by NERDC. Arowolo (2015) stated that the senior secondary Mathematics curriculum takes into consideration the relevance of the subject

to global world. He further mentions that the objectives of its curriculum should enable students to:

- Prepare for further and tertiary education
- Develop skills that enhance capital market skills
- Be proficient in the application of ICT
- Acquire competency in various vocations they may wish to pursue at tertiary level.

2.1.3 Concept of mathematics performance

Performance has been viewed in several ways by different researchers, some of who are Sofyan (2020), that performance is the result, the successfulness, the extent or ability, the progress in learning educational experiences that the individual indicates in relation to his/her educational learning. According to Odual (2013), performance is the end product of learning experience, what students have gained as a result of what they have learnt. He further stated that Mathematics performance deals primarily with the better performance of students in either teacher-made test or standardised test administered by examining bodies. Mathematics achievement was described by Bhairab (2017) as the competency shown by the student in Mathematics, the result of acquired knowledge or information, understanding, skills and techniques developed in the subject of Mathematics in a particular stage. Hence, Mathematics performance is the better performance of students in Mathematics in either teacher-made or standardized test administered to them by examining bodies.

2.1.3.1 Concept of gender

Gender is the fact of been a male or female. Abdullahi (2016) refers to gender as the social construct that established and differentiated status and roles between men and

women, particularly in how they contribute to, participate in, and are rewarded by the economy and the prevailing social system. Gender achievement of students in learning Mathematics are not new. In line with the above, Firdiani *et al.* (2020) opined that male roles are more associated with mental rotation, spatial perception, and spatial visualization and female roles related to the phonological verbal fluently, synonym generation, and grammar. Also, the difference between male and female verbal ability cause the difference in gender Mathematical communication. Mawaddah *et al.* (2018) state that males are different from females psychologically; while females are more interested in real-life issues, males are more interested in abstract aspects. Also, the difference between males and females in learning Mathematics is that males are superior in reasoning, whereas females are superior in accuracy, precision, carefulness and thoughtfulness.

2.1.4 Concept of mathematics communication skills

A skill is the ability to carry out a task with determined results, often within a given amount of time, energy, or both. This can often be divided into general and specific skills. For example, in work, some general skills would include time management, teamwork and leadership, self-motivation and others, whereas specific skills would be used only for a certain job. Skill usually requires certain environmental stimuli and situations to assess the level of skill being shown and used. People need a broad range of skills to contribute to the modern economy (Merriam-Webstar Dictionary, 2020). Communication is a process of transferring information, ideas, emotions from one entity to another entity or group to another group using signs, words, pictures, videos, graphics, and numbers (Warner & Kaur, 2017).

Communication skills is the ability of the students to express their ideas, describe and discuss concepts coherently and clearly. It is the students' capability to explain and justify action in procedure and process both orally and in writing (Lomibao *et al.*, 2016). Mailis *et al.* (2019) stated that Mathematical communication skills include the ability to present Mathematical ideas verbally, in writing, pictures, graphics and other visual forms. Mathematical communication skill is the ability of students to use Mathematics as a tool of communication (language of Mathematics) (Febry *et al.*, 2017). Here, Mathematical communication skills are those skills that the students must possess in order to communicate Mathematics problems effectively. These include using Mathematics symbols, terms, notations, diagrams, graphs, tables and pictures among others. Hence, this research considers the following Mathematics communication skills; problem-solving skills, reasoning skills, communication skills, connection skills and representation skills.

2.1.5 Mathematical communication skills of senior secondary school students

A number of factors had been identified by various researchers and educators as being responsible for low performance in Mathematics. Abdullahi (2016) characterized them as teachers' attitude to teaching of Mathematics, students attitude towards Mathematics, methods of teaching Mathematics, use of instructional materials. Henry *et al.* (2015) also list socio-economic status, gender, prior Mathematics achievement, parental support, peer influence, students' perception of good classroom assessment, school and class climate, attitude toward Mathematics and parental support. Odual (2013) mention school factors, overcrowding and Mathematical abilities as the factors responsible for low performance in Mathematics. Little or no attention has been given to Mathematical communication skills of students, whereas communication plays significant role in learning Mathematics.

In the work of Sumaji *et al*. (2019), communication facilitates students' use of vocabulary, phrases, symbols, and Mathematics meanings. Ahmad and Andi (2017) stated that in communicating, a person must be able to provide meaning and language that can be understood by the converser, resulting in good communication. According to them, the meaning of communicative here is that the conversation that occurs between two or more people who interact with each other and understand the contents of the conversation. Cragg *et al.* (2017) Stated that a good understanding of Mathematics is essential for success in modern society, leading not only to good job prospects but also a better quality of life. Amoncio (2012) believed that when students can fully communicate the way they think, teachers can do an excellent job in intervening at the level of their understanding and can provide better opportunities for them to succeed. Ihdi and Scholastika (2017) stated that; lack of understanding of the problems, lack of knowledge of the strategy and the inability to translate problems into Mathematical model hinder the knowledge of the structure of Mathematics due to more passive learning of Mathematics than the active learning.

Hence, the researcher sought to investigate the following Mathematical communication skills;

Mathematical Problem-solving skills
Mathematical Proofs and Reasoning skills,
Mathematical Communication skills,
Mathematical Connection/Relations skills and
Mathematical Representations skills.

2.1.5.1 Mathematical problem-solving skills

Problem solving skills has long been seen as important skills of teaching and the learning of Mathematics. Clever (2020) opines that a problem is any unpleasant situation which prevents people from achieving what they want to achieve, hence any activity to eliminate a problem is termed problem solving. Sammons (2018) stated that students should be engaged in solving problems posed in Mathematics class as well as those that occur in real-life situations. They should be encouraged to construct new Mathematical meaning from their problem-solving efforts. Being able to communicate mathematically is essential for these tasks. First, students must make sense of problems, make connections to the math they know, and then translate the problems into Mathematical terms. Adi (2014) stated that Mathematics is abstract, it is to simplify and clarify the Mathematical problem-solving. Gulumser (2013) defined Mathematical problem-solving skills as the ability to apply Mathematical concepts and rules effectively in order to solve unordinary problems. This skill cuts across the Mathematics content in the area of number and numeration (numerical process) and algebraic process.

National Council of Teachers of Mathematics (NCTM) (2014) explains that solving problems is not only a goal of learning Mathematics but also a major means of doing so. It is an integral part of Mathematics, not an isolated piece of the Mathematics programme. Students require frequent opportunities to formulate, grapple with, and solve complex problems that involve a significant amount of effort. They are to be encouraged to reflect on their thinking during the problem-solving process so that they can apply and adapt the strategies they develop to other problems and in other contexts. By solving Mathematical problems, students acquire ways of thinking, habits of persistence and curiosity, and confidence in unfamiliar situations that serve them well outside the Mathematics classroom. According to Dendane (2009), Mathematical problem-solving skill is a process that involves a set of factors and tasks to achieve a defined goal. It depends on

many skills and factors which therefore makes it challenging both to learn and to teach. If the instructor's understanding of the process is limited, difficulties in teaching the concept will arise. Hence, there is great need to understand these factors and skills if we want to help our students acquire this important process. Also, if well facilitated, this skill may help students to:

1. develop and improve the generic ability to solve real life problems;
2. develop critical thinking skills and reasoning;
3. gain deep understanding of concepts; and
4. work in groups, interact with and help each other.

Most of the Mathematics textbooks suggest few types of problems as examples with detailed solutions and then suggest similar problems as exercises. Student's learning is limited if only routine problems are solved. The problems used to create genuine learning opportunities should be of the challenging type and not only those similar to ones already solved in the past. Hoyles and Lagrange (2010) explain that problem-solving frameworks and instructional approaches came from analyzing students' problem solving experiences that involve or rely mainly on the use of paper and pencil work. Thus, there is a need to re-examine principles and frameworks to explain what learners develop in learning environments that incorporate systematically the coordinated use of digital technologies. Clever (2020) explains some of the importance of problem-solving skills to include:

i. make the impossible possible: knowledge alone is not the key to solving problems but rather, complimenting it with systematic problem solving approaches makes the difference. This helps individuals and organizations to overcome perilous challenges;
ii. make you to stand out: people are trained to do the usual, they have acquired skills and knowledge in what they do. However, people can hardly solve problems when

they are unexpected or unprecedented ones. If you become a regular problem solver at your workplace, you are easily noticed, recognized, and appreciated;

iii. increased confidence: No matter where you work or what your profession is, having the ability to solve problems will boost your confidence level. Because you are sure of your ability to solve problems, you do not spend time worrying about what you will do if a problem should arise.

According to Jacob and Sheena (2019), a problem in Mathematics is any situation that must be resolved using Mathematical tools but for which there is no immediately obvious strategy. Mathematicians have always understood that problem-solving is central to their discipline because without a problem there is no Mathematics. This practice requires teaching in profoundly different ways as schools moved from a teacher directed to a more dialogic approach to teaching and learning. The challenge for teachers is to teach students not only to solve problems but also to learn about Mathematics through problem-solving. They cited Wu and Zhang that importance of problem-solving in learning Mathematics comes from the belief that Mathematics is primarily about reasoning, not memorization. Problem-solving allows students to develop understanding and explain the processes used to arrive at solutions, rather than remembering and applying a set of procedures. It is through problem-solving that students develop a deeper understanding of Mathematical concepts, become more engaged, and appreciate the relevance and usefulness of Mathematics. They further stated that Problem-solving in Mathematics supports the development of: (i) the ability to think creatively, critically, and logically; (ii) the ability to structure and organize; (iii) the ability to process information; (iv) enjoyment of an intellectual challenge; and (v) the skills to solve problems that help them to investigate and understand the world.

Hence, it is clear that problem-solving skills need to be applied in learning Mathematics in the classroom so that students are able to communicate proficiently, think critically, collaborate and create new ideas in Mathematics

2.1.5.2 Mathematical proofs and reasoning skills

Proofs and Reasoning skills are some of the skills that students are expected to possess in order to communicate successively in Mathematics. Reasoning is defined by Merriam-Webster dictionary (2020) as the use of reason; that is, the power of comprehending, inferring, or thinking especially in an orderly rational way. And proof as the process of establishing the validity of a statement especially by derivation from other statement in accordance with principles of reasoning. Agata (2014) defines proof as a sequence of logical statements which gives an explanation of why a given statement is true. Ayal *et al.* (2016) defines reasoning as an activity or the activity of thinking in order to prepare a new statement, which was based on some statements whose truth is known in advance. Therefore, ability to reason is essential to understanding Mathematics, this prompted Thomas (2020) to define reasoning skills as crucial for being able to generate and maintain viewpoints or beliefs that are coherent with, and justified by relevant knowledge. It also determines how people comprehend, evaluate, and accept claims and arguments. Sumarsih *et al.* (2018) declare that it is a basic skill of Mathematics that is necessary for a number of purposes: to understand Mathematical concepts, to use Mathematical ideas and procedures flexibility, and to reconstruct Mathematical ideas.

According to Gunhan (2014), Mathematical reasoning refers to the ability to formulate and represent a given Mathematics problem then explain and justify the solution or argument. Agata (2014) submits that Mathematical proof and reasoning are absolute, which means that once a theorem is proved, it is proved forever. He stated that previously

established theorems may be used to deduce the new ones; also one may also refer to it as the rules accepted by everyone. Ayal *et al.* (2016) argue that the Mathematical reasoning ability is the ability to express the arguments that are essential for understanding Mathematics. They further cited Sumarmo that some of the indicators of the ability of belonging to the Mathematical reasoning are: (1) draw the logical conclusion; (2) provide an explanation of the models, pictures, facts, nature, relationships or patterns exist; (3) estimate the answer and process solutions; (4) use a pattern of relationships to analyze the situation, or make an analogy, generalization, and arrange conjecture; (5) propose opponent example; (6) follow the rules of inference, check the validity of the argument, proving and compose a valid argument; and (7) develop direct evidence, indirect evidence and proof by induction. This skill cuts across the Mathematics content in the area of logical reasoning, geometry and algebraic process.

In the work of Gurbuz and Erdem (2016), it is stated that people who reason and think analytically tend to note patterns, structures, or regularities in both real-world and Mathematical situations, they ask if those patterns are accidental or if they occur for a reason, they make and investigate Mathematical conjectures, they develop and evaluate Mathematical arguments and proofs, which are formal ways of expressing particular kinds of reasoning and justification. Sumarsih *et al.* (2018) state that Mathematical reasoning is essentially about the development, justification and use of Mathematical generalizations; generalizations create an interconnected web of mathematical knowledge and conceptual understanding, also seeing Mathematics as a web of interrelated ideas is both a result of an emphasis on Mathematical reasoning and a foundation for reasoning further. Carol and Susan (2016) opine that instructional programme from prekindergarten through grade 12 should enable all students to:

1. recognize reasoning and proof as fundamental aspects of mathematics;

2. make and investigate Mathematical conjectures;
3. develop and evaluate Mathematical arguments and proofs; and
4. select and use various types of reasoning and methods of proof.

Mathematical reasoning skills is characterised by activities such as looking for, and exploring, patterns to understand Mathematical structures, and using available resources to solve problems. Mathematical reasoning skills if merged with scientific conduct possesses the capacity of advancing students' inquiry skills beyond memorisation of facts and procedures, and lead the learners to creating new knowledge (Sokolowski, 2018). To develop Mathematical reasoning students will: (1) engage in substantial problem-solving; (2) be able to communicate and interpret their results; (3) learn Mathematics through modeling real-world situations; (4) expand their Mathematical reasoning skills as they develop convincing Mathematical arguments; (5) use appropriate technology to enhance their Mathematical thinking and understanding, to solve Mathematical problems, and to judge the rationality of their results; (6) perform arithmetic operations, as well as reason and draw conclusions from numerical information; (7) use algebra and/or other symbolic representations to translate and solve problems; (8) develop a spatial and measurement sense; (9) demonstrate understanding of the concept of function verbally, numerically, graphically, and/or symbolically; and (10) analyze data and use probability and statistical models to make inference about real-world situations (Thomas, 2020).

Bright (2015) explains three ideas for improving students' Mathematical reasoning skills:

1. help students ask 'why?': the teacher instructs students to justify their answers. If they can verbalize how they arrived at their answer, they can more easily pin point the logical thinking that was involved. For example, say you ask students to solve this equation: 12 + X = 73 + 15 logically, students could reach the answer in a few

different ways. First, since 12 is only 3 less than 15, the numbers are relatively easy to compute. So, after that reasoning, students could conclude that the answer must be 73 added to 3, or 76. Or, since logically X must be equal to 12 less than the sum of 73 and 15, students could first add the larger numbers to 88, then subtract 12 from 76. As much as possible, have students explain their thought processes in this way, and make sure they show their work on assignments and tests to practice this line of thinking;

2. teach proofs: geometric proofs are a practical application of Mathematical reasoning. They ask students to write down first what they are given in a geometry problem, then what they suspect. Then, in a second column, students must write out why each statement is true. Geometric proofs force students to look at problems in small increments, rather than quickly solving them in their head without thought. In that way, they help students understand the reasoning behind solving the problem; and
3. have students work together: to help students practice reasoning, have them work in pairs or groups. When they work together on a math problem, they will be able to justify to each other how they got an answer, and they will also be able to analyze and critique the other students' reasoning.

According Mailis *et al.* (2019) students' ability to think and convey ideas is strongly influenced by how their brains work, as students have different levels of intelligence. Therefore, to optimally stimulate the brain during the learning, a teacher must establish a fun learning environment and challenge students' thinking skills to increase students' engagement leading to more meaningful learning. Hence, it is clear that the Mathematical reasoning skills need to be fully incorporated into classrooms, schools, and districts around the country in order to help students to excel in their academic pursuit and to produce citizens and employees adequately prepared to face the challenges ahead.

2.1.5.3 Mathematical communication skills

One of the important skills that is expected of the students to be able to solve Mathematical problems is communication skills. Mathematical communication is the ability to explain Mathematical thinking process by standard mathematical terminology and symbols the way other people would understand it (Gulumser, 2013). Mailis *et al.* (2019) opine that Mathematical communication skills must be well integrated into the classroom and students should be guided to express and write ideas, questions, and solutions. They concluded that these skills should be a major concern in Mathematics learning to foster students' skills of thinking and conveying ideas. Sutama *et al.* (2019) portray that Mathematics communication skills have an important role in learning because through Mathematics communication, students can organize and consolidate their Mathematical thinking. Also, students are subjects who have ability to actively seek, process, construct, and apply knowledge in daily life; in this manner, to deeply understand and apply knowledge, students need to be encouraged to work to solve problems, find everything for themselves, and strive to realize their ideas.

Sutama *et al* (2019) further list out competence of 21st century skills as (a) critical thinking and problem-solving skill (b) communication skill (c) creativity and innovation skill (d) collaboration skill. They cited Hirsch et al that the ability of communication in Mathematics include: (1) the ability to express Mathematical ideas through oral, written, and able to demonstrate it, and visually depicting; (2) the ability to understand, interpret, and evaluate Mathematical ideas through oral, written or other visual forms; and (3) ability to use terms, Mathematical notations, and structures to present ideas, describe relationships, and situational strategies.

According to Puspita (2016) by Mathematical communication skills, the ideas and messages of material should be well taught to the students in order to help build their knowledge resulting in the increase of their learning outcomes. Ahmad and Andi (2017) state that when a student is able to communicate things effectively, then it is a good capital in behaving towards others and able to cooperate with others in doing an innovation. Febry *et al.* (2017) state that communication is at the heart of learning in Mathematics. Mathematical communication skills include: (1) the use of Mathematical language that is realized in the form of oral, written, or visual; (2) the use of Mathematical representations that is realized in the form of written or visual; and (3) clarity of presentation, namely interpreting Mathematical ideas, use the Mathematics term or notation to represent Mathematical ideas, as well as describe the relationships or Mathematical approach. Wichelt (2009) point out that communication is a key part of students' learning, in which they need to be able to communicate with their teachers and their peers in order to understand knowledge of a Mathematical concept. Teachers can stimulate students' growth of Mathematical knowledge through the ways they ask and respond to questions.

Students' ability to think and convey ideas is strongly influenced by how their brains work as students have different levels of intelligence. Therefore, to optimally stimulate the brain during the learning, the teacher must establish a fun learning environment and challenge students' thinking skills to increase students' engagement leading to more meaningful learning (Mailis *et al.*, 2019). Sammons (2018) state that, this skill is explicit in emphasizing the importance of students being able to organize and consolidate their thinking through communication, as well as being able to communicate their Mathematical thinking coherently and clearly to their peers, teachers, and others. Correspondingly, must be able to analyze and evaluate the Mathematical thinking and strategies of others and use the language of Mathematics to express Mathematical ideas

precisely. In NCTM (2014) Mathematical communication is seen as a way of sharing ideas and clarifying understanding. Through communication, ideas become objects of reflection, refinement, discussion, and amendment. Similarly, when students are challenged to communicate the results of their thinking to others orally or in writing, they learn to be clear, convincing, and precise in their use of Mathematical language.

Summaji et al (2019) state that Mathematical communication of the students in the class can be realized by using 4 strategies: (1) giving appropriate tasks; (2) creating conducive environment to express their notions; (3) directing them to explain and argue toward the given results; and (4) directing them to actively process various ideas and notions. They further stated that Mathematical communication can be found in three aspects: (1) communicating mathematic ideas by writing texts; (2) communicating Mathematics ideas by drawing pictures, tables, diagrams, graphics; and (3) communicating Mathematics ideas by Mathematical expression (making model/equation then work out them). Based on the above definitions and assertions, Mathematical communication skills need to be well incorporated into the classroom in order to help students learn Mathematics as well as enable them to excel in their academic pursuit.

2.1.5.4 Mathematical connection skills

Connection is one of the must have skill to be able solve Mathematics problem and do well in any other field successfully. Armitage (2019) refers to connections as Mathematically relevant observations that students make about their problem-solving solutions and that connections require students to look at their solutions and reflect. Siregar and Muhammad (2019) describe Mathematical connection skills as an ability that must be built and studied. Also, with good Mathematical connection skills (i) students will be able to understand the relationship of various concepts in Mathematics and apply

Mathematics in everyday life; (ii) students will feel the benefits of learning Mathematics and; and (iii) their understanding of the concepts learned will help them to retain and recall those concepts when the need arises.

According to Ndiung and Fransiskus (2018) the notion of 'connections' in Mathematics relates both to those that exist: (i) within and between different content areas in Mathematics such as within number or between number and measurement; (ii) between Mathematics learning and learning in other areas; and (iii) between Mathematics and the context within which a child lives, works or plays. According to Hotmaria *et al.* (2018), learning is said to be meaningful if the information learned by learners is prepared in the appropriate cognitive structure so that they have a strong memory and transfer learning is easily achieved, by not often memorizing Mathematical ideas without trying to interpret the idea. Dedi and Jojon (2013) describe some of the indicators in Mathematical connections as:

a. finding the relationship of the various representations of concepts and procedures;
b. understanding the relationship between Mathematical topics;
c. using Mathematics in other areas of study or daily life;
d. understanding the representation of equivalent concept or similar procedure;
e. finding the connection between one procedure to another in an equivalent representation;
f. using connections among Mathematical topics and between Mathematics with another subject.

Siregar and Muhammad (2019) proposed that, it is very important that the teacher has knowledge of Mathematical connections and be able to create a rich environment to support the development of Mathematical connection skills among students, considering

the opportunity to discuss their ideas with colleagues and to develop their Mathematical understanding through conversation, students have a greater opportunity to develop Mathematical connection skills. According to NCTM (2014), when students connect Mathematical ideas, their understanding is deeper and more lasting, view Mathematics as a coherent whole and sees Mathematical connections in the rich interplay among Mathematical topics, in contexts that relate Mathematics to other subjects, and in their own interests and experience. Dedi and Jojon (2013) state that the Mathematical concept and procedure newly developed can be applied to solve other problems in Mathematics and other disciplines.

In line with the above, Haji *et al.* (2017) itemize the importance of Mathematical connection skills in Mathematics as: (1) expanding horizons; (2) clarifying Mathematics as a whole; and (3) clarifying the benefits of Mathematics. Hotmaria et al (2018) affirm that Mathematical connection skills can improve students' cognitive abilities such as recall, understand the application of environmental concepts and so on, without applying the concept of student experience, it would be difficult to remember certain material and remember too many separate concepts whereas Mathematics is rich in principles. Armitage (2019) points out that teachers should help students to develop an understanding of Mathematical connections in the following areas:

(1) develop students' abilities to use multiple strategies to show their Mathematical thinking and support that their answers are correct;
(2) encourage students to continue their representations. Mathematical connections may be made when students continue a representation beyond the correct answer;
(3) explore the rich formal language of mathematics. Mathematical connections may be made as students begin to use the formal language of Mathematics and its connection to their representations, calculations and solutions;

(4) incorporate inquiry into the problem-solving process. Asking students to clarify, explain, support a part of their solution to a math partner, the whole class, or a teacher, this not only helps to develop independent problem solvers but also leads to more Mathematics connections; and

(5) encourage self- and peer-assessment opportunities in your classroom. Encourage students to self-assess their problem-solving solutions either independently, with a Mathematics partner or with the support of their teacher.

In line with the above, the teachers need to play a significant role to improve the Mathematical connection skills of the students through classroom activities such as engaging students in classroom discussion, giving alternative answers, sharing their explanations and ideas, and communicating with each other in order to improve their Mathematical connection skill in solving the problem.

2.1.5.5 Mathematical representation skills

This aspect of Mathematical communication skill is very important for students to be able to solve problems in Mathematics effectively and efficiently. Representation skill is a process in which students communicate ideas or answer problem (Zeny & Bella, 2017). Novia and Dian (2018) states that representation is an expression of Mathematical thoughts or ideas which are displayed in an attempt to find a solution to the problem being faced. Aflich *et al.* (2018) see representation to mean how the student re-interprets a problem into a simple form based on his understanding and he communicates a solution obtained through external representations that can be verbal, symbolic, or visual. Aflich et al (2018) further stated that representation skill is the foundation that allows a student to understand and utilize Mathematical ideas appropriately.

Adi (2014) assert that representation plays an important role, namely (1) to transform abstract ideas into tangible concepts, with pictures, symbols, words, graphics and others. (2) provide a broad overview of the concepts in terms of the analogy existing topics. Hence, it is expected that when students have access to the representations and the ideas shown to them, then they have a set of tools that significantly expand their skill to be ready to think Mathematically.

In the work of Novia and Dian (2018), Mathematical representation refers to an expression of Mathematical ideas that are displayed as models and utilized to find solutions being faced and afterwards become the results of thoughts expressed through images, graphics, words, and Mathematical symbols. Ming-Jang *et al.* (2015) refer to it as the different forms of representations that learners use to interpret a problem. In addition, Adi (2014) describes it as depiction, translation, disclosure, reappointment, figurative skills or even modeling ideas, Mathematical concepts, and the relationship between them that contains a configuration, construction, or certain situations that students appear in various forms on an attempt to achieve clarity of meaning, demonstrate understanding or find a solution to his problems.

Samsuddin and Retnawati (2018) state that Mathematical representation consists of two inseparable parts, namely: (1) external representation, one that physically exists and is observable, such as graphic, pictures, equations and table; (2) internal representation, such as model, scheme or concepts which is mental or cognitive and cannot be directly observable. Meanwhile, the internal representation is how students develop their knowledge to work their mind. Aflich *et al.* (2018) divide Mathematical representations into five categories: real life experience representation, concrete representation, oral or verbal language representation, pictures or graphs representation and arithmetic symbols

representation. Among these five categories, the last three representations reflect the more abstract and higher level in the representation of Mathematical problem-solving. Thus:

1. language representation skill: the skill of translating observed properties and relationships in Mathematical problems into verbal or vocal representations;
2. picture or graphic representation skill: the skill of translating Mathematical problems into picture or graphic representations; and
3. arithmetic symbol representation skill: the skill of translating Mathematical problems into arithmetic formula representations.

Mathematics representation skill is one component of a standard process in Principles and Standards for School Mathematics in addition to the skills of problem-solving, reasoning, communication and connections, with several reasons. According to Adi (2014), (1) fluency in doing the translation between different representations of different types are the basic skills of the students to develop a concept and Mathematical thinking; (2) mathematical ideas are presented through various representations. The teacher will provide an enormous influence on students in learning Mathematics; and (3) students need practice in building their own representation so that they have the skill, good understanding and flexible concept that can be used in solving problem. Adi (2014) also opine that there are four ideas that are used in understanding the concept of representation skill including:

1. representation can be seen as an internal abstraction of Mathematical ideas or cognitive schemes constructed by students through experience;
2. as a mental reproduction of previous mental state;
3. as the grain structure through image, symbol, or emblem; and
4. as the knowledge of something that represents something else.

Mathematical representation skill is very important in helping students to solve problems effectively. Novia and Dian (2018) enumerate some of the importance to include: (i) help students develop concepts, understand concepts and express Mathematical ideas; (ii) facilitate students to more easily clarify Mathematical conditions or problems; (iii) really helps learners to understand Mathematical concepts in the forms of images, symbols and written words; and (iv) the use of correct representations by students will help them transform abstract ideas into the more concrete ones as well as form an understanding of Mathematical concepts.

In the work of Aflich *et al*. (2018) five indicators of the Mathematical representation skills were formulated' they include: 1) use visual representation to solve a problem; 2) present data/information from a representation into diagrams, graphs or tables and solve a problem using written words or texts; 3) develop equations or Mathematical models of the provided representations and solve a problem by involving Mathematical expressions; 4) draws geometric patterns, to write down the steps of solving Mathematical problems with word and solve problems with Mathematical expressions; and 5) create a problem situation based on the provided data or representation. The indicators of Mathematical representation skills according to National Council of Teachers of Mathematics (2014) establish that the learning programme from kindergarten through senior secondary school should enable students to:

1. create and use representations to organize, record, and communicate Mathematical ideas;
2. select, apply, and translate Mathematical representations to solve problems; and
3. use representations to model and interpret physical, social, and Mathematical phenomena

Samsuddin and Retnawati (2018) state that teachers also have an important role to play in ensuring that students gain an understanding of the Mathematical representation skills. They further outline recommendations for teachers to facilitate students' Mathematics learning in respect to Mathematical representation, which are:

i. teachers should realize that their belief regarding which representation mode students can do, cannot do, and should be able to do may affect instructional plans;
ii. teachers should recognize which translations are more difficult than others. For instance, students may find translation from symbolic to tabular representation easier than translation from graphical to symbolic translation;
iii. teachers have to assure that students learn all the representations with the translation, particularly those which are more difficult;
iv. teachers need to take everything that support students' translation to consideration in the learning process, for instance, teachers' questioning techniques;
v. teachers can use real world contexts which are familiar to students; and
vi. teachers can use rich-tasks to engage students.

Such representations skills such as drawings (sketch) skills, diagrams skills, graphical skills and symbolical skills need to be inculcated in the classroom to help students communicate their Mathematical ideas effectively and efficiently.

2.2 Theoretical Framework

Despite the fact there are so many educational theorists, this study uses the following theories to back up its review: the behaviourism, cognitivism and constructivism.

2.2.1 Behaviourism

In the work of Paul (2019), Behaviourism is based on the idea that knowledge is independent and on the exterior of the learner. In a behaviourist's mind, the learner is a

blank slate that should be provided with the information to be learnt. Through this interaction, new associations are made and thus learning occurs. Learning is achieved when the provided stimulus changes behaviour. A non-educational example of this is the work done by Pavlov. Through his famous "salivating dog experiment, Pavlov showed that a stimulus (in this case ringing a bell every time he fed the dog) caused the dog to eventually start salivating when he heard a bell ring. The dog associated the bell ring with being provided with food so any time a bell was rung the dog started salivating, it had learnt that the noise was a precursor to being fed. In a similar approach to classroom management, the teacher taught the student that if he stands in a specific place in the classroom with his arms folded, they know that he is getting frustrated with the level of noise and they start to remain silent or if he sits cross-legged on his desk, he is about to say something important, supportive and they should listen because it affects them directly (Paul, 2019).

Thadei (2013), highlighted the implication of the behaviourism learning theories to teaching and learning to include:

i. As environment properly arranged help learning to occur, teachers should prepare the environment that will help learners to learn such as arranging activities that suit environment.
ii. Teachers also need to help learners make practice of what they have learned. This is important as learning is subject to the rate of occurrence of behaviour. This is as well significant for strengthening the responses.
iii. Learning should be reinforced. That is, students should be given rewards. Teachers are to reward any desired behaviour in learning. However, to weaken the undesired behaviour learned, teachers should apply punishment.
iv. In developing the profession of teaching, teachers have to note that developing

professionally has some benefits such as being able to help learners learn. Increasing the knowledge base, being rewarded economically and developing/improving their personal lives.

Hence, behaviourism learning theory involves repeated actions, verbal reinforcement and incentives to take part. It is great for establishing rules, especially for behaviour management. Therefore, this theory relates to this study by emphasizing that students should be engage in practicing and repeating Mathematics activities or exercises so that the pattern of carrying out related Mathematics activities can be mastered by them and increase their Mathematical communication skills.

2.2.2 Cognitivism

Cognitive theories were developed in the early 1900s in Germany from Gestalt psychology by Wolfgang Kohler. In the work of Paul (2019), cognitivism focuses on the idea that students process information they receive rather than just responding to a stimulus, as with behaviourism. There is still a behaviour change evident, but this is in response to thinking and processing information. In cognitivism theory, learning occurs when the student re-organises information, either by finding new explanations or adapting old ones. He further gives the examples of how teachers can include cognitivism in their classroom to include linking concepts together, linking concepts to real-world examples, discussions and problem-solving. Thadei (2013) stated that Cognitivists acknowledge the role of environmental conditions as influences on learning, but teachers' explanations and demonstrations of concepts serve as environmental inputs for students, practice of skills and correct feedback to promote learning. What students do with information, how they attend to, rehearse, transform, code, store, and retrieve is critically important. Hence, cognitivists suggest that learning takes place in the mind as is a result of mental processes on the information received.

According to Paul (2019), there are some basic ideas to get your head around and some stages to understand this learning theory. The basic ideas are:

a) Schemas: The building blocks of knowledge.
b) Adaptation processes: These allow the transition from one stage to another. He called these: Equilibrium, Assimilation and Accommodation.
c) Stages of Cognitive development: Sensorimotor, Preoperational, Concrete Operational and formal Operational.

Children develop Schemas of knowledge about the world which are the clusters of connected ideas about things in the real world that allow the child to respond accordingly. When the child has developed a working Schema that can explain what he perceives in the world, that Schema is in a state of Equilibrium. When the child uses the schema to deal with a new thing or situation, that Schema is in Assimilation and Accommodation happens when the existing Schema is not up to the job of explaining what is going on and needs to be changed. Once its changed, it returns to Equilibrium and life goes on. Hence, Learning is therefore a constant cycle. Cognitive learning theorists stress the acquisition of knowledge and skills, formation of mental structures and processing of information and beliefs (Chunk, 2012).

Implication of the cognitive theories of learning to the development of teaching by Thadei (2013) are:

a) Teachers should organise the teaching materials in a way that the concept in them can easily be acquired and processed by learners' mind.
b) Teachers need to use variety of teaching techniques: This helps them lead students to explore the concepts from different angels.

c) Observational learning by Albert Bandura suggests that students learn by observing: teachers therefore need to be role models to their students.
d) Current learning builds upon the previous one: teachers therefore should seek for students' prior knowledge before they launch new concepts.
e) Teachers need to provide exercises and practices to the learners: this is because students learn best in the course of doing exercises which help them to accommodate the information into the mind.
f) Courses and topics should be divided into subparts which can easily be understood by students, the small parts should be taught in such a way that they reinforce each other.

Hence, this theory's relation to the present study is that students should put more effort by finding more explanations to what the teacher has taught them in the class, they should relate Mathematics concepts together, relate Mathematics concepts with other concepts and relates Mathematics concepts to real life situation in order to build their Mathematical communication skills thereby increasing their chance of achievement in Mathematics.

2.2.3 Constructivism

According to Brau (2020), there are three foundational psychologists of constructivism. They are: Jean Piaget who falls into the radical constructivism aspect, Lev Vygotsky concentrates on the social aspects of learning through experiences and John Dewey straddles the line between the two perspectives and has many ideas that match with each side. He further states that the common ground that united these psychologists under the umbrella of constructivism is that all of them believed that the learning theories (such as behaviourism and humanism) at the time did not adequately represent the actual learning process. Also, their ideas were rooted in experiences in the classroom instead of experiments in a laboratory (compared to behaviourism). Pual (2019) asserts that

constructivism is based on the premise that we construct learning new ideas based on our own prior knowledge and experiences. Thus, students need to have a prior base of knowledge for constructivist approaches to be effective. As students are constructing their own knowledge base, outcomes cannot always be anticipated, consequently, the teacher should check and challenge misconceptions that may have arisen. He further lists examples of constructivism in the classroom to include problem-based learning, research, creative projects and group collaborations.

In another research by Thadei (2013), constructivism is a theory of knowledge with roots in philosophy, and psychology with Vygotsky, Brunner and John Dewey as the founders; they believe that (1) knowledge is not passively received but actively built up by the cognizing subject; (2) the function of cognition is adaptive and serves the organization of the experiential world. He explains that learning involves constructing one's own knowledge from one's own experiences. Also, Constructivist learning is a very personal endeavor, where by internalized concepts, rules, and general principles may consequently be applied in a practical real-world context. Thadei (2013) describes four forms of constructivist relationship between teacher and student as:

1. Power on: this is a traditional approach of instruction where the teacher teaches and then allows students to construct new knowledge, post teaching process.
2. Power of: this is also a traditional approach of instruction where the teacher ignores learning opportunities in the course of teaching but students are told to take note of them to be explored, post learning process.
3. Power for: this is a democratic approach of teaching where the learner is freer to explore physical environment so as to solve some problems and create new knowledge.
4. Power with: this is a democratic approach of teaching where learners have high

opportunity in the course of learning.

Thadei (2013) also mentioned the five phases of constructivist teaching scheme in as:

i. Orientation: focusing learners interest on a particular area for learning
ii. Elicitation: helping children become aware of their prior knowledge so that the teacher can know the student's range of ideas.
iii. Restructuring ideas: helping children become aware of an alternative point of view, this goes together with modifying, replacing or extending views.
iv. Application of new idea: reinforcing the newly constructed idea
v. Review: reflection on how learner`s ideas have changed

Thadei (2013) elaborates the contribution of constructivism theories to teaching and learning to include the following:

a) Constructivism views each learner as a unique individual with unique needs and complex backgrounds, teacher must help these students to attain their goals;
b) Uniqueness and complexity of the learner encourages the teacher to utilize it as an integral part of the learning process. Professional development should consider the importance of using learners experience in teaching and learning process;
c) Learners are challenged within close proximity to their current level of development. By experiencing the successful completion of challenging tasks, learners gain confidence and motivation to embark on more complex challenges, Vygotsky calls it zone of proximal development (ZPD). Teachers should encourage and accept student autonomy and initiative. They should try to use raw data and primary sources, in addition to manipulative, interactive, and physical materials. So that students are put in situations that might challenge their previous conceptions and that will create contradictions that will encourage discussion among them. In our teaching therefore, we need to use some activities which originate from our environment so that learning can be meaningful to students;
d) Constructivist approach insists that instructors/facilitators must help the learner to get to his or her own understanding of the content. That is, the teacher should encourage students critical thinking and inquiry by asking them thoughtful, open-ended questions, and encourage them to ask each other question so that they can construct their own meaning when learning.

The theory's relation with the present study is that students should be encourage to learn new ideas based on their prior knowledge and experiences, they should be encouraged to think critically about concepts, they should be taught from simple to complex concepts and from known to unknown concepts to enable them understand the contents and retain the previous concepts thereby relating them with the new concepts. By so doing students

Mathematical communication skills will improve then increase their performance in Mathematics.

2.3 Empirical Studies

2.3.1 Empirical studies on the mathematical communication skills and mathematics performance of senior secondary school students

Recent evidence derived from a variety of surveys undertaken by different people using different tests in various parts of the world reveal relationship between Mathematical communication skills and Mathematics performance of senior secondary school students. Septiana *et al.* (2019) carried out a study on 'Mathematics Communication Skills of Students in Senior High School on Introvert personality in Sukoharjo, Indonesia'. The research used descriptive qualitative method with 20 subjects in the eleventh grade of a national senior high school in Sukoharjo and the data was collected through questionnaires, tests and interviews. The study revealed that students who had an introvert personality type were able to analyze and write information obtained by Mathematical symbols with 90% in the high category; these students easily understood what must be said or changed into mathematical symbols.

On the other hand, students' Mathematical communication skills in the ability to express ideas, graphical, Mathematical situations or algebraic forms of writing had a 24.5% in the low category. These students were not able to change Mathematics equivalents into a graphic image, many of them had difficulty determining the area of completion and were not able to read comprehension of a Mathematical equation, resulting in difficulty with drawing graphic. This study used same instruments, variable and subjects but different in all other mechanism with the present study.

According to the study by Rahmy *et al.* (2019) on 'Mathematics communication skill of students in Junior High School Based on Students' Thinking Style in Indonesia' using descriptive qualitative research. The data was obtained from 32 students of junior high school in Nganjuk region with heterogeneous abilities by using the research instruments of written test, questionnaire, and interview. The findings revealed that students who were with sequential concrete and sequential abstract thinking styles were capable of arranging similar conjectures, making arguments, exploring ideas, formulating generalization. However, they were having difficulty presenting Mathematics in their own language. Meanwhile, students with random concrete and random abstract thinking styles were able to express ideas and formulate generalizations, they were however having difficulties in establishing conjectures. This study used same instruments, variable and subjects but different design from the present study.

Mailis *et al.* (2019) on 'Students' Mathematical Communication Ability through the Brain-Based Learning Approach using Autograph' and descriptive qualitative design. The Mathematical communication skills test and the activity observation were the instruments used to obtain data from Twenty-eight (28) 10th grade students of the high schools in Banda Aceh for the study. The result showed that students' skills in expressing Mathematical ideas in various ways have not met the expectation. This study has Mathematical communication ability and students as the subjects which is same as the present study but different in design and data collection techniques.

Another study by Puspa *et al.* (2019) on the 'Profile of Mathematical Communication Skills Junior High School Students in Problem-Solving in Indonesia'. This research is a qualitative type that is, a research process that is done naturally in accordance with objective condition in the field without any manipulation, where in this case data retrieval is done through student written test, oral test delivery, and in-depth interview. This

research used triangulation of time in which the written tests, oral tests, and interviews were carried out twice in different times. The results disclosed that there are some differences in each student; while there were students who were more detailed in doing and remembering things that were taught, there were other students who did things briefly and precisely; so it can be said that each student has different Mathematical communication skills in solving problem. This study has Mathematics communication skills and students in common but different in every other mechanism.

The work of Septiana *et al.* (2018) 'Mathematical Communication Skills of Senior High School Students based on their Personality Types in Indonesia' used descriptive research design. The data of this research was collected using written test and interview from 34 students of senior high school in Sukoharjo region with heterogeneous abilities and gave an overview that Mathematical communication skill of students having introvert personality can arrange conjecture, make an argument, and formulate generalization definition. However, they had difficulty in understanding a Mathematical presentation. Meanwhile, the students having extrovert personality could explore their ideas, but they had difficulty in revealing the idea or Mathematical paragraph in their language. The similarities between this study and the present study is that they both used survey design and written test but other things such as population, sample and sampling techniques are different.

Ahmad and Andi (2017) on the analysis of Mathematical communication skills of junior high school students of coastal Kolaka Indonesia. The subjects of the study were VIII Coastal Junior High School of Kolaka District in the second semester of the academic year 2016/2017 adopted descriptive method. The data collection technique in this study were test and interview techniques. The finding showed that ability of students are still low based on the their answer sheets which appears that students are having difficulty or

are unable to state the situation in Mathematical symbols or difficulty in changing the daily situation in the Mathematical language and that most students are still confused to make an introduction in Mathematical operations as auxiliary variables to facilitate calculation. This study used descriptive survey method, test and students which is the same as the present study but every other thing is different from the present study.

Alamgir *et al.* (2017) carried out a survey on the 'Communication Skills of a Teacher and their Roles in the Development of the Students' Academic Success in Pakistan' using descriptive survey design. The empirical data regarding the role of a teacher's communication skills in students' academic success was obtained from 418 teachers from a sample of 14 universities in Pakistan. The study found that majority of the students opined that they learn well from teachers who have good communication skills or who adopt good communication skills while dealing inside and outside the institution. Effective teaching not only depends on the knowledge base of the teacher but also relates to the method and style of teacher's communication skills. Also, good communication is not only important for a teacher but students also need to have good communication skills. This study had communication skills and descriptive design as similarities with the present study but other approaches are different.

Lomibao *et al.* (2016) on the influence of Mathematical communication on students' Mathematics performance and anxiety in Philippines employed a mixed method of quantitative quasi-experimental control group and descriptive qualitative design. This study used 188 fourth year high school students in Bulua National High School, school year 2013-2014, as the participants of the study. Two intact classes with 94 students were randomly assigned as experimental group and the other two groups with 94 students as control group composed of 47 students in each section. Interviews were also done to verify responses for triangulation. The study revealed that content analysis of the

students' answers on the two-tiered test questions showed that students had improved in terms of achievement score and showed a good grasp of the concept as shown in their answers in the second-tier questions. Also, students gave varied justifications of their answers, which evidently showed that they were able to make connections and had applied previous concepts learned. This study had Mathematics communication skills, descriptive design and students as similarities with the present study but other approaches are different.

The study of Puspita (2016) on the analysis of Mathematical communication skills of students in Mathematics education at the University of Muhammadiyah Jember Indonesia used descriptive qualitative design to show that when expressing mathematical ideas through speech, writing, demonstrating, and describing it visually, students express it clearly and completely but often with some errors. Whereas when they understand, interpret, and evaluate Mathematical ideas, either orally or in writing, or in any other visual form, they did it right, clear, and complete. When using the term, notation, Mathematical structures to present ideas and describe relationships with models or other situations, they used it in full, but not in terms of truth and clarity. On the other hand, when expressing Mathematical ideas orally it is not true and clear. Whereas when they understand, interpret, and evaluate Mathematical ideas, either orally in writing, or in any other visual form, they did it right, clear, and complete. Furthermore, when they used the term, notation, Mathematics structures to present ideas and describe relationships with other situation models, they did not do it correctly, clearly and completely. Mathematical communication skills and students are the only similarities in this study and the present study.

Yaako and Okoro (2019) conducted a research on problem-solving strategy on senior secondary school students' performance and attitude toward Mathematics in Khana Local

Government Area of Rivers State. This study used qausi-experiment with pretest-posttest control group design adopted the 2 x 2 x 2 factorial analysis for variable matching. The sample of 116 SSS II students with two instruments namely Mathematics Performance Test (MPT) and Students Mathematics Attitude Questionnaires (SMAQ) then analyzed the data collected using Analysis of Variance (ANOVA) and Kruskal Wallis Statistics. The findings show that there is significant difference among two groups of students when exposed to Problem Solving and Lecture Method, there is no significant difference in performance between male and female student when exposed to problem solving, method also, significant difference exist among the two groups in mean attitude score toward Mathematics when exposed to problem solving, instructional strategy and those taught using lecture methods. This study used different designs and statistical tool of analysis but same instruments, variables and subjects as the present study.

The research of Suharto and Widada ((2018) on the 'Contribution of Mathematical Connection and Mathematical Communication to Problem-Solving Ability of Senior High School Students in Kota Bengkulu, Indonesia'. This was a survey research design conducted in senior high schools throughout the Kota Bengkulu that used sample of 170 students with three research instruments namely problem-solving ability test, Mathematical connection ability test and Mathematical communication test then analyzed the data collected by using Confirmatory Factor Analysis (CFA). The finding showed that there is a positive direct effect of Mathematical communication skills on problem-solving abilities, positive direct effect of Mathematical connection skills on problem-solving abilities. Also, there is a positive direct effect of Mathematical communication skills on Mathematical connection abilities of the students. This study used different statistical tool of analysis but same design, instruments, variables and subjects as the present study.

Ndiung and Fransiskus (2018) on their study about Mathematics connection ability and students' Mathematics learning achievement at elementary school. This was ex-post facto research design conducted in Watu Weri state elementary school that used proportionate stratified random sampling technique to select 35 students with test and documentation as data collection techniques then analyzed the data by using linear regression. The result showed that there is effect between Mathematics connection ability toward students' Mathematics learning achievement because of the Mathematics inter-dependence between concept and material and other subjects as well for man's everyday life such as reasoning, problem-solving and creativity development. This study used the same sampling techniques to select the its sample subjects and instrument however, different in all other mechanism.

The students' ability from schools National Examination in Mathematics with high category was the best followed by medium and low categories. Meanwhile, most students also have difficulty in expressing ideas and developing logical arguments as revealed by Sumarsih *et al.* (2018) on Profile of Mathematical Reasoning Ability of 8th Grade Students seen from communication ability, basic skills, connection, and logical thinking in Indonesia. This research used mix method of quantitative and qualitative descriptive approaches with a set of multiple choice tests to measure these abilities which involve communication ability, basic skills, connection and logical thinking. A total of 259 respondents were determined by stratified cluster random sampling for collecting data and later analyzed using one-way Analysis of Variance (ANOVA). This research used same sampling technique, constructs and multiple choice tests which is one of the instruments used in the present study but different approach in all other items.

The findings of Mohamad *et al*., (2017) on 'Improving the Reasoning Skills of Students to overcome Learning Difficulties in Additional Mathematics' in secondary school in

Johor in Malaysia used descriptive qualitative design. The research participants consisted of 30 students who were selected through purposive sampling at a secondary school in Johor. The data was collected using Differentiation Question Reasoning Test (DQRT) based on Marzano's Rubric for Specific Task of Situations (1992) to determine the students' level of reasoning on their achievement in Differentiation, a topic in Additional Mathematics and to analyse the form four students' final year examination results for the same subject at the same school. the findings showed that the proficiency level of students' reasoning skills in the differentiation topic was (40%) for generally weak, (53.33%) for moderate and only 6.67% for good. Therefore, students with moderate and weak performance would need a good reasoning level to improve their performance in Additional Mathematics in the topic, Differentiation. This study used the same construct (reasoning skills), instrument and subjects but differ in all other mechanisms from the present study.

Another study on Understanding the Role of Reasoning Ability in Mathematical Achievement in United Kindom by Caren and Victoria (2015). There were two measures of Mathematical ability, the Woodcock Johnson-III Math fluency test and the Wood-cock Johnson-III calculation test and seventy-four students participated in the study. They revealed that while conditional reasoning performance is correlated with Mathematical ability, it does not predict performance on this task when Mathematical fluency is taken into account. They found that the cognitive reflection task however does predict performance on the calculation task. Also, good performance on the unbelievable conditionals requires a person to recognize the conflict between believability and logic before they can recognize the correct inference. The study had a correlational design and all participants completed the same four measures. This study used the same design and instrument (test) but different instruments from the present study.

From the investigation of Zeny and Bella (2017) on the analysis of Mathematical Representation, Communication and Connection in Trigonometry in Indonesia. This research used qualitative description design and 5 students of class X SMA Pangudi Luhur Yogyakarta as respondents using observation, written test and interviews as instruments of data collection. The data was analysed with technique of data analysis from Miles and Huberman (1984) that is, in the form of data reduction, data presentation and conclusion. The results obtained indicate that most of the students still have problems in representing the problem and in building connections with the materials that have been studied. Also, that the students still need guidance in Mathematical representation and connection through the learning process in order to improve their ability in solving the Mathematics problem, particularly on trigonometry. This research used the same descriptive survey design but with different approach, and has the same instrument yet differences in all other mechanisms.

Novia and Dian (2018) carried out a research on the analysis of Mathematical Representation Skills in Solving Problems of Systems of Linear Equations in Two Variables in Indonesia. The descriptive study with qualitative approach was utilized as the method, a total of 22 grade IX F students of junior high school Tapung were selected as the subject and data was collected through the measuring technique in the form of Mathematical representation test with interview. The results indicate several types of Mathematical representations utilized in system of linear equations in two variables, including visual representation of 77%, symbolic representation of 91%, and verbal representation of 27%. This signifies that the representation skills of the students are still in low category and the students' tendency in solving the problems of system of linear equations in the two variables is to use the symbolic representation. This study used the

same construct (Mathematical representation skills), test instrument and subjects but all other mechanisms are different.

The findings of Aflich *et al.* (2018) on the Mathematical Representation Ability of Senior High School Students titled 'An Evaluation of Students' Mathematical Disposition in Indonesia' used descriptive qualitative design. This study employed a qualitative descriptive method, the subjects of this study were 35 students of 10^{th} grade of public senior high school in Padalarang, West Java Indonesia. Questionnaires and test were used as instruments to collect the data and the test results were analyzed using qualitative analysis in accordance with the indicators of Mathematical representation ability and questionnaires' responses were converted into quantitative data. The study showed that almost all the students were able to use visual representation to solve Mathematical problems, create Mathematical models and solve problems by involving Mathematical expressions. Consequently, most of the students could not fulfill two indicators of the Mathematical representation ability, that is; draw a sketch of the given situation and make the Mathematical model based on the situation and data given. This study used same constructs, instruments (test) and subjects but all other things are different from the present research.

The findings of Ani *et al.* (2016) on 'Mathematical Understanding and Representation Ability of Public Junior High School in North Sumatra Indonesia'. The study used developmental research design with cluster sampling techniques using two sets of non-test instrument namely interview guidance and observation for data collection. The data obtained was analysed descriptively based on four aspects included in the interview and aspects of observation as well as data of Mathematical understanding and Mathematical representation test result. They found that conventional approach was still used in all the classes by the students in learning activity; most of the students did not attain minimal

mastery achievement, also achievement of the students in Mathematical understanding and representation test is low. This study used the same construct (representation skills) and subjects but all other mechanisms are different from the present study.

Adi (2014) also conducted a research on the, 'Mathematical Representation Ability and Students' Self-Confidence through Realistic Mathematics Approach' in Indonesia. This study used quasi-experimental method with the entire population of the seventh grade students of 50 people using sample saturated/whole of the population of class VII as an experimental class B and class VII A as a control class and analysed the collected data using t-test. They reported that by using realistic Mathematics approach, students were led to a more complex understanding of the learning of Mathematics because they did not always learn Mathematics in the abstract but started from the Mathematical form of concrete that would help to train their Mathematical representation ability. Moreover, in this first realistic Mathematics approach, students were asked to construct their own knowledge about the learning of Mathematics before being guided by the teacher. This is because the realistic Mathematics approach has more advantages than conventional learning which is more teacher-centered. This study used the same construct (representation skills) and subjects but all other mechanisms are different from the present study.

2.3.2 Empirical studies on gender and mathematical communication skills

Studies related to Gender and Mathematics Communication Skills include Firdiani *et al.* (2020) on the Gender and Mathematical communication ability in Junior High School in Bandung Indonesia. The research method used was the qualitative research method with 6 male and 6 female students of class VIII with age characteristic between 13-14 years old and have the ability of high, medium and low in general mathematics. Data was

collected by using test and interview. Data analysis used includes data reduction, data collection, and conclusions. The results showed that both male and female students with high ability in general mathematics are able to express situations in the form of pictures or mathematical models, analyse and evaluate mathematical ideas in other forms, but male and female students who have medium and low ability in general mathematics still have difficulty in expressing situations in the form of drawings or mathematical models, analysing and evaluating mathematical ideas in other forms. This study used different design, but same variables, instruments and statistical tool of analysis and subjects as the present study.

Adeneye (2017) on 'Assessing Senior Secondary School Students' Mathematical Proficiency as Related to Gender and Performance in Mathematics in Nigeria' investigated Mathematical proficiency as related to gender and performance in Mathematics among 400 Nigerian senior secondary school students from 10 elitist senior secondary schools in Lagos State using the quantitative research method within the blueprint of descriptive survey design. The data collected was analysed using the descriptive statistics of frequency, percentage, mean, standard deviation and inferential statistics of independent samples t-test, and multiple regression analysis. The result showed that, gender differences in Mathematical proficiency are no longer important and are dissipating even at the subscale level there are subtle gender differences in performance in Mathematics. This study used same descriptive survey design but different approach from the present study.

Mawaddah *et* al. (2018) studied Gender Differences of Mathematical Critical-Thinking Skills of Secondary School Students in Indonesia. The study employed qualitative descriptive survey aimed to describe Mathematical critical-thinking skills of secondary school students in solving Mathematical problems concerning gender. Four students

selected from 30 students of Year 9 in a junior high school in Banda Aceh using critical-thinking skills test and interview as research instruments. The results showed that the critical thinking skills of female students were slightly better than that of male students, which implies that there is gender difference in Mathematical critical-thinking skills. This study is related to the present study in using students while all other aspects are different.

The study of Odual (2013) on the relationship between Mathematical ability and achievement in Mathematics among female secondary school students in Bayelsa state adopts correlational survey design. This study investigated the relationship between female senior secondary school students' Mathematical ability and achievement level in Mathematics in five (5) out of eight (8) local government areas of Bayelsa State Nigeria. This study adopted multi-stage sampling technique, two research instruments titled Student Mathematical Ability Test (SMAT) and Mathematical Achievement Test (MAT) were used to collect data from a sample of 121 female students from rural and 141 female senior secondary school students from urban schools which were randomly selected using the simple random sampling method both at the Local Government and at the school level. The study shows that there is a positive relationship between Mathematical ability and achievement in Mathematics and that Mathematical ability has a significant contribution to achievement in Mathematics. The research used the same correlational survey design and students to gather data and same instrument with the present study but are different in other things.

2.4 Summary of the Literature Reviewed

This study has been reviewed under the following categories; conceptual frame work, theoretical frame work and empirical study for the sake of emphasis. Under conceptual framework, attempt was made to conceptualize the nature of Mathematics as an excellent vehicle for the development and improvement of a person's intellectual competence in logical reasoning, spatial visualization, analysis and abstract thought. Nature and objectives of senior secondary school Mathematics curriculum were also reviewed in

order to guide the conduct of the research. Also, academic performance from different perspectives of numerous authors show performance to be a key component in education.

The study used the following theories to back up its review: the behaviourism theory; which states that learning and behavioural changes are acquired by linking stimuli and response. Cognitivism theory; which believes that learning is internal and a result of a students' processing and organizing new information. Also, the constructivism theory which believes that knowledge is constructed by adapting new information based on previous experience. All these theories were reviewed as they relate to communication skills and students' performance in Mathematics.

The study also reviewed literature on Mathematical Communication skills as those skills that the students must possess in order to communicate Mathematics problems effectively. Such as using Mathematics symbols, terms, notations, diagrams, graphs, tables and pictures, among others. Hence, this research considers the following Mathematical Communication skills; problem-solving skills, reasoning skills, communication skills, connection skills and representation skills in terms of concept of Mathematics performance.

The study reviewed literature that are related to the present study, though most of the studies used different approaches, some used junior secondary schools and even tertiary institutions and were mostly done outside Nigeria and some analysed the Mathematical communication skills of the students based on their personality. To the best of researcher's knowledge, no attention has been given to Mathematics performance of senior secondary school students in relation to Mathematical communication skills in Kutigi Educational Zone of Niger State. Hence, this prompts the present study to investigate the relationship between Mathematical communication skills and

Mathematics performance of senior secondary school students in Kutigi Educational Zone of Niger State, Nigeria.

CHAPTER THREE

3.0 RESEARCH MEHODOLOGY

3.1 Research design

The study is a descriptive survey research and adopts correlational research design. This is because the researcher intends to search for relationships that exist between the variables. Due to the fact that the variables studied are already present in the students, the study will not in any way attempt to manipulate the variables (Odual, 2013).

3.2 Population of the study

The total population of the study comprised all the year two students of 2020/2021 session of the fifty-six (56) senior secondary schools in Kutigi Educational Zone of Niger State with the total population of eight thousand one hundred and forty-eight (8148) students, comprising five thousand two hundred and eight (5208) male students and two thousand and nine hundred and forty (2940) female students. The target population of the study consists of all the senior secondary school two (SS 2) students of all the sampled senior secondary schools in Kutigi Educational Zone of Niger State, totaling eight hundred and fifty-eight (858) students; five hundred and sixty-nine (569) male students and two hundred and eighty-nine (289) female students. Details are attached in Appendices B and C.

3.3 Sample and sampling technique

Multi-stage sampling technique was adopted; cluster sampling techniques was used to classify the schools into three local government areas, namely Lavun, Mokwa and Edati local government areas. Simple random sampling technique was used to select two (2) secondary schools from each local government area to give six (6) schools. Then, proportional stratified random sampling technique was used to select the sample based on Krecjie and Morgan's (1970) table for determining sample size with the total sample of two hundred and sixty-nine (269) students; one hundred and seventy-nine (179) male students and ninety (90) female students. These techniques were adopted since

it allows one to draw more precise conclusions by ensuring that every subgroup is properly represented in the sample (Shona, 2019). See Appendix D.

3.4 Research instrument

The instrument used for this study was titled "Mathematical Communication Skills Test (MCST)". The items of the instrument (MCST) was an adapted West Africa Examination Council (WAEC) 2019/2020 session questions. It contained twenty-five (25) items, with five (5) items for each construct covering all the Mathematical Communication skills of the students under study. The content of the instrument covers Mathematics syllabus related to number and numeration, algebraic process, geometry, probability and statistics as contained in the Senior Secondary School two (SS 2) Mathematics curriculum. The items of MCST are theory questions that students solved on the answer sheet to show their skills in solving Mathematics problems, see Appendix E. On the scoring of the test items, the marks were awarded based on each item magnitude to give each construct one hundred percent (100%). Mathematics Promotion Examination Scores of students was used as Mathematics performance, since the their questions are set by ministry of Education see Appendix. Also, Mathematical Communication skills of the students were also observed from their answer sheets.

3.5 Validity of the research instrument

The instrument was face validated by experts from Science Education Departments of Federal University of Technology Minna, Mathematics Department of FCT College of Education, Zuba and a secondary school Mathematics teacher from Police Secondary School Minna to ensure that all items and words that will confuse the respondents are completely removed from the instruments and content validated to ensure that the content of the study are represented in the instruments. Also, the necessary corrections were made

based on the comments and suggestions of these experts. This was done in order to ensure the instruments measure what they set to measure.

3.6 Reliability of the research instrument

Test re-test method of reliability was used to determine reliability of instrument **(**MCST) by administering the test on forty (40) students of the population who were not among the sample students. After one week, the same instrument was re-administered on the same set of students, and 0.82, 0.74, 0.81, 0.70 and 0.71 coefficient of reliability were obtained for the five constructs respectively for MCST using Pearson Product Moment Correlation (PPMC) formula giving 0.76 as the average reliability . These showed that the instrument was reliable. The computation of the reliability test is attached in Appendix F.

3.7 Method of data collection

To collect the necessary data for the study, the researcher visited the sampled schools with an introduction letter from Science Education Department of Federal University of Technology Minna, seeking for permission to use students' Promotion Examination Scores of Mathematics and the students of these schools as the subject of the study. After being permitted, Mathematics teachers of the various schools were requested by the researcher to lead and meet with the students as well as assist in administering the research instrument to the students. Then, Mathematical Communication Skills Test (MCST) were distributed to the sampled students of various schools and they were instructed and guided on how to fill them. The answering of MCST were supervised properly and collected immediately after they have answered the test questions in order to avoid damage or missing of the instrument. The data wascollected during the second term of 2020/2021 academic session. Six weeks was used to collect the data from the sampled schools.

3.8 Method of data analysis

The scores of items were coded into Statistical Package for Social Sciences (SPSS) software in order to analyse the data. Mean and Standard Deviation supported by Scatterplots were used to answered the research questions while Pearson Product Moment Correlational Coefficient was used to test the hypotheses at 0.05 level of significant. Also, the Mathematical communication skills of the students was analyse in form of data reduction and presentation.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Answer to research questions

The research questions raised were answered using mean and standard deviation supported by Scattered plots.

Research question one

What is the relationship between Mathematical communication skills and Mathematics performance of secondary school students in Kutigi Educational zone of Niger state?

Table 4.1: Summary of the mean and standard deviation of mathematical communication skills and mathematics performance of secondary school students

Variables	N	$\bar{x}$	SD	$\bar{x}$ difference
Mathematics communication skills	269	31.11	15.77	
				32.28
Mathematical Performance	269	63.39	12.89	

Table 4.1 shows the Mean score of 31.11 with Standard Deviation of 15.77 for Mathematical communication skills and Mean score of 63.39 with standard deviation of 12.89 for Mathematics performance, this gives the Mean difference of 32.28 between the variables. This therefore, indicates a positive relationship between the variables. The descriptive statistics (Scatterplots) of the two groups is presented in figure 4.1 below.

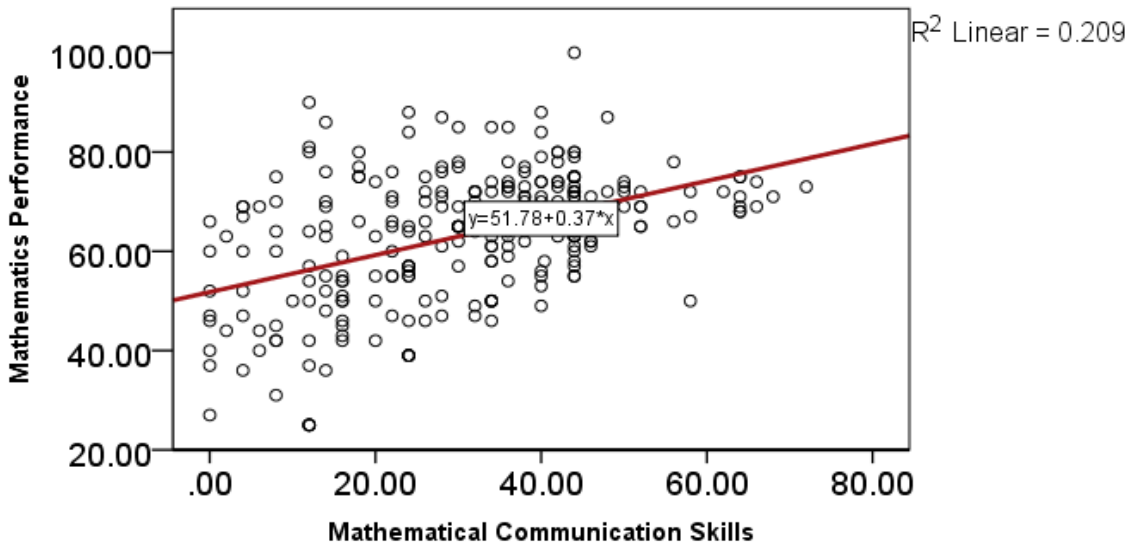


Figure 4.1: Scatterplot relationship between mathematical communication skills and mathematics performance of secondary school students

Figure 4.1 shows the scatterplot of the relationship between Mathematical communication skills and Mathematics performance of secondary school students, this indicates a positive relationship between the variables. The fitted line shows that as Mathematical communication skills increases, the Mathematics performance of the secondary school students also tends to increases.

Research question two

What is the relationship between problem-solving skills and Mathematics performance of secondary school students in Kutigi Educational zone of Niger state?

Table 4.2: Summary of the mean and standard deviation of problem-solving skills and mathematics performance of secondary school students

Variables	N	$\bar{x}$	SD	$\bar{x}$ difference
Problem-Solving skills	269	37.99	23.60	
				25.40
Mathematical Performance	269	63.39	12.89	

Table 4.2 shows the Mean score of 37.99 with Standard Deviation of 23.60 for problem-solving skills and Mean score of 63.39 with standard deviation of 12.89 for Mathematics

performance, this gives the Mean difference of 25.40 between the variables. This indicates a positive relationship between the variables. The descriptive statistics (Scatterplot) of the two groups is presented in Figure 4.2

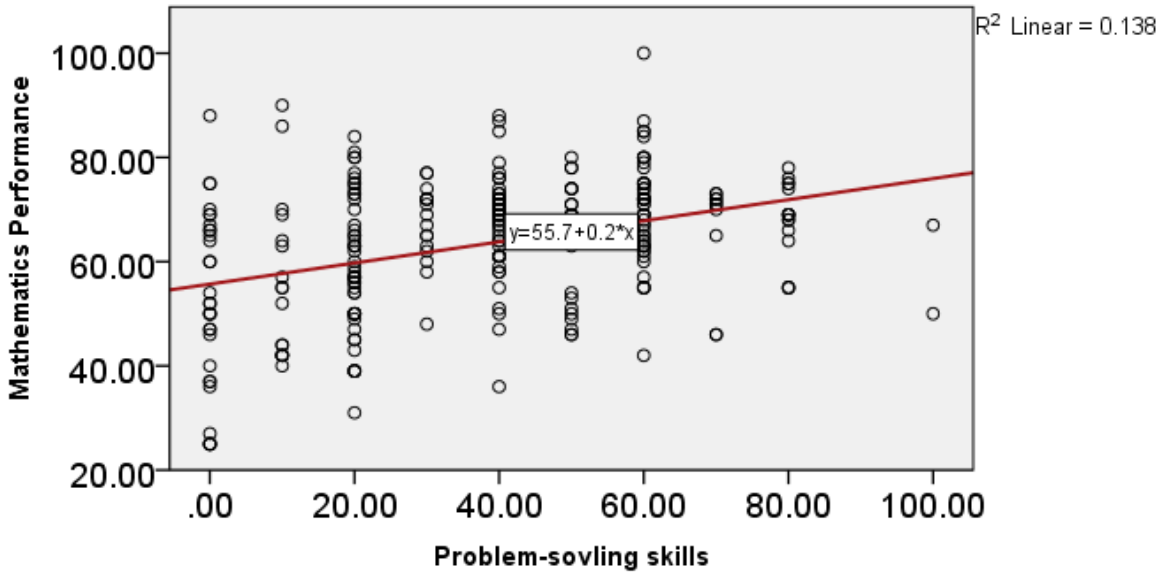


Figure 4.2: Scatterplot relationship between problem-solving skills and mathematics performance of secondary school students

For the problem-solving skills and Mathematics performance in figure 4.2 above, the scatterplot displays a positive relationship between the constructs. The trend line indicates that secondary school students Mathematics performance increases as their problem-solving skills increased.

Research question three

What is the relationship between proofs and reasoning skills and Mathematics performance of secondary school students in Kutigi Educational zone of Niger state?

Table 4.3: Summary of the mean and standard deviation of proofs and reasoning skills and mathematics performance of secondary school students

Variables	N	$\bar{x}$	SD	$\bar{x}$ difference
Proofs and Reasoning skills	269	33.79	26.51	
				29.60
Mathematical Performance	269	63.39	12.89	

Table 4.3 shows the Mean score of 33.79 with Standard Deviation of 26.51 for proofs and reasoning skills and Mean score of 63.39 with standard deviation of 12.89 for Mathematics performance, this gives the Mean difference of 29.60 between the variables. This therefore, indicates a positive relationship between the variables. The descriptive statistics (Scatterplot) of the two groups is presented in figure 4.3

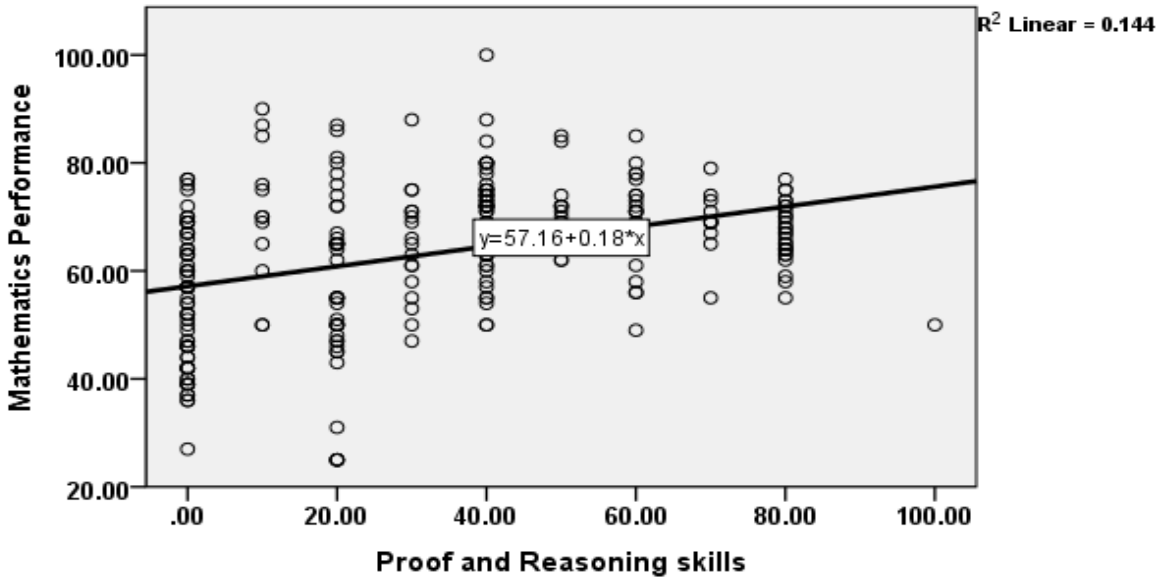


Figure 4.3: Scatterplot relationship between proofs and reasoning skills and mathematics performance of secondary school students

From figure 4.3 above, the scatterplot relationship between proofs and reasoning skills and Mathematics performance of secondary school students, shows a positive relationship between the variables. The fitted line shows that as proofs and reasoning skills increases, the Mathematics performance of the secondary school students also tends to increases.

Research question four

What is the relationship between connection skills and Mathematics performance of secondary school students in Kutigi Educational zone of Niger state?

Table 4.4: Summary of the mean and standard deviation of connection skills and mathematics performance of secondary school students

Variables	N	$\bar{x}$	SD	$\bar{x}$ difference
Connection skills	269	20.45	19.86	
				42.94
Mathematical Performance	269	63.39	12.89	

Table 4.4 shows the Mean score of 20.45 with Standard Deviation of 19.86 for connection skills and Mean score of 63.39 with standard deviation of 12.89 for Mathematics performance, this gives the Mean difference of 42.94 between the variables. This therefore, indicates a positive relationship between the variables. The descriptive statistics (Scatterplot) of the two groups is presented in figure 4.4

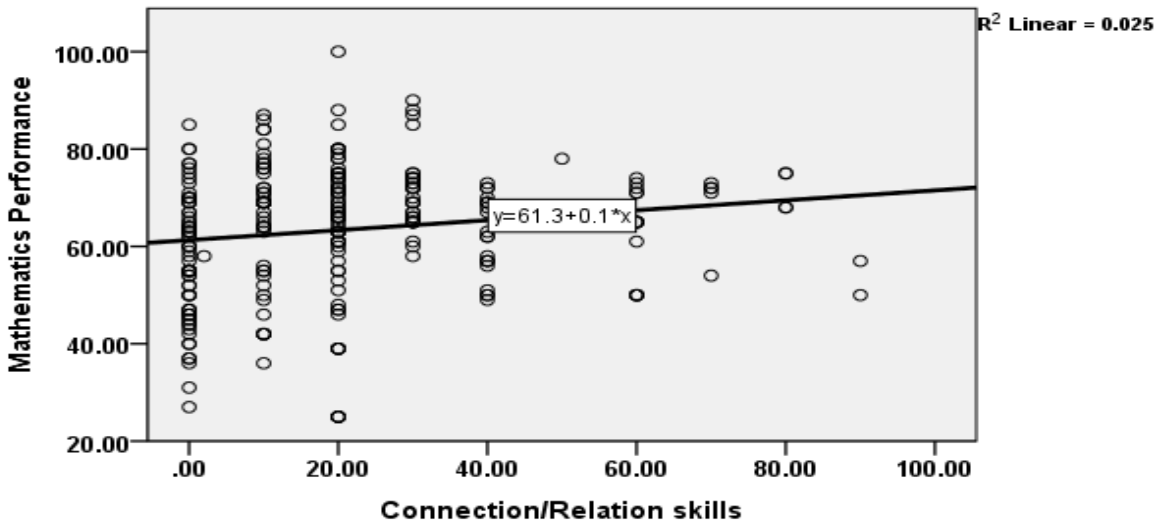


Figure 4.4: Scatterplot relationship between connection skills and mathematics performance of secondary school students

Figure 4.4 shows the scatterplot of the relationship between connection skills and Mathematics performance of secondary school students, this indicates a positive

relationship between the variables. The fitted line shows that as connection skills increases, the Mathematics performance of the secondary school students also tends to increases.

Research question five

What is the relationship between representation skills and Mathematics performance of secondary school students in Kutigi Educational zone of Niger state?

Table 4.5: Summary of the mean and standard deviation of representation skills and mathematics performance of secondary school students

Variables	N	$\bar{x}$	SD	$\bar{x}$ difference
Representation skills	269	35.76	27.27	
				27.63
Mathematical Performance	269	63.39	12.89	

Table 4.5 shows the Mean score of 35.76 with Standard Deviation of 27.27 for representation skills and Mean score of 63.39 with standard deviation of 12.89 for Mathematics performance, this gives the Mean difference of 27.63 between the variables. This therefore, indicates a positive relationship between the variables. The descriptive statistics (Scatterplot) of the two groups is presented in figure 4.5

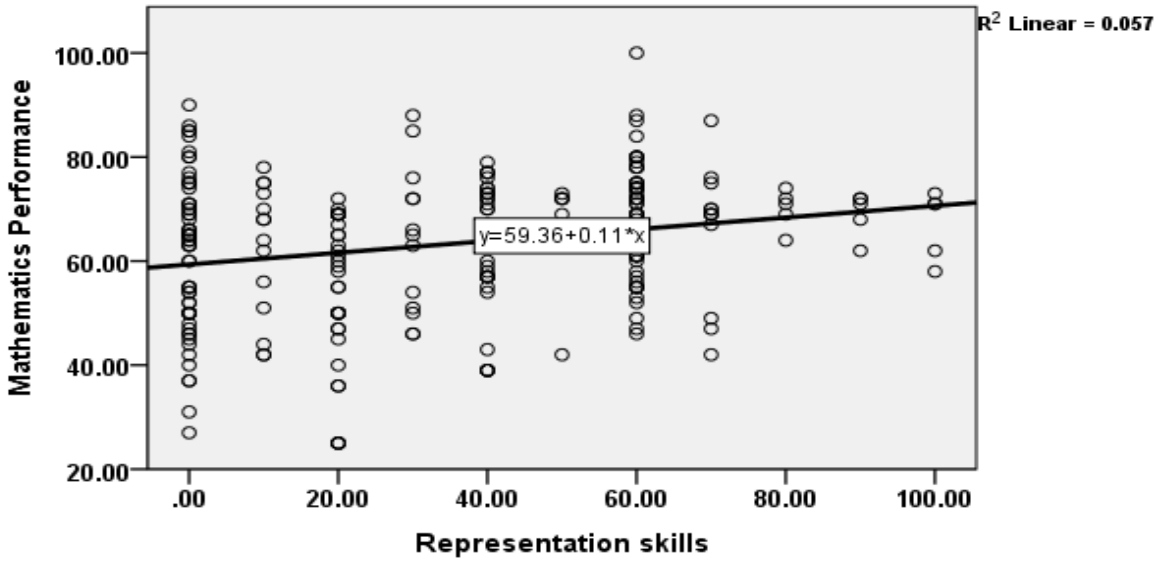


Figure 4.5: Scatterplot relationship between representation skills and mathematics performance of secondary school students

For the representation skills and Mathematics performance in figure 4.5 above, the scatterplot displays a positive relationship between the constructs. The trend line indicates that secondary school students Mathematics performance increases as their representation skills increased.

Research question six

What is the relationship between gender and Mathematical communication skills of secondary school students in Kutigi Educational zone of Niger state?

Table 4.6: Summary of the mean and standard deviation of gender and mathematical communication skills of secondary school students

Variables	N	$\bar{x}$	SD	$\bar{x}$ difference
Gender	269	1.31	0.46	
				29.80
Mathematics communication skills	269	31.11	15.77	

Table 4.6 shows the Mean score of 1.31 with Standard Deviation of 0.46 for gender and Mean score of 31.11 with standard deviation of 15.77 for Mathematics communication

skills, this gives the Mean difference of 29.80 between the variables. This therefore, indicates a positive relationship between the variables. The descriptive statistics (Scatterplot) of the two groups is presented in figure 4.6

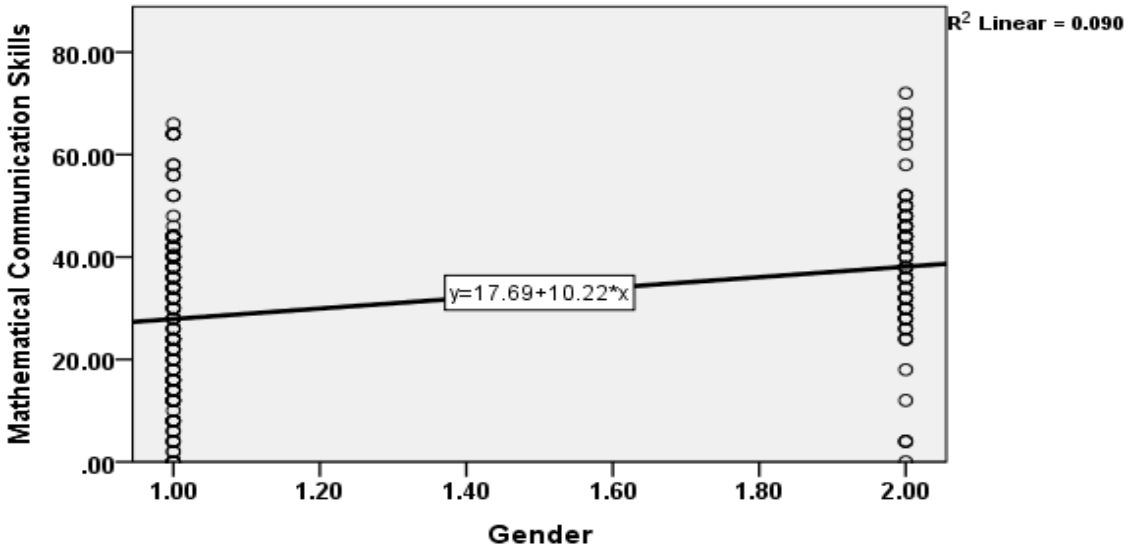


Figure 4.6: Scatterplot relationship between gender and mathematical communication skills of secondary school students

Figure 4.6 above is a scatterplot of relationship between gender and Mathematical communication skills of secondary school students, it shows a positive relationship between the Mathematical communication skills and gender. The fitted line shows that there is an increase once you move from the male to female and increasing the skills.

4.2 Testing null hypotheses

Hypothesis one (H_{O1}): There is no significant relationship between Mathematical communication skills and Mathematics performance of secondary school students

Table 4.7: Summary of Pearson product moment correlation between mathematical communication skills and mathematics performance of secondary school students

Variables	N	$\bar{x}$	SD	r_{-cal}	p_{-value}
MCS	269	31.11	15.77		
				0.46	0.00
MP	269	63.39	12.89		

Table 4.7 shows the Mean score of 31.11 with standard deviation of 15.77 for Mathematical communication skills and Mean score of 63.39 with Standard Deviation of 12.89 for Mathematics performance, also r is 0.46. Therefore, the null hypothesis one (H_{O1}) was rejected because p-value of 0.00 is less than 0.05 alpha level. Hence, there was moderately positive relationship between Mathematical communication skills and Mathematics performance of secondary school students.

Hypothesis two (H_{O2}): There is no significant relationship between problem-solving skills and Mathematics performance of senior secondary school students

Table 4.8: Summary of Pearson product moment correlation between problem-solving skills and mathematics performance of secondary school students

Variables	N	$\bar{x}$	SD	r_{-cal}	p_{-value}
PSS	269	37.99	23.60		
				0.37	0.00
MP	269	63.39	12.89		

Table 4.8 above shows that the Mean score of Problem-Solving skills is 37.99 with Standard Deviation of 23.60 and Mean score of Mathematics performance was 63.39 with Standard Deviation of 12.89, also r is 0.37. Hence, the null hypothesis two (H_{O2}) rejected since p-value of 0.00 < 0.05 alpha level. This shows that, there exists moderately positive

relationship between problem-solving skills and Mathematics performance of senior secondary school students.

Hypothesis three (H_{O3}): There is no significant the relationship between proofs and reasoning skills and Mathematics performance of senior secondary school students

Table 4.9: Summary of Pearson product moment correlation between proofs and reasoning skills and mathematics performance of secondary school students

Variables	N	$\bar{x}$	SD	r_{-cal}	p_{-value}
PRS	269	33.79	26.51		
				0.38	0.00
MP	269	63.39	12.89		

From table 4.9 above, the Mean score of proofs and reasoning skills is 33.79 with Standard Deviation of 26.51 and Mean score of Mathematics performance is 63.39 with Standard Deviation of 12.89, also r is 0.38. Hence, the null hypothesis three (H_{O3}) rejected since p-value of 0.00 < 0.05 alpha level. This indicates that, there was moderately positive relationship between proofs and reasoning skills and Mathematics performance of senior secondary school students.

Hypothesis four (H_{O4}): There is no significant relationship between connection skills and Mathematics performance of senior secondary school students

Table 4.10: Summary of Pearson product moment correlation between connection skills and mathematics performance of secondary school students

Variables	N	$\bar{x}$	SD	r_{-cal}	p_{-value}
CS	269	20.45	19.86		
				0.16	0.01
MP	269	63.39	12.89		

Table 4.10 shows the Mean score of 20.45 with standard deviation of 19.86 for connection skills and Mean score of 63.39 with Standard Deviation of 12.89 for Mathematics

performance, also r is 0.16. Therefore, the null hypothesis four (H_{O4}) was rejected because p-value of 0.01 is less than 0.05 alpha level. Hence, there exists positive weak relationship between Connection skills and Mathematics performance of secondary school students.

Hypothesis five (H_{O5}): There is no significant relationship between representation skills and Mathematics performance of senior secondary school students

Table 4.11: Summary of Pearson product moment correlation between representation skills and mathematics performance of secondary school students

Variables	N	$\bar{x}$	SD	r_{-cal}	p_{-value}
RS	269	35.76	27.27		
				0.24	0.00
MP	269	63.39	12.89		

From table 4.11, the Mean score of representation skills is 35.76 with Standard Deviation of 27.27 and Mean score of Mathematics performance is 63.39 with Standard Deviation of 12.89, also r is 0.24. Hence, the null hypothesis five (H_{O5}) is rejected since p-value of 0.00 < 0.05 alpha level. This shows that, there exists positive weak relationship between Representation skills and Mathematics performance of senior secondary school students.

Hypothesis six (H_{O6}): There is no significant relationship between Gender and Mathematical communication skills of secondary school students.

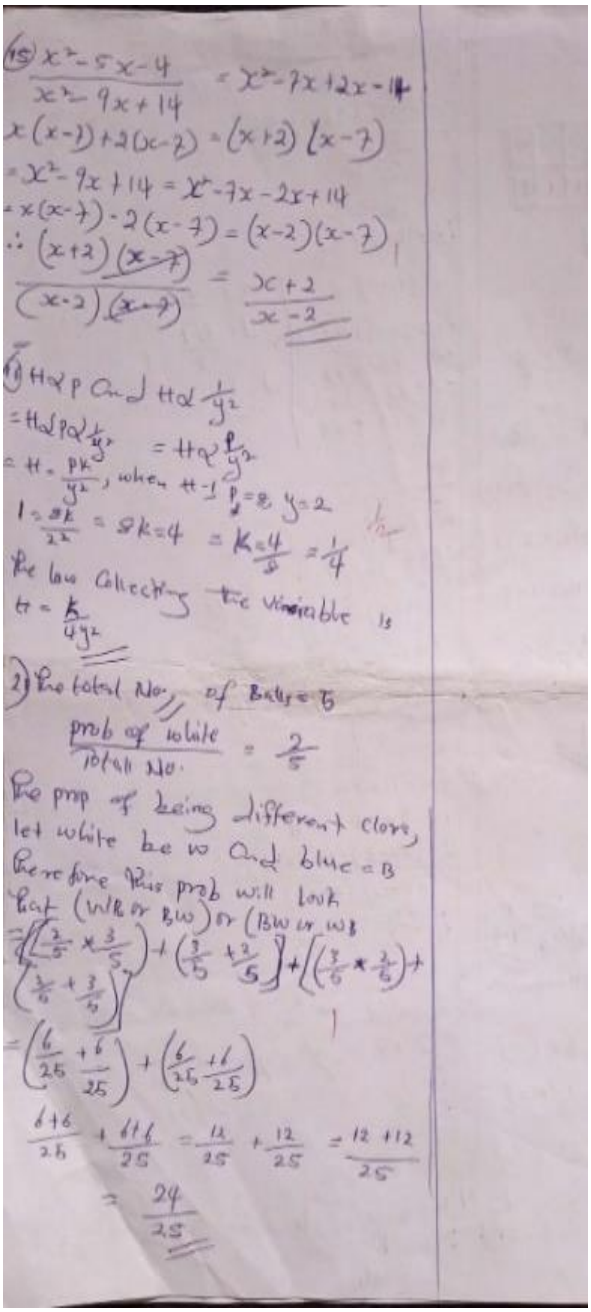
Table 4.12: Summary of Point-Biserial correlation between gender and mathematical communication skills of secondary school students

Variables	N	$\bar{x}$	SD	$r_{pb\text{-}cal}$	$p_{\text{-value}}$
Gender	269	1.31	0.46		
				0.30	0.00
MCS	269	31.11	15.77		

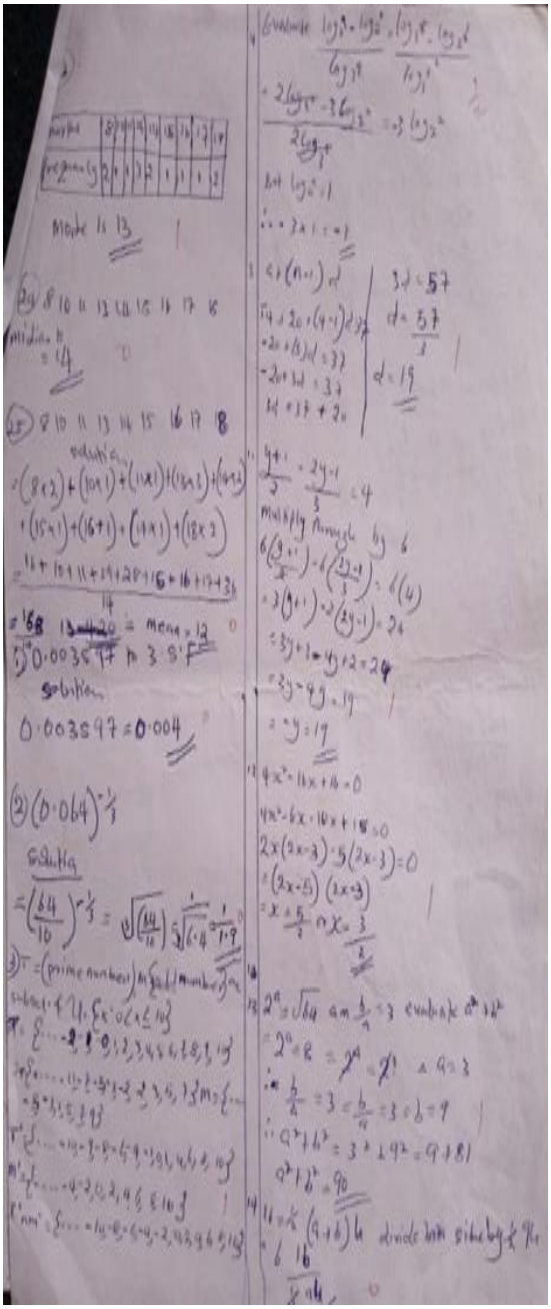
Table 4.12 shows the Mean score of 1.31 with standard deviation of 0.46 for Gender and Mean score of 31.11 with Standard Deviation of 15.77 for Mathematical communication skills, also r_{pb} is 0.30. Therefore, the null hypothesis four (H_{O4}) was rejected because p-value of 0.00 is less than 0.05 alpha level. This indicates that, there was weak positive relationship between Gender and Mathematical communication skills of secondary school students.

4.3 Data reduction

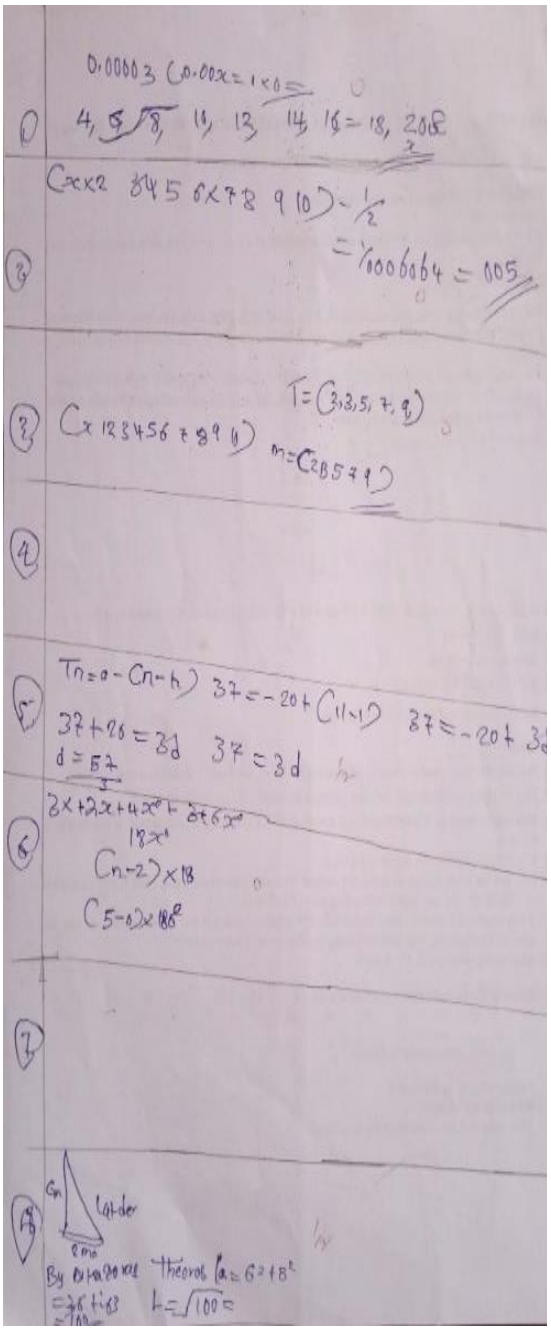
This displayed shows the answers of the students



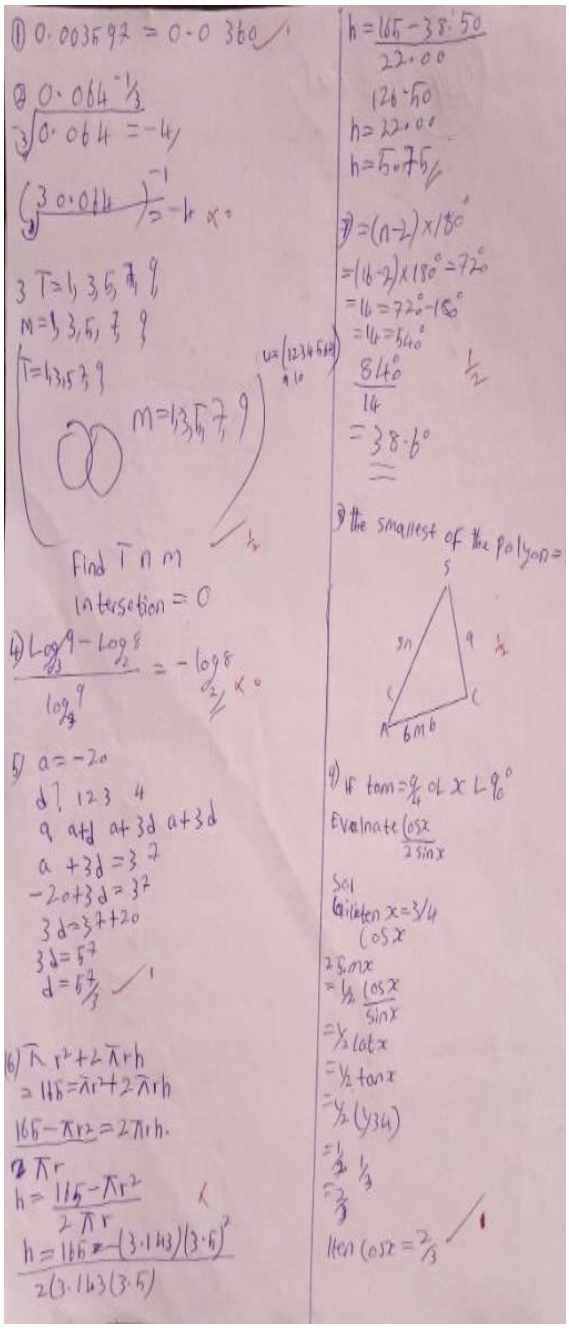
This student was able to relate the concepts and expressed Mathematical expressions accurately but unable to solve all the questions.



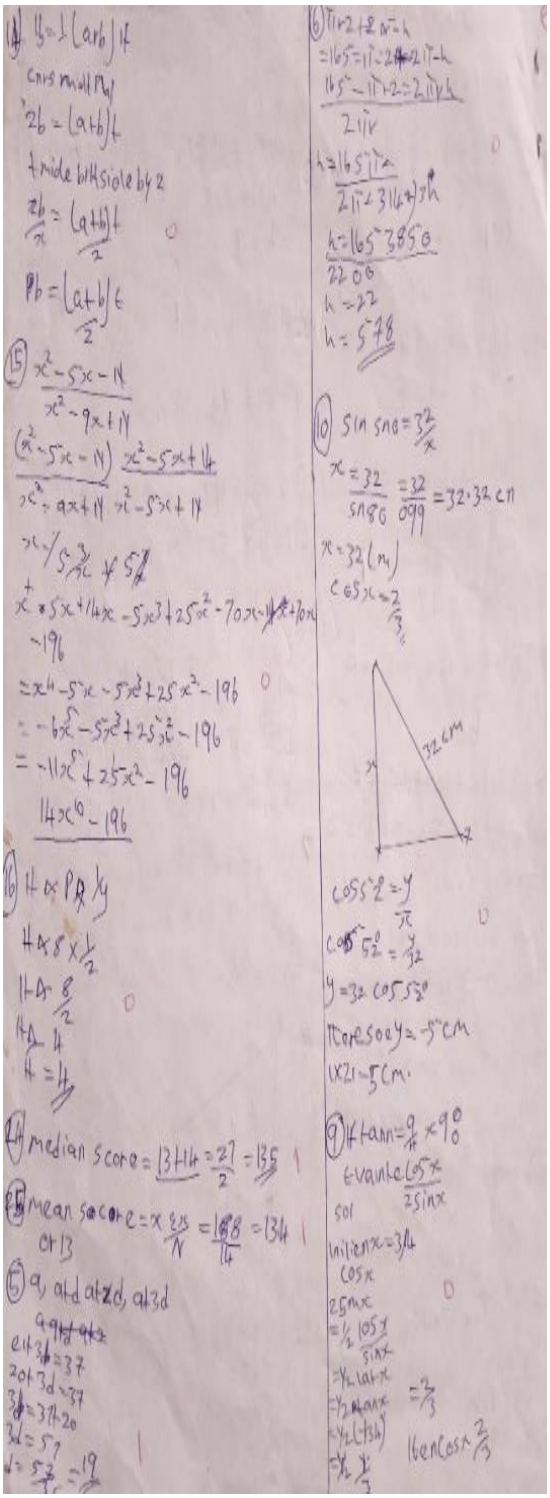
This student was able to relate concepts, used operational signs correctly and transformed scores to the table but unable to use table to answer questions correctly.



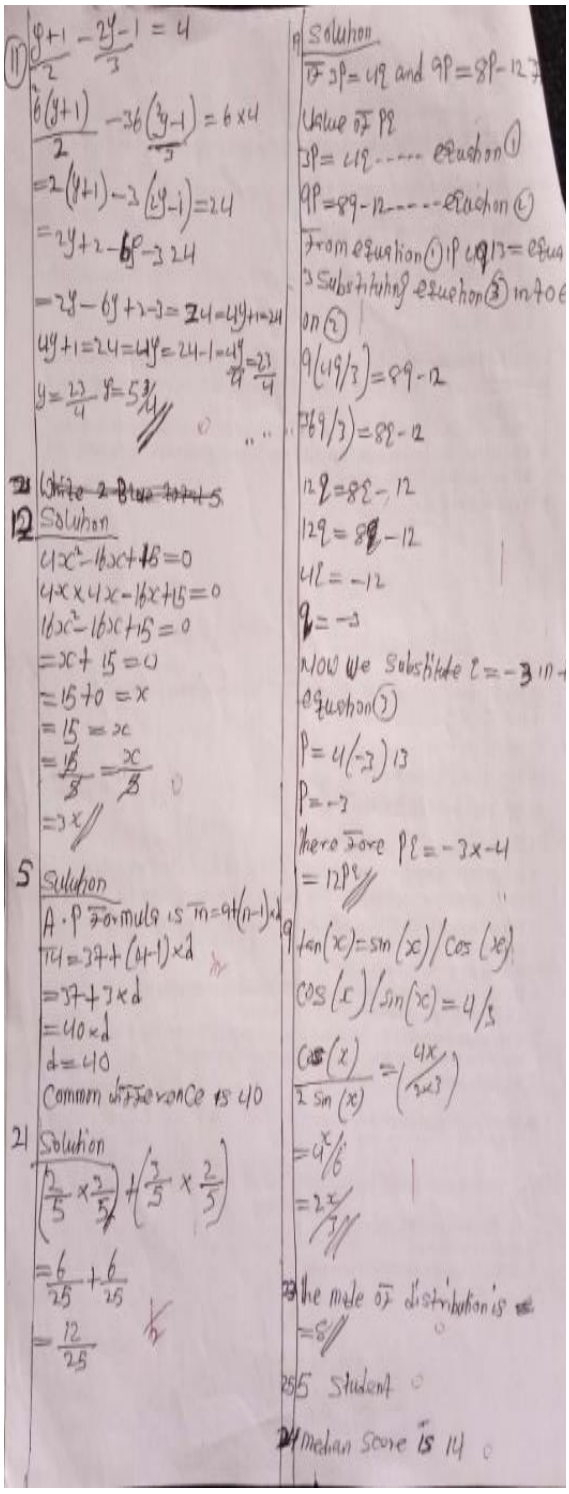
This student had difficulty in answering the given questions.



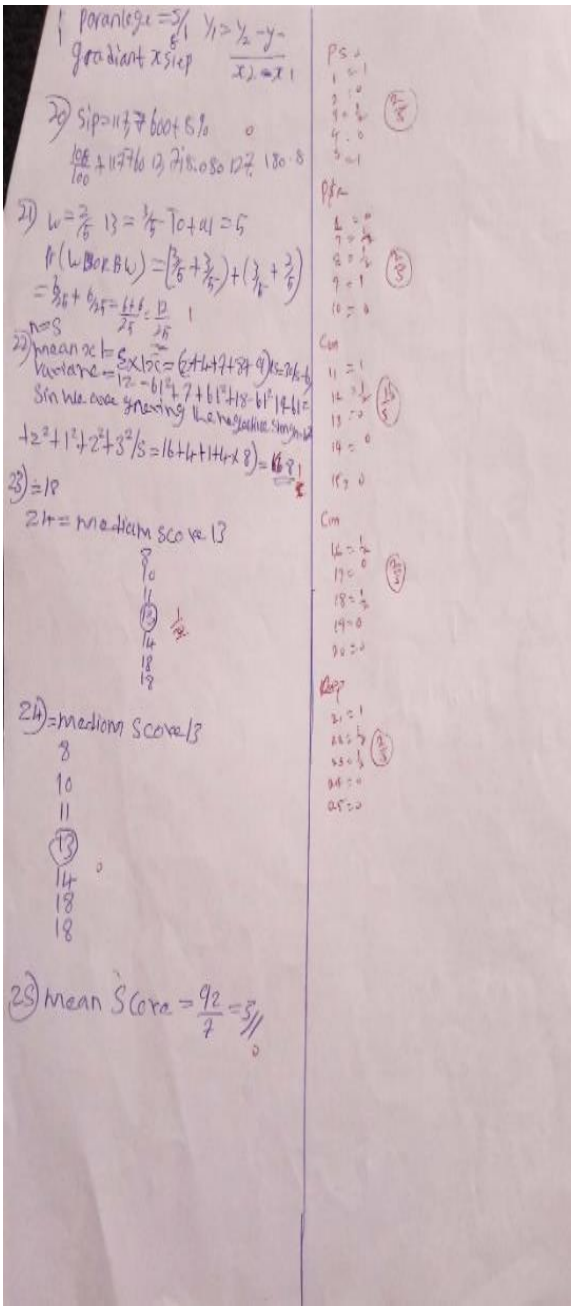
This student was able to bring out variables but unable to evaluate and simplify the problem.



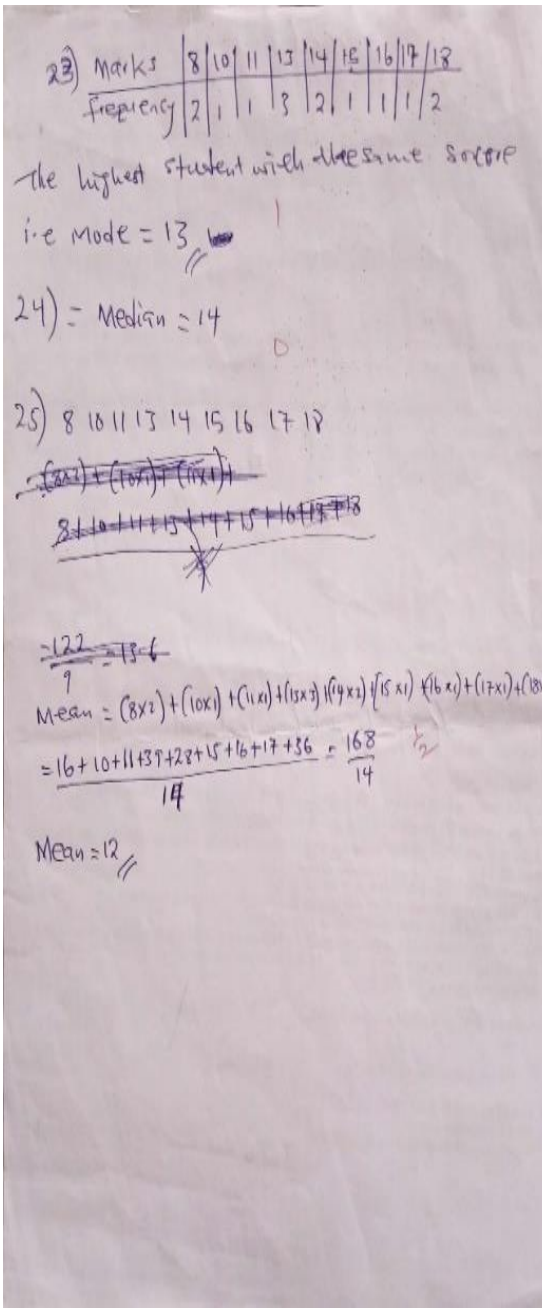
This student understands the underlying logical rules and can recall formula but not able to solve for correct answer.



This student was able to relate mathematics concepts with each other but unable to solve most of the problems correctly.



This student was not able to transform the test scores into table, also unable to give correct answer.



This student was able to transform the test scores into table yet unable to solve to get correct answer.

4.4 Summary of findings

The summary of the major findings from this study were:

1. There was moderately positive relationship between Mathematical communication skills and Mathematics performance of secondary school students;
2. There exists moderately positive relationship between problem-solving skills and Mathematics performance of senior secondary school students;
3. There was moderately positive relationship between proofs and reasoning skills and Mathematics performance of senior secondary school students;
4. There was positive weak relationship between Connection skills and Mathematics performance of secondary school students;
5. There exists positive weak relationship between Representation skills and Mathematics performance of senior secondary school students;
6. There was positive weak relationship between Gender and Mathematical communication skills of secondary school students.

4.5 Discussion of findings

The results of this study were discussed according to the presented findings.

First finding show that there was moderately positive relationship between Mathematical communication skills and Mathematics performance of secondary school students. This is due to the fact that some students were unable to solve the Mathematics problem given to them, unable to use Mathematical operational signs, terms, notations correctly and express Mathematical expressions accurately as shown from their answer sheets. Hence, this indicates clearly that Mathematical communication skills is a major contributor to Mathematics performance of secondary school students. This supports the findings of

Mailis *et al.* (2019) who showed that students' skills in expressing Mathematical ideas in various ways have not met the expectation. The result is also in line with Septiana *et al.* (2018) whose study revealed that some students could not express their ideas on graph or reveal a Mathematical sentence in their languages. In contrary to this study, Lomibao *et al.* (2016) revealed that students had improved in terms of achievement score and showed a good grasp of the concept as shown in their answers in the second-tier questions and that students gave varied justifications of their answers, which evidently showed that they were able to make connections and had applied previous concepts learned.

Second finding revealed that there exists moderately positive relationship between problem-solving skills and Mathematics performance of senior secondary school students. It is revealed from students' answer sheets that some can analyse facts and put them in systematic order, evaluate, simplify and easily solve Mathematics problems while many of them cannot do so. This finding is in agreement with work of Puspa *et al.* (2019) who disclosed that while there were students who were more detailed in doing and remembering things that were taught, there were other students who did things briefly and precisely; so it can be said that each student has different Mathematical communication skills in solving problem. This study also agreed with the findings of Suharto and Widada (2019) who found that there is a positive direct effect of Mathematical communication skills on problem-solving abilities

Third finding shows that there was moderately positive relationship between proofs and reasoning skills and Mathematics performance of senior secondary school students. From the students' answer sheets, it can be deduced that students do not understand the underlying logical rules, cannot recall formula quickly also not able to overcome generalization and pattern in solving Mathematics problem. This supports the work of Rahmy *et al.* (2019) who revealed that students who were with sequential concrete and

sequential abstract thinking styles were capable of arranging similar conjectures, making arguments, exploring ideas and formulating generalizations. However, they were having difficulty presenting Mathematics in their own language. Meanwhile, students with random concrete and random abstract thinking styles were able to express ideas and formulate generalizations, they were however having difficulties in establishing conjectures. The finding is in line with the study of Mohamad *et al*. (2017) which showed that the proficiency level of students' reasoning skills in the differentiation topic was (40%) for generally weak, (53.33%) for moderate and only 6.67% for good. Therefore, students with moderate and weak performance would need a good reasoning level to improve their performance in Mathematics.

From the fourth finding, it shows that there was positive weak relationship between connection skills and Mathematics performance of secondary school students. This is because most of the students were having difficulty in relating Mathematics concept with each other and analyzing real life situation using Mathematical ideas as shown from their answer sheets. This supports the findings of Ndiung and Fransiskus (2018) who found that there is effect between Mathematics connection ability toward students' Mathematics learning achievement because of the Mathematics inter-dependence between concept and material and other subjects as well for man's everyday life such as reasoning, problem-solving and creativity development.

The fifth finding revealed that there exists positive weak relationship between representation skills and Mathematics performance of senior secondary school students. It has shown from the students' answer sheets that while there were students who were able to represent information on tables to give answers, there were others who were not able to use Mathematics diagrams to represent mathematics concepts and transform test scores into table before solving to get correct answer. This is in agreement with the

findings of Novia and Dian (2018) who found that the representation skills of the students are still in low category and the students' tendency in solving the problems of system of linear equations in two variables is to use the symbolic representation. This is also in line with the findings of Zeny and Bella (2017) who discovered that most of the students still have problems of representing the problem and in building connections with the materials that have been studied. Also, that the students still need guidance in Mathematical representation and connection through the learning process in order to improve their ability in solving the Mathematics problem.

The last finding disclosed that there was positive weak relationship between Gender and Mathematical communication skills of secondary school students. It is indicated by the fitted line on the scatterplot that mathematical communications skills of female students is higher than that of male students. This is in line with the study of Mawaddah *et* al. (2018) which showed that the critical thinking skills of female students were slightly better than that of male students, which implies that there is gender difference in Mathematical critical-thinking skills. This study contradicts the study of Yaako and Okoro (2019) who found that there is no significant difference in performance between gender of student when exposed to problem solving method.

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Based on the findings, the study concludes that;

The five Mathematical Communication skills under studied; problem-solving skills, proofs and reasoning skills, communication skills, connection skills and representation skills have positive relationship on the Mathematics performance of the secondary school students. Hence, as Mathematical Communication Skills increases the mathematics performance of the secondary school students also increases.

Also, there was positive relationship between Gender and Mathematical Communication Skills of secondary school students. However, it shows that Mathematical Communication Skills of the female students was higher than that of the male students.

5.2 Recommendations

This study recommends the following based on its findings of the study

1. Students should develop and maintain more interest and confidence in Mathematics learning in secondary schools
2. Students should be encouraged to be curious when encountering any problem in Mathematics. Also, Individual differences in students' skills and background should be taken into consideration by teachers
3. Mathematics teachers should adopt a good measure to strengthen Mathematical communication skills during teaching and learning process to enhance students' performance in Mathematics
4. Government should also improve the teachers' welfare so as to motivate and enable them discharge their functions effectively and efficiently

5. There should be constant seminars, workshops and conferences for Mathematics teachers in secondary schools to update them in new skills and innovations and hence, improve their quality of instructional delivery
6. Suitable instructional materials should be designed and developed or improvised to facilitate Mathematics teaching and learning in secondary schools

5.3 Contribution to knowledge

The results of this study have greatly contributed to the body of knowledge in the following ways:

1. The study has provided knowledge on the relationship between the five Mathematical communication skills and Mathematics performance of secondary school students to be positive;
2. It has provided that female secondary school students' Mathematical Communication Skills were higher than that of the male students; and
3. It has also contributed to existing literatures and provided a platform for researchers on relationship between the five Mathematical communication skills and Mathematics performance of secondary school students.

5.4 Suggestions for further studies

Future researchers can also find out:

1. the relationship between Mathematical communication skills, interest, attitude and mathematics performance of secondary school students;
2. related study can be conducted among primary school students;
3. similar study should be conducted in other parts of the country; and
4. similar study should also be conducted in other field of studies.

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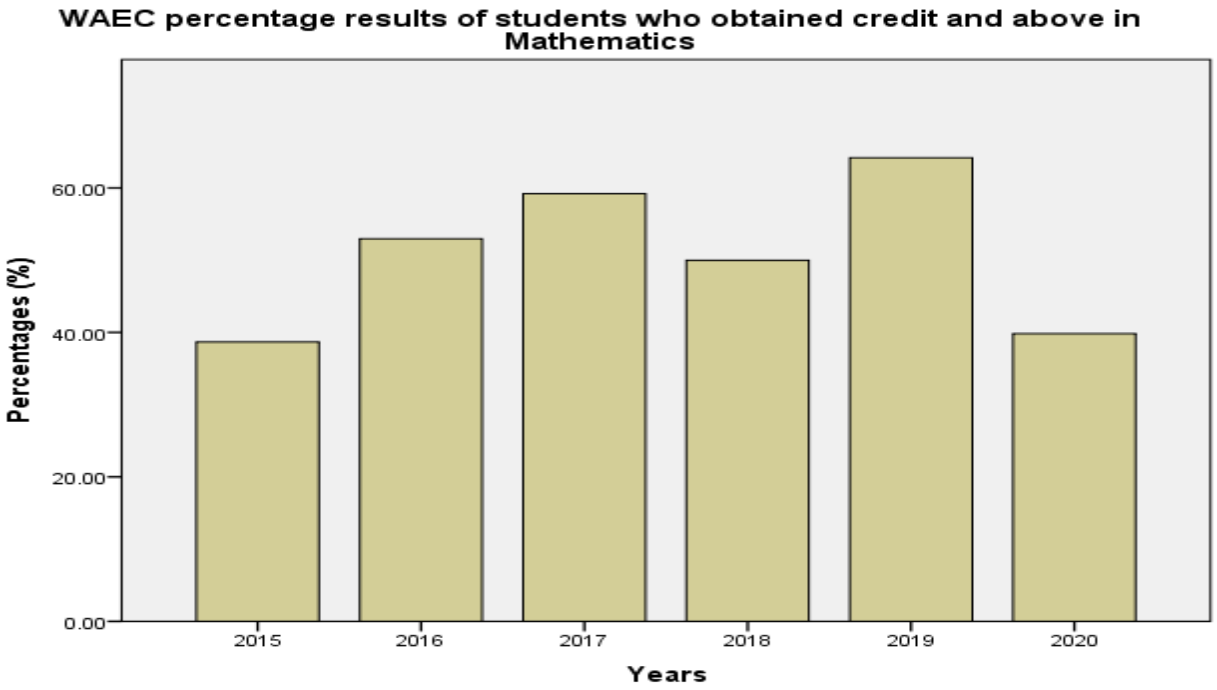
APPENDIX A

WAEC percentage results of students who obtained credit and above in Mathematics

Year	Percentages (%)
2015	38.68
2016	52.97
2017	59.22
2018	49.98
2019	64.18
2020	39.82



Source: WAEC Head of National Office report, 2015 - 2020

APPENDIX B

Table showing the distribution of the Population of the study

S/No	Name of Schools	Number of Students		
		Male	Female	Total
	MOKWA LOCAL GOVERNMENT			
1	Day Secondary School Kudu	138	81	219
2	Government Secondary School Bokani	176	223	399
3	Government Secondary School Kpaki	105	33	138
4	Day Secondary School Kpege-Mokwa	310	114	424
5	Government Secondary School Gbara	324	67	391
6	Hakimi Aliyu Day Secondary School Mokwa	368	190	558
7	Mungo Park Secondary School Jebba North	93	38	131
8	Day Secondary School Wuya-Kede	132	30	162
9	Day Secondary School Rabba	75	50	125
10	Day Secondary School Muwo	34	09	43
11	Government Girls Secondary School Mokwa	-	150	150
12	College of Arts and Islamic Study Mokwa	53	41	94
13	Day Secondary School Takuma	57	38	95
14	Government Day Science College Ja'agi	53	20	73
15	Government Science College Mokwa	177	70	247
16	Day Secondary School Dumi	140	47	187
17	Government Science and Vocational College Jebba North	68	37	105
18	Day Secondary School Muregi	69	38	107
19	Women Day College Mokwa	00	33	33
	LAVUN LOCAL GOVERNMENT			
20	Government Science College Doko	00	00	00
21	Army Day Secondary School Bida	150	103	253
22	Day Secondary School Gaba	168	26	194
23	Day Secondary School Dabban	180	200	380
24	Day Secondary School Kutigi	301	70	371
25	Government Senior Secondary School Jima	200	55	255
26	Day Secondary School Batati	120	50	170
27	Women Day College Kutigi	00	129	129
28	Day Secondary School Busu	99	86	185
29	Day Secondary School Jipan	68	22	90
30	Day Secondary School Mambe	17	06	23
31	Day Secondary School Sosa	00	00	00
32	Day Secondary School Yeti	00	00	00
33	Day Secondary School Panti	63	32	95

34	Day Secondary School Lanle	23	53	76
35	Day Secondary School Egbako	00	00	00
36	Idris Legbo Science College Kutigi	174	00	174
37	Shaba Mahmud CAIS Shabafu	98	47	145
38	College of Art and Islamic Studies Santali	38	04	42
39	A. A. Kure CAIS Ndaloke	77	27	104
40	Com. Tech. & Comm. College Vunchi	77	77	154
41	Day Secondary School Charati	00	00	00
42	Day Secondary School Eyagi Sodangi	00	00	00
	EDATI LOCAL GOVERNMENT			
43	Day Secondary School Enagi	79	30	109
44	Day Secondary School Sakpe	37	28	65
45	Day Secondary School Gonagi	260	223	483
46	Day Secondary School Gbodoti	80	53	133
47	Day Secondary School Gbangban	176	32	208
48	Day Secondary School Etsu Tasha	100	60	160
49	Day Secondary School Katamba Bologi	45	55	100
50	Government Day Secondary School Diko-Enagi	34	24	58
51	Day Secondary School Edati Bafo	101	66	167
52	Day Secondary School Rokota	26	07	33
53	College of Art and Islamic Studies Enagi	45	66	111
54	Day Secondary School Emigi Kwale	00	00	00
55	Day Secondary School Lenfa Bororo	00	00	00
56	Day Secondary School Fazhi	00	00	00
	Total	**5208**	**2940**	**8148**

Source: Ministry of Education Minna, Niger State 2021.

APPENDIX C

Table showing the distribution of the target population of the study

S/No	Name of Schools	Number of Students		
		Male	**Female**	**Total**
1	Government Day Secondary School Kudu	131	17	148
2	Hakimi Aliyu Secondary School Mokwa	140	47	187
3	College of Art and Islamic Studies Enagi	45	66	111
4	Day Secondary School Enagi	79	30	109
5	Idris Legbo Science College Kutigi	174	00	174
6	Women Day College Kutigi	00	129	129
	Total	**569**	**289**	**858**

Source: Ministry of Education Minna, Niger State 2021.

APPENDIX D

Table showing the distribution of the sample of the study

S/No	Name of Schools	Number of Students		
		Male	**Female**	**Total**
1	Government Day Secondary School Kudu	41	05	46
2	Hakimi Aliyu Secondary School Mokwa	44	15	59
3	College of Art and Islamic Studies Enagi	14	21	35
4	Day Secondary School Enagi	25	09	34
5	Idris Legbo Science College Kutigi	55	00	55
6	Women Day College Kutigi	00	40	40
Total		**179**	**90**	**269**

Source: Ministry of Education Minna, Niger State 2021.

APPENDIX E

MATHEMATICAL COMMUNICATION SKILLS TEST (MCST) FOR SS TWO (2)

Dear Respondent,

This test is designed to find relationship between Mathematical Communication Skills and Mathematics Performance of Senior Secondary School Students. The test is purely for academic research purposes hence, any information supplied will be treated as strictly confidential. Your co-operation is highly appreciated, please complete the following.

SECTION A

Sex: Male [ ] Female [ ]

School Type: All Boys [ ] All Girls [ ] Co-Education [ ]

SECTION B

Please answer all questions.

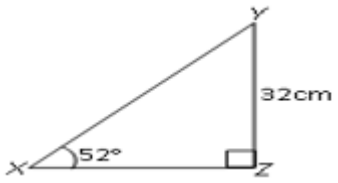
Problem solving skills

1. Express 0.003597 correct to three significant figures.
2. Evaluate $(0.064)^{-1/3}$.
3. If T = {prime numbers} and M = {odd numbers} are subsets of $\mu = \{x : 0 < x \leq 10$, and x is an integer$\}$, find $(T^{I} \text{ n } M^{I})$.
4. Evaluate $\frac{\log_3 9 - \log_2 8}{\log_3 9}$
5. The fourth term of an Arithmetic Progression (A. P.) is 37 and the first term is -20. Find the common difference?

Reasoning and proof skills

6. The total surface area of a solid cylinder is 165 cm^2. If the base diameter is 7 cm, calculate the height. [Take $\pi = 22/7$].
7. The interior angles of a polygon are $3x^{0,}$ $2x^0$, $4x^0$, $3x^0$ and $6x^0$. Find size of the smallest angle of the polygon.

8. The foot of a ladder is 6 m from the base of an electric pole. The top of the ladder rest against the pole at a point 8 m above the ground. How long is the ladder?
9. If tan x = $\frac{3}{4}$, 0 < x < 90^0, evaluate $\frac{\cos x}{2\sin x}$



10. In ΔXYZ above, |YZ| = 32cm, <YXZ = 52^0 and XYZ = 90^0. Find correct to nearest centimetre, |XZ|.

Communication skills

11. Solve $\frac{y+1}{2}$ - $\frac{2y-1}{3}$ = 4.
12. Solve $4x^2$ -16x + 15 = 0
13. If $2^a = \sqrt{64}$ and $\frac{b}{a}$ = 3, evaluate $a^2 + b^2$.
14. Make b the subject of the relation $lb = \frac{1}{2}$(a +b)h.
15. Simplify: $\frac{X^2-5X-14}{X^2-9X+14}$

Connection skills

16. H varies directly as p and inversely as the square of y. If H = 1, p = 8 and y = 2, find H in term of p and y.
17. Find the equations of a straight line passing through the point (1, -5) and having gradient of $\frac{3}{4}$.
18. Bala sold an article for # 6,900.00 and made a profit of 15%. Calculate his percentage profit if he sold it for # 6,600.00.
19. If 3p = 4q and 9p = 8q -12, find the value of pq.
20. Eric sold his house through an agent who charged 8% commission on the selling price. If Eric received $ 117,760.00 after the sale, what was the selling price of the house?

Representation skills

21. A box contains 2 white and 3 blue identical balls. If two balls are picked at random from the box, one after the other with replacement, what is the probability that they are of different colours?
22. calculate the variance of 2, 4, 7, 8 and 9

The following scores are obtained by students in a test: 8 18 10 14

18 11 13 14 13 17 15 8 16 13

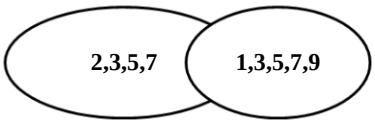
Use this to answer questions 23 to 25.

23. Find the mode of the distribution.
24. What is the median score?
25. How many students scored above the mean score?

ANSWERS TO MCST

1. 0.003597 = 0.00360 to 3 significant figures
2. $(0.064)^{-1/3} = (\frac{64}{100})^{-1/3} = \frac{1}{(\frac{64}{100})^{1/3}}$

   $= \frac{1}{(\frac{4^3}{10^3})^{1/3}} = \frac{1}{(\frac{4}{10})^{3/3}} = \frac{1}{(\frac{4}{10})} = \frac{10}{4} = \frac{5}{2}$

3. 

   μ = {1,2,3,4,5,6,7,8,9,10} T = {2,3,5,7} M = {1,3,5,7,9} T′ = {1,4,6,8,9,10}

   M′ = {2,4,6,8,10} T'∩M′ = {4,6,8,10}

4. First, simplify $\log_3 9 = \log_3 3^2 = 2\log_3 3$ since, $\log_a b = \frac{\log_{10} b}{\log_{10} a}$

   similarly, $\log_a a = \frac{\log_{10} a}{\log_{10} a} = 1$ Therefore, $\log_3 3 = \frac{\log_{10} 3}{\log_{10} 3} = 1$ then, $2\log_3 3 = 2(1) = 2$

   $\log_2 8 = \log_2 2^3 = 3\log_2 2 = 3(1) = 3$ hence, $\frac{\log_3 9 - \log_2 8}{\log_3 9} = \frac{2-3}{2} = \frac{-1}{2}$

5. The nth term of an A.P is given by:

   Tn = a + (n - 1)d ;a = -20, n = 4 (4th term), Tn = 37

   Therefore, 37 = -20 + (4 - 1)d

   37 + 20 = 3d

   3d = 57

   $d = \frac{57}{3}$

   d = 19

6. Area of a cylinder (A) = $2\pi rh + 2\pi r^2$;

   A = 2πr(r + h) ------- eqn(1) But

   A = 165cm^2,

r = radius = $\frac{\text{diameter}}{2}$ = $\frac{7}{2}$ = 3.5,

h = height from eqn(1), h = $\frac{A}{2\pi r}$ - r -----eqn(2) Substituting the values into equation(2), h = $\frac{165}{2(\frac{22}{7} \times 3.5)}$ - 3.5 = 4 then, h = 4cm

7. The sum of the nth side of an interior angle of a polygon, p is given by:

   P = (n - 2) x 180

   For 5-sided figure, the sum of the interior angle p = (5 − 2) ×180° = 540°

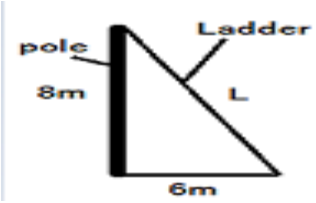
   3x° + 2x° + 4x° + 3x° + 6x° =540°

   18x° = 540°

   x = 540/18 = 30

   But, the smallest angle is 2x°

   therefore = 2(30°) =60°

8. 

   The diagram above is a right angle triangle, therefore Pythagoras theorem can be used to find the length, L of the ladder. From Pythagoras theorem, hypotenus^2 = opposite^2 + adjacent^2; hypotenuse = L, opposite = 8m adjacent = 6m therefore, Length of the ladder,

   $L^2 = 8^2 + 6^2 \rightarrow L = \sqrt{100} = 10m$

9. tan(x) = $\frac{3}{4}$, and tan(x) = $\frac{\sin(x)}{\cos(x)} = \frac{3}{4}$

   then, $\frac{\cos(x)}{\sin(x)} = \frac{4}{3}$

   therefore $\frac{\cos(x)}{2\sin(x)} = \frac{4}{2\times3} = \frac{4}{6} = \frac{2}{3}$

10. From trigonometry,

    tan(x) = opposite/adjacent ;opposite = 32cm, adjacent = |XZ| and x = 52°.

    Then, tan(52) = $\frac{32}{|XZ|}$ therefore,

    |XZ| = $\frac{32}{\tan(52)|} = \frac{32}{1.28}$ = 25cm

11. $\frac{y+1}{2}$ - $\frac{2y-1}{3}$ = 4 Find the LCM of the denominator (that is, 2 and 3 which is 6).

$\frac{6(y+1)}{2} - \frac{(2y-1)}{3} = 24$

3(y + 1) - 2(2y - 1) = 24

3y + 3 - 4y + 2 = 24

3y - 4y + 3 + 2 = 24

-y + 5 = 24 Subtract 5 from both sides

-y = 24 – 5

-y = 19 Multiply both sides by -1,

y = -19

12. From factorization method of solving quadratic equation:

$4x^2$ -16x + 15 = 0

$4x^2$ - 10x - 6x + 15 = 0

2x (2x - 5) - 3(2x - 5) = 0

(2x - 3) (2x - 5) = 0

2x - 3 = 0 or 2x - 5 = 0

x = $\frac{3}{2}$ or $\frac{5}{2}$

x = $1\frac{1}{2}$ or $2\frac{1}{2}$

13. $2^a = \sqrt{64}$

$2^a = 8$ From indices, $8 = 2^3$

Therefore, $2^a = 2^3$ base are equal, so power is equal. a = 3.

From the question $\frac{b}{a} = 3 \rightarrow b = 3a$

b = 3(3) → b = 9.

Therefore, $a^2 + b^2 = 3^2 + 9^2 = 9 + 81 = 90$

14. $lb = \frac{1}{2}$(a +b)h. multiply both sides by 2 2lb = (a + b)h, open up the bracket on the right hand side with h

2lb = ah + bh, subtract bh from both sides 2lb - bh = ah, factorising out b,

b(2l-h) = ah, divide both sides by (2l - h)

b = $\frac{ah}{2l-h}$

15. From the methods of solving quadratic equation (I will be using factorisation method because it is easier and faster but it does not work all the time)

$\frac{X^2-5X-14}{X^2-9X+14}$

$X^2 - 5X - 14 = X^2$ - 7x + 2x – 14 = x (x - 7) + 2(x - 7) = (x - 7) (x + 2)

X^2 - 9x + 14 = X^2 - 7x - 2x + 14 = x (x - 7) - 2(x - 7) = (x - 7) (x - 2)

Therefore, $\frac{X^2-5X-14}{X^2-9X+14} = \frac{(x-7)(x+2)}{(x-7)(x-2)} = \frac{(x+2)}{(x-2)}$

16. H $\propto \frac{p}{y^2}$; H = $\frac{kp}{y^2}$ (k is the proportionality constant), if H = 1, P =8, y = 2

then 1 = $\frac{k \text{ x } 8}{2^2} \rightarrow 1 = \frac{8k}{4} \rightarrow 1 = 2k \rightarrow k = \frac{1}{2}$ Substituting k = $\frac{1}{2}$ in H = $\frac{kp}{y^2}$ yield H = $\frac{p}{2y^2}$

17. From the point-slope form of straight line equation, y - y_1 = m(x - x_1), m = $\frac{3}{4}$,

y_1 = -5, x_1= 1. Then, y - (-5) = $\frac{3}{4}$ (x - 1)

y + 5 = $\frac{3x}{4}$ - $\frac{3}{4}$; multiply through by 4

4y + 20 = 3x – 3 rearrange

3x - 4y - 3 - 20 = 0 hence, 3x - 4y -23 = 0

18. To calculate the percentage profit at N6,600, we need to first calculate the cost price. This can be calculated at N6,900 and 15% profit percentage.

Percentage profit= $\frac{\text{selling price} - \text{cost price}}{\text{cost price}}$; percentage profit at N6,900 =15%, selling price = N6,900 cost price (cp) = ?

Then, $\frac{15}{100} = \frac{6900-CP}{CP}$ Cross multiply 0.15cp = 6900 – cp collecting like terms 0.15cp + cp = 6,900 → 1.15cp = 6,900

cp = $\frac{6900}{1.15}$ = 6,000. Therefore, the cost price = N6,000

Percentage profit at N6,600 = $\frac{6600-6000}{6000}$ = 0.1 → 0.1 x 100 (we are multiplying by 100 since we want the answer as percentage) = 10%

19. 3p = 4q --- equation (1),

9p = 8q - 12 -----equation (2) from equation(1), p = $\frac{4q}{3}$------- equation(3) Substituting equation(3) into equation(2),

9($\frac{4q}{3}$) = 8q – 12 → $\frac{36q}{3}$ = 8q – 12

$12q = 8q - 12$

$12q - 8q = -12 \rightarrow 4q = -12 \rightarrow q = -3$

Now, we substitute q = -3 into equation(3) we have $p = \frac{4(-3)}{3} = -4$ Therefore $pq = -3 \times -4 = 12$

20. Selling price = Price received by Eric + Agent's commission

Price received by Eric = \$117, 760.00. Agent's commission = 8% of selling price

selling price is unknown, so let's call it x

Since we know that the agent collected 8% of the selling price, the agent's commission will simply be $\frac{8}{100} \times X = \frac{8X}{100}$. Then selling price (x) = 117, 760.00 + $\frac{8X}{100}$ x - $\frac{8X}{100}$ = 117, 760.00. Multiply through by 100: 100x - 8x = 11, 776, 000

$92x = 11, 776, 000 \rightarrow x = \frac{11,776,000}{92}$

= 128, 000. Therefore, the selling price of the house is \$128,000

21. Probability of picking a white ball = Pr(W) and Probability of picking a blue ball = Pr(B) Probability of picking a white and a blue ball (picking white ball first) = Pr(WB)

Probability of picking a blue and a white ball (picking blue ball first) = Pr(BW)

$Pr(W) = \frac{2}{5}$, $Pr(B) = \frac{3}{5}$

then $Pr(WB) = Pr(W) \times Pr(B) = \frac{2}{5} \times \frac{3}{5} = \frac{6}{25}$.

$Pr(BW) = Pr(B) \times Pr(W) = \frac{3}{5} \times \frac{2}{5} = \frac{6}{25}$. Then, $Pr(WB) + Pr(BW) = \frac{6}{25} + \frac{6}{25} = \frac{12}{25}$

22. Variance = $\frac{\Sigma|(x - x')|^2}{n}$ where x represent each term, x' is the mean, n is the number of terms and || represent absolute value (ignoring negative sign). Then, n = 5

mean, $x' = \frac{\Sigma x}{n} = \frac{2+4+7+8+9}{5} = \frac{30}{5} = 6$

variance

$= \frac{|2-6|^2+|4-6|^2+|7-6|^2+|8-6|^2+|9-6|^2}{5} = \frac{|-4|^2+|-2|^2+|1|^2+|2|^2+|3|^2}{5}$

since we are ignoring negative sign,

$= \frac{4^2+2^2+1^2+2^2+3^2}{5} = \frac{16+4+1+4+9}{5} = \frac{34}{6} = 6.8$

Marks	8	10	11	13	14	15	16	17	18
Frequency	2	1	1	3	2	1	1	1	2

The above table can be used to answer questions 23 to 25

23. Mode is simply the number that appears the most. Therefore, the mode of the dataset is 13

24. The median is the middle number in a sorted, ascending or descending, list of numbers.

    Arranging in ascending order: 8, 8, 10, 11, 13, 13, 13, 14, 14, 15, 16, 17, 18, 18

    There are two middle numbers (13 and 14). Thus, the median will just simply be the sum of the two numbers divided by 2. That is, $\frac{13+14}{2} = \frac{27}{2} = 13.5$

25. Mean = $\frac{\Sigma x}{n}$

    $= \frac{8+8+10+11+13+13+13+14+14+15+16+17+18+18}{14} = \frac{288}{14} = 13.4$

    Only scores 14, 14, 15, 16, 17, 18 and 18 are above 13.4

    Thus, there are 7 students that scored above the mean.

APPENDIX F

Reliability Index on Mathematical Communication Skills Test (MCST)

Correlations

		Problem solving skills	Problem solving skills Retest
Problem solving skills	Pearson Correlation	1	.816**
	Sig. (2-tailed)		.000
	N	40	40
Problem solving skills Retest	Pearson Correlation	.816**	1
	Sig. (2-tailed)	.000	
	N	40	40

Correlations

		Reasoning and Proof skill	Reasoning and Proof skills Retest
Reasoning and Proof skills	Pearson Correlation	1	.740**
	Sig. (2-tailed)		.000
	N	40	40
Reasoning and Proof skills Retest	Pearson Correlation	.740**	1
	Sig. (2-tailed)	.000	
	N	40	40

Correlations

		Communication skills	Communication skills Retest
Communication skills	Pearson Correlation	1	.808**
	Sig. (2-tailed)		.000
	N	40	40
Communication skills Retest	Pearson Correlation	.808**	1
	Sig. (2-tailed)	.000	
	N	40	40

Correlations

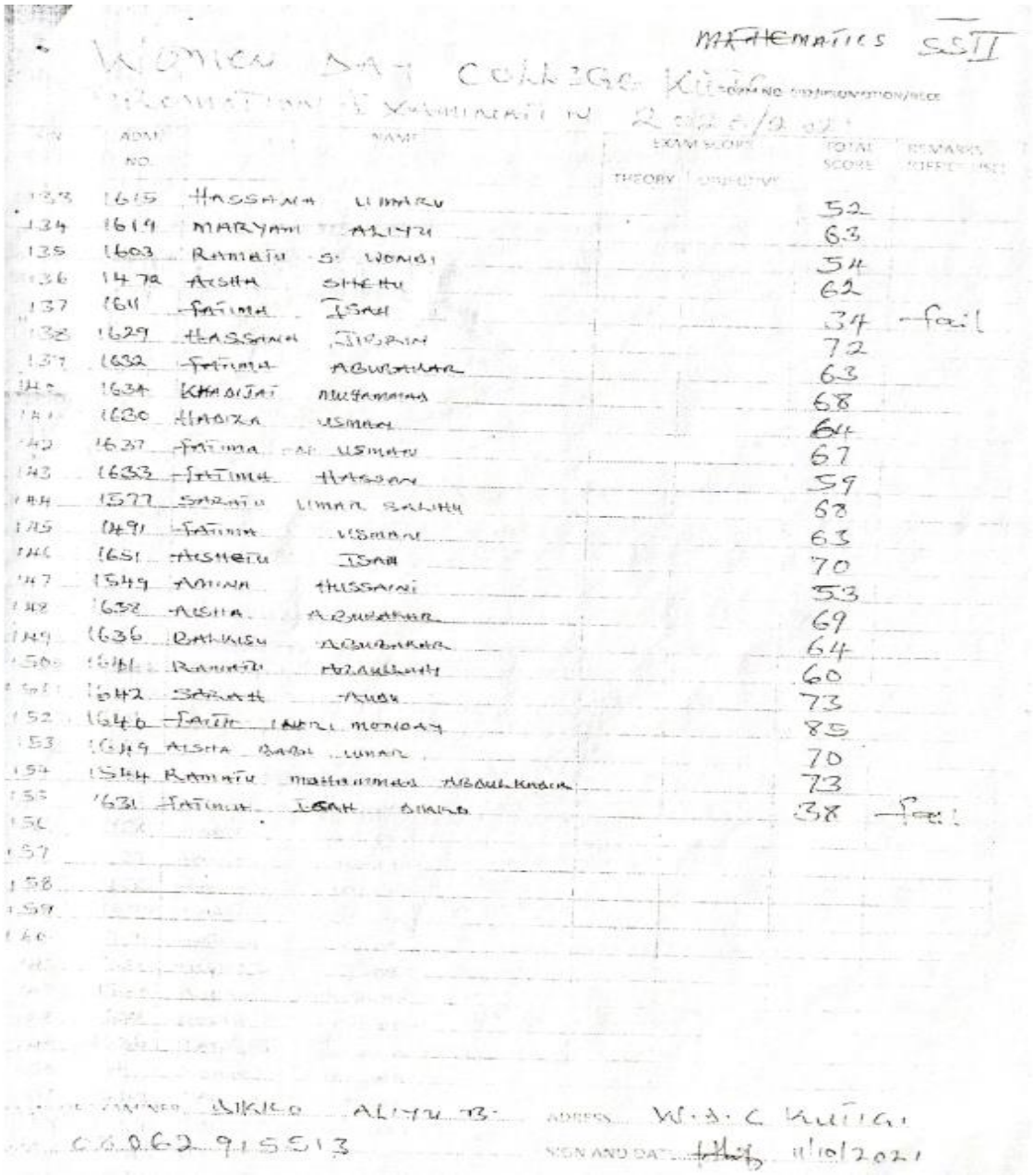
		Connection/Relation skill	Connection/Relation skill Retest
Connection/Relation skills	Pearson Correlation	1	.700**
	Sig. (2-tailed)		.000
	N	40	40
Connection/Relation skills Retest	Pearson Correlation	.700**	1
	Sig. (2-tailed)	.000	
	N	40	40

Correlations

		Representation skill	Representation skill Retest
Representation skills	Pearson Correlation	1	.706**
	Sig. (2-tailed)		.000
	N	40	40
Representation skills Retest	Pearson Correlation	.706**	1
	Sig. (2-tailed)	.000	
	N	40	40

APPENDIX G

Secondary Schools Mathematics Performance



MATHEMATICS SS II

WOMEN DAY COLLEGE KUIGA

EXAMINATION EXAMINATION 2021/2022

S/N	ADM NO	NAME	EXAM SCORE THEORY	EXAM SCORE OBJECTIVE	TOTAL SCORE	REMARKS CORRECTNESS
133	1615	HASSANA UMARU			52	
134	1619	MARYAM ALIYU			63	
135	1603	RAMATU S/ WONDI			54	
136	1472	AISHA SHEHU			62	
137	1611	FATIMA ISAH			34	fail
138	1629	HASSANA JIBRIN			72	
139	1632	FATIMA ABUBAKAR			63	
140	1634	KHADIJA NUHAMANA			68	
141	1630	HABIBA USMAN			64	
142	1637	FATIMA AP USMAN			67	
143	1633	FATIMA HASSAN			59	
144	1577	SAMAILA UMAR SALIHU			58	
145	1491	FATIMA USMAN			63	
146	1651	AISHETU ISAH			70	
147	1549	AMINA HUSSAINI			53	
148	1632	AISHA ABUBAKAR			69	
149	1636	BALKISU ABUBAKAR			64	
150	1641	RAMATU MAZAKUWAYA			60	
151	1642	SARAH ALIU			73	
152	1646	FAITH DANIEL MONDAY			85	
153	1649	AISHA BABA UMAR			70	
154	1544	RAMATU MUHAMMED ABDULKADIR			73	
155	1631	FATIMA ISAH BIRMA			38	fail
156						
157						
158						
159						
160						

EXAMINED SIKIRU ALIYU B. ADDRESS W.A.C KUIGA

08062915513 SIGN AND DATE 11/10/2021

MATHEMATICS SSII

WOMEN DAY COLLEGE KUTAFA

FORM NO 002/PROMOTION/DECE

PROMOTION EXAMINATION 2020/2021

ADM NO	NAME	EXAM SCORE THEORY	EXAM SCORE OBJECTIVE	TOTAL SCORE	REMARKS (OFFICE USE)
1514	AISHA MOHAMMED			86	
1266	RAMATU ABUBAKAR			69	
1492	HADIZA MOHAMMED DIKKO			81	
1216	HAFSAT MOHAMMED			71	
1202	HAUWA HASSAN			67	
1247	FIRDAUSI SULEIMAN			77	
1573	FATIMA N: MOHAMMED			68	
1589	AISHETU MOHAMMED			52	
1590	AMINA ABUBAKAR			63	
1488	FATIMA MOHAMMED			68	
1484	AISHETU KUSU BABA			70	
1491	AISHETU MOHAMMED			61	
1586	AMINA [illegible]			73	
1497	AISHETU N: SULEIMAN			64	
1602	RAMATU N: MOHAMMED			60	
1613	AMINA ABDULLAHI KUTIGI			62	
1600	FATI N: ADAMU			68	
1401	AMINA MOHAMMED DIKKO			54	
1506	FATIMA ABDULLAHI			58	
1617	AISHETU USMAN			73	
1526	FATIMA S: ABUBAKAR			64	
1613	HUSSAINA MOHAMMED			63	
1611	AISHETU [illegible]			79	
1624	AISHETU JIYA			68	
1622	FATI BAKU			72	
1618	FATIMA UMARU			69	
1614	KHADIJAT I: MOHAMMED			70	
1607	AMINA ABDULLAHI KUTIGI			73	
1400	RAMATU MUSA			68	
1598	ZAINAB KUSU BABA			79	
1621	FATIMA ALHASSAN			52	
1628	BINTA ABDULLAHI			60	
1625	ZAINAB KOKO			62	

NAME OF EXAMINER DIKKO ALIYU 22. ADRESS W.D.C KUTIGI

PHONE NO 08062915513 SIGN AND DATE [illegible] 11/10/2021

MATHEMATICS SS II

WOMEN DAY COLLEGE KUIGI FORM NO: 002/PROMOTION/FEE

PROMOTION EXAMINATION 2020/2021

S/N	ADM. NO.	NAME	EXAM SCORE THEORY	EXAM SCORE OBJECTIVE	TOTAL SCORE	REMARKS (OFFICE USE)
67	1420	RAMATU IDRISA			66	
68	1224	HAWAWU IDRISU			73	
69	1425	HASSANA MOHAMMED			70	
70	1419	FATIMA MOHAMMED SHARAFU			65	
71	1252	AISHETU AHMADU			60	
72	1235	AISHETU OTHMAN			69	
73	1249	AISHETU ABDULLAHI			52	
74	1185	FATIMA IDRISU			64	
75	1432	FATIMA MOHAMMED BUBA			73	
76	1209	FATIMA ABDULLAHI			60	
77	1238	FATIMA -N- IBRAN			64	
78	1430	AISHETU ABDULMALIK			68	
79	1421	HADIZA MOHAMMED			60	
80	1268	FATIMA M. ISAH			59	
81	1194	HAJARA MOHAMMED			70	
82	1437	HAUWA SHUAIBU KUIGI			68	
83	1221	HADARA MOHAMMED			62	
84	1240	FATIMA SALAU			64	
85	1238	AISHETU -N- ABDU			82	
86	1470	FATIMA M. LEGBO			63	
87	1182	AISHETU ADAMU GARBA			64	
88	1570	MARYAM -R- USMAN			41	fail
89	1482	SAIDU USMAN			63	
90	1513	HASSANA ISAH			64	
91	1471	AISHA AHMAD SANUSI			59	
92	1466	HASSANA YUSUFU			71	
93	1551	HAUWA ABDULLAHI KUIGI			81	
94	1421	FATIMA -B- SALIHU			61	
95	1568	HAUWA AHMAD SANUSI			72	
96	1564	HADARA MUHAMMAD			64	
97	1490	FATIMA IDRIS			56	
98	1481	AMINA ALIYU			39	fail
99	1478	RAMATU YUSUF			73	

NAME OF EXAMINER DANLADI ALIYU -B- ADDRESS W.D.C KUIGI

GSM 08062915513 SIGN AND DATE 11/10/2021

MATHEMATICS SS II

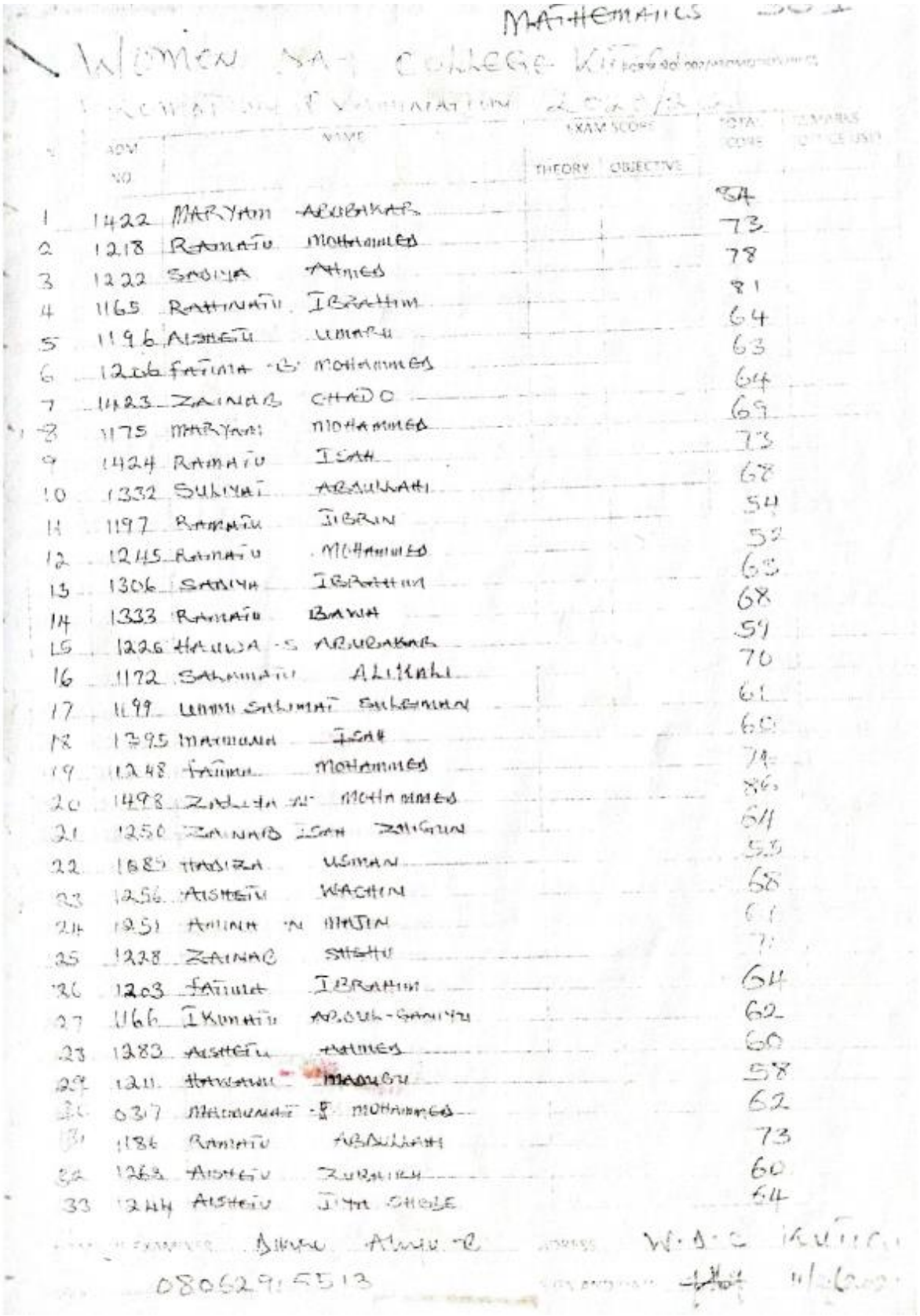
WOMEN DAY COLLEGE KUTIGI

PROMOTION EXAMINATION 2020/2021

S/N	ADM NO	NAME	EXAM SCORE THEORY	EXAM SCORE OBJECTIVE	TOTAL SCORE	REMARKS (OFFICE USE)
34	0123	FATIMA MOHAMMED			61	
35	1240	FATIMA CHADO			70	
36	1251	FATIMA K MOHAMMED			60	
37	1174	HABIBA T MOHAMMED			69	
38	1262	FATIMA Z MOHAMMED			69	
39	1237	AISHETU ADAMU			70	
40	1249	AISHETU ABDULWAHAB			68	
41	1270	AISHETU MOHAMMED			64	
42	1173	FATIMA IDRIS			81	
43	1238	HADIZA YAHAYA			66	
44	1253	MOJAIDA AHMADU			53	
45	1225	RAMATU ALHASSAN			60	
46	1210	FATIMA Z. SALAU			50	
47	1233	FATIMA B. IBRAHIM			68	
48	1409	AISHETU MOHAMMED			61	
49	1241	AMINA NDAMUSA			72	
50	1276	AISHETU ABUBAKAR			63	
51	1431	FATIMA MOHAMMED			68	
52	1251	AISHETU NDAKI			67	
53	1368	AMINA TUKURU			73	
54	1255	HAUWA SHAGA			64	
55	1232	BASIRU ABDULLAHI			69	
56	1193	AMINA MUHAMMADU			53	
57	1212	FATIMA TAHIRU			55	
58	1215	HAUWA SALIHU			68	
59	1243	FATIMA ZIGAU			74	
60	1217	MAIMUNA T. MOHAMMED			82	
61	1258	BARAMAT IBRAHIM			73	
62	1200	FATIMA IDRIS HASSAN			68	
63	1183	FATIMA MOHAMMED			71	
64	1204	BATURE USMAN			83	
65	1431	FATIMA MOHAMMED			64	
66	1171	AISHETU ABUBAKAR			81	

NAME OF EXAMINER BAKO ALIYU B. ADRESS W.D.C KUTIGI

GSM 080 6291 5513 SIGN AND DATE 11/10/2021



MATHEMATICS

WOMEN SA[illegible] COLLEGE [illegible]

S/N	ADM NO	NAME	EXAM SCORE THEORY	EXAM SCORE OBJECTIVE	TOTAL SCORE	REMARKS
1	1422	MARYAM ABUBAKAR			54	
2	1218	RAMATU MOHAMMED			73	
3	1222	SADIYA AHMED			78	
4	1165	RAHINATU IBRAHIM			81	
5	1196	AISHETU UMARU			64	
6	1206	FATIMA G MOHAMMED			63	
7	1423	ZAINAB CHADO			64	
8	1175	MARYAM MOHAMMED			69	
9	1424	RAMATU ISAH			73	
10	1332	SULIYAT ABDULWAHI			68	
11	1197	RAHINATU IBRAN			54	
12	1245	RAMATU MOHAMMED			52	
13	1306	SARIYA IBRAHIM			65	
14	1333	RAMATU BAWA			68	
15	1226	HALIMA S ABUBAKAR			59	
16	1172	SAHANATU ALIYARI			70	
17	1199	UMMI SALAMAT SULEIMAN			61	
18	1395	MARIAMA ISAH			69	
19	1248	FATIMA MOHAMMED			79	
20	1498	ZULAIHA M MOHAMMED			86	
21	1250	ZAINAB ISAH ZANGUN			64	
22	1685	HADIZA USMAN			53	
23	1256	AISHETU WACHIN			68	
24	1251	AMINA N HAJIN			61	
25	1228	ZAINAB SHEHU			71	
26	1203	FATIMA IBRAHIM			64	
27	1166	IKUMATU ABDUL-GANIYU			62	
28	1283	AISHETU [illegible]			60	
29	1211	[illegible] MAIGARI			58	
30	0317	[illegible] M MOHAMMED			62	
31	1186	RAMATU ABDULLAHI			73	
32	1263	AISHETU ZUBAIRU			60	
33	1244	AISHETU JIYA CHOLE			64	

EXAMINER: BIKAU AHMED ADDRESS: W.A.S. KUJE

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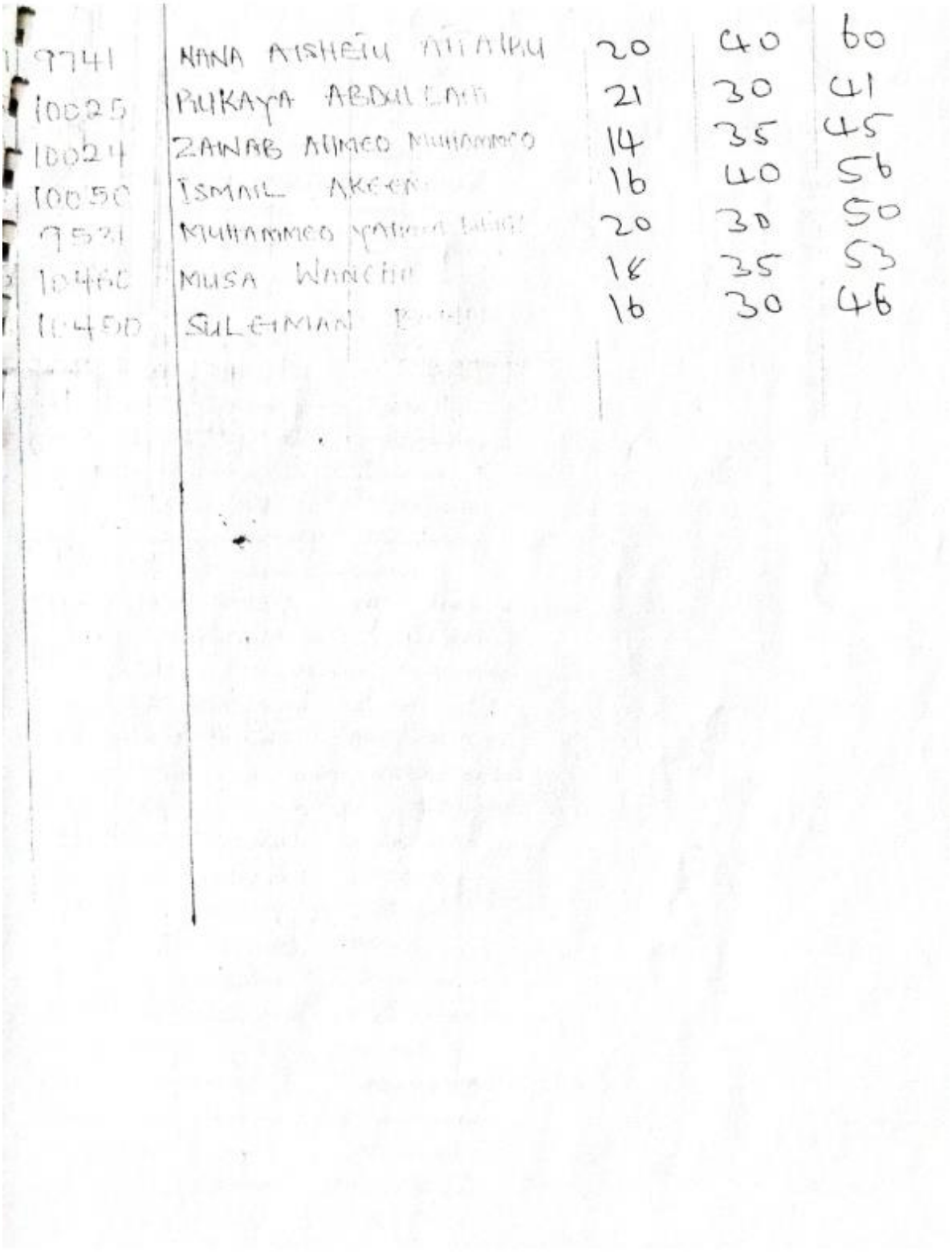
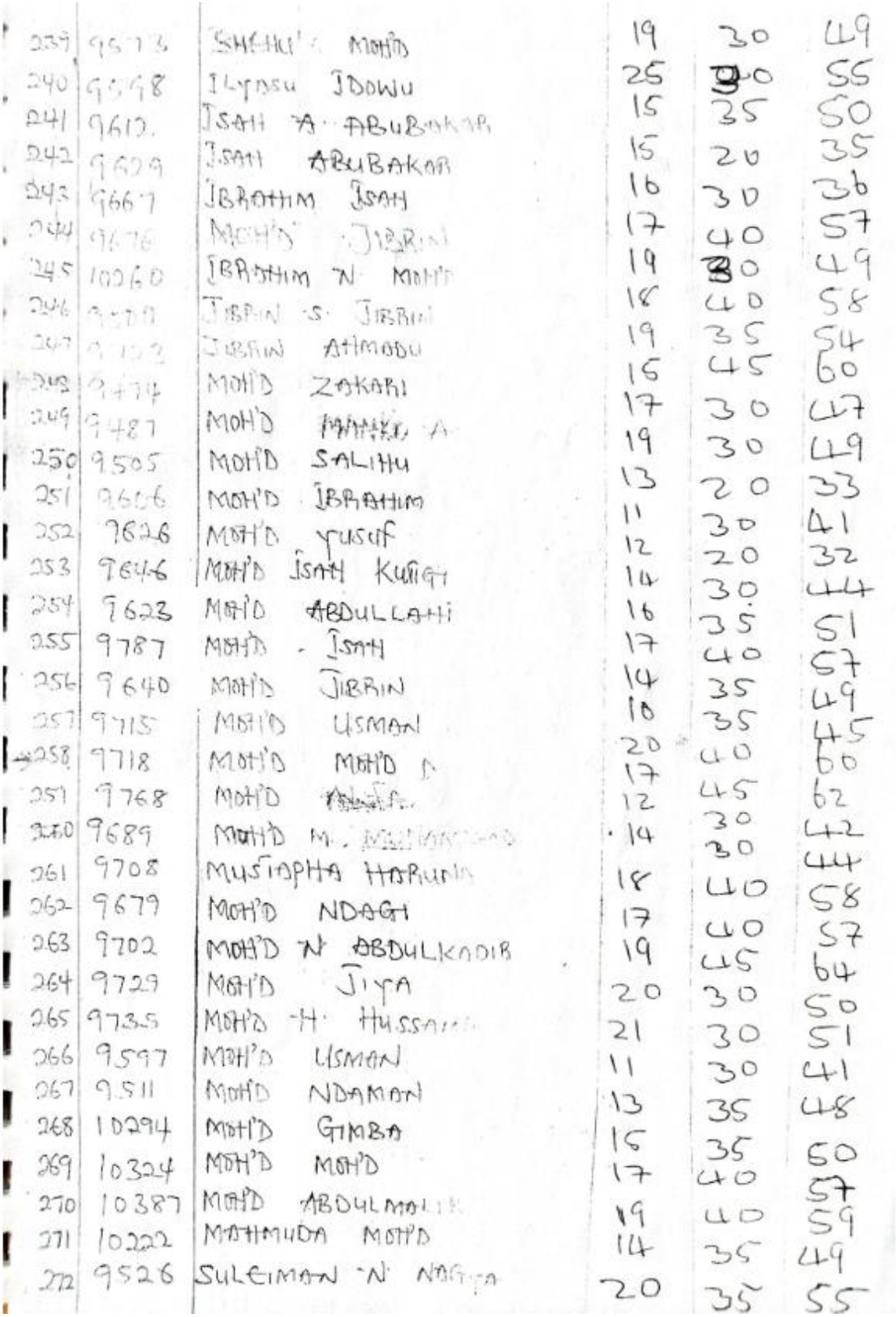
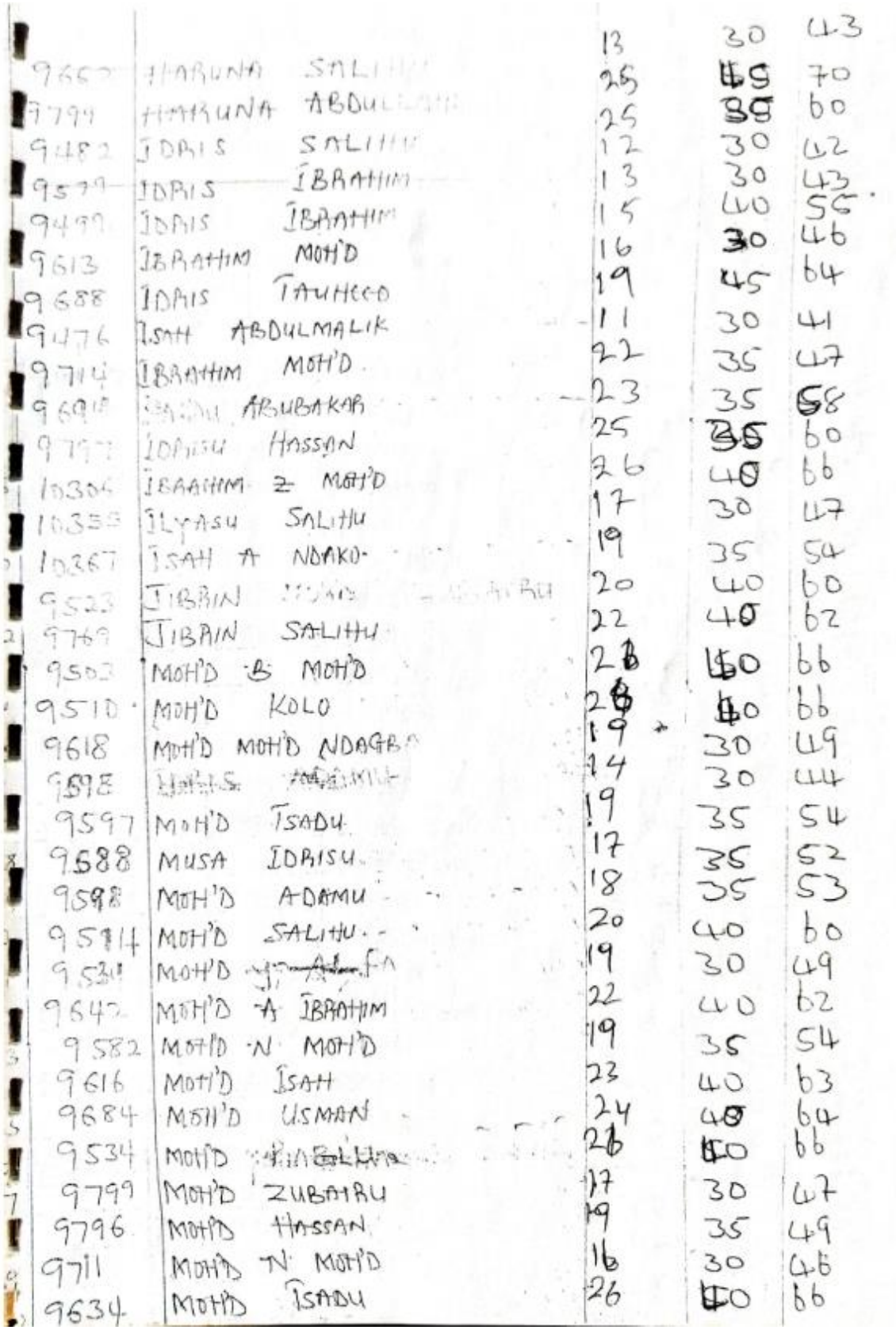


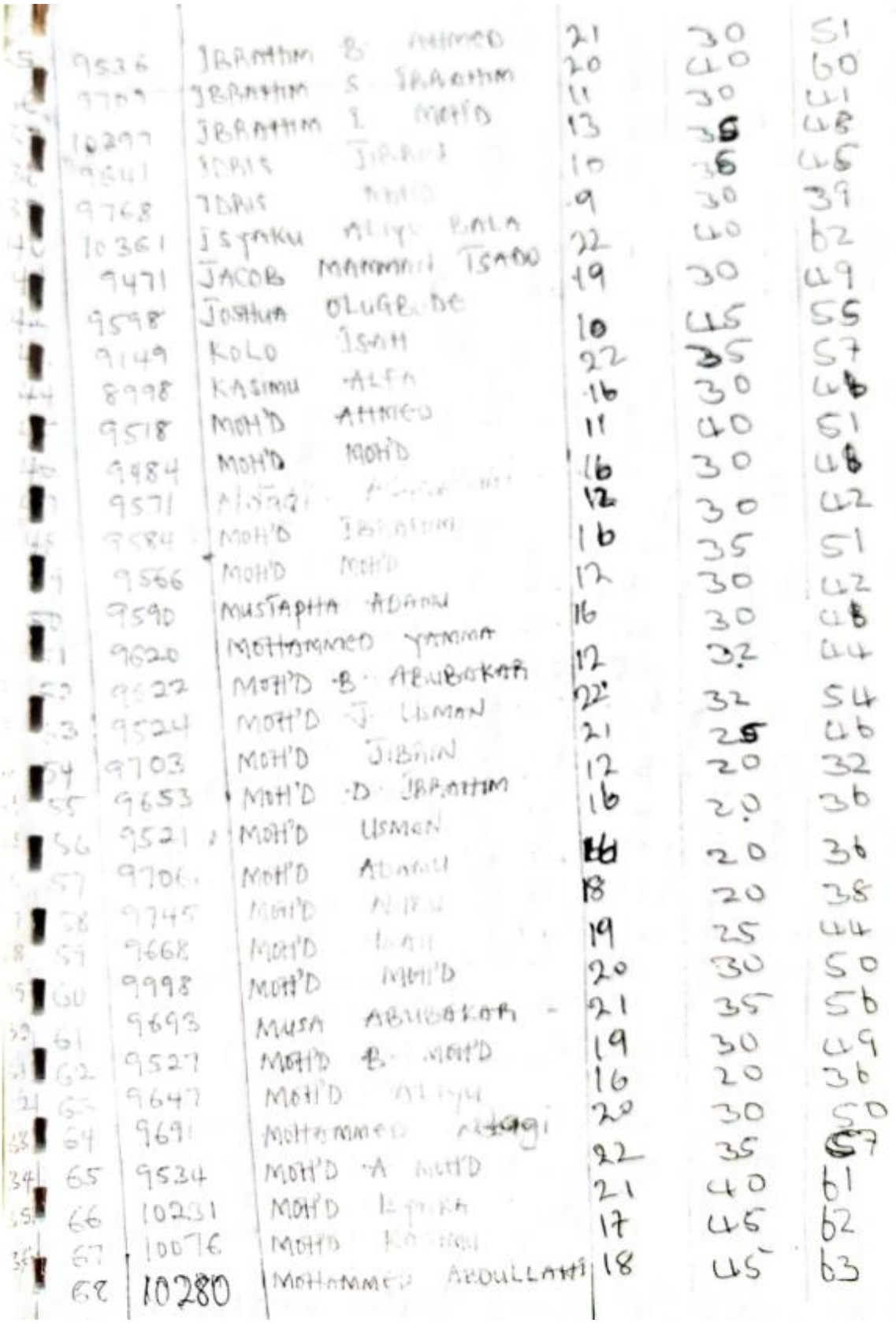
9741	NANA AISHEIN ATTAIKU	20	40	60
10025	RUKAYA ABDULLAH	21	30	41
10024	ZAINAB ALIMCO MUHAMMED	14	35	45
10050	ISMAIL AKEEN	16	40	56
9521	MUHAMMED YAHAYA	20	30	50
10466	MUSA WANETO	18	35	53
10450	SULEIMAN	16	30	46



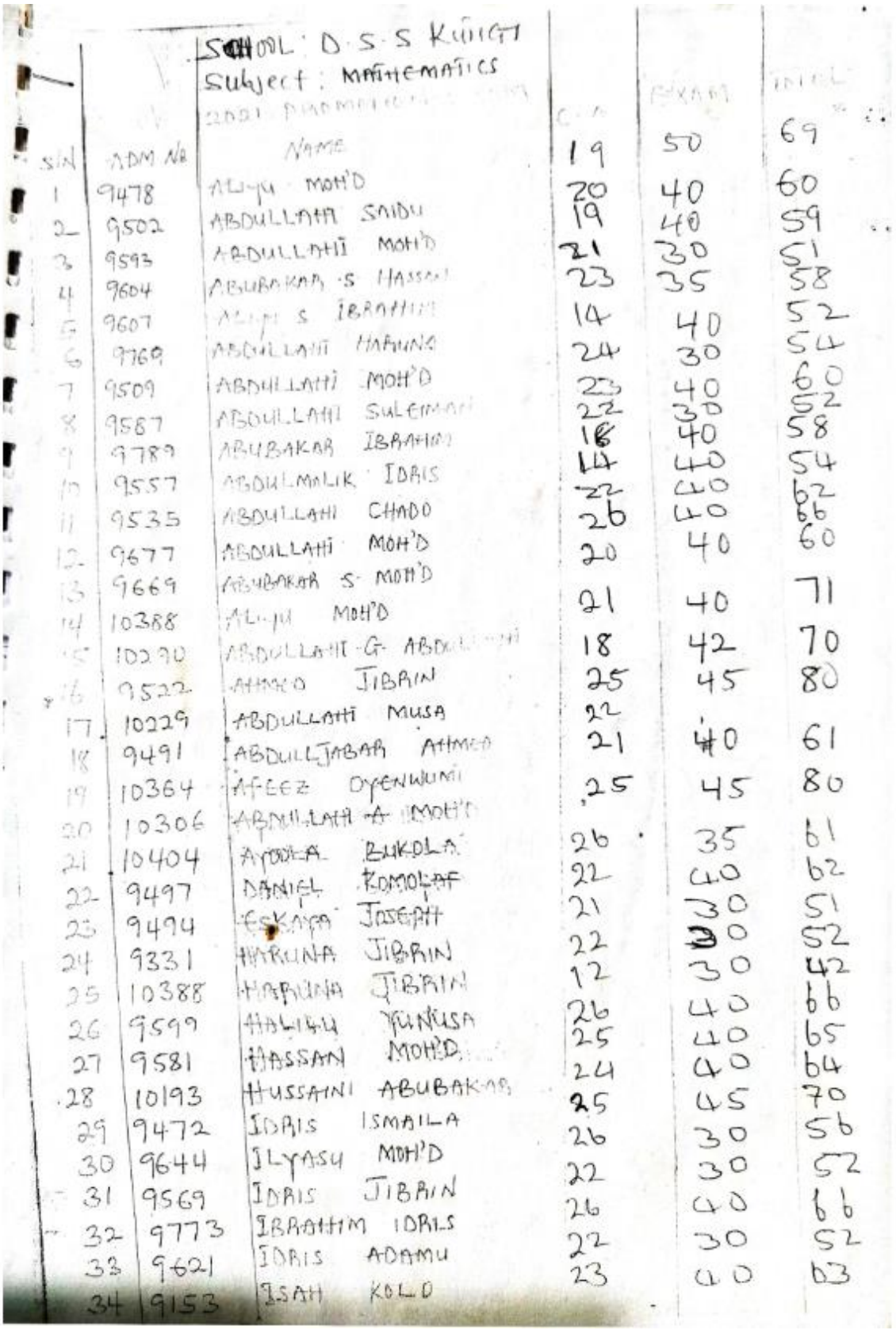
239	9573	SHEHU MOH'D	19	30	49
240	9598	ILYASU IDOWU	25	30	55
241	9610	ISAH A ABUBAKAR	15	35	50
242	9629	ISAH ABUBAKAR	15	20	35
243	9667	IBRAHIM ISAH	16	30	36
244	9676	MOH'D JIBRIN	17	40	57
245	10260	IBRAHIM N MOH'D	19	30	49
246	9679	JIBRIN S JIBRIN	18	40	58
247	9702	JIBRIN ATIMODU	19	35	54
248	9714	MOH'D ZAKARI	16	45	60
249	9787	MOH'D [illegible] A	17	30	47
250	9505	MOH'D SALIHU	19	30	49
251	9606	MOH'D IBRAHIM	13	20	33
252	9626	MOH'D YUSUF	11	30	41
253	9646	MOH'D ISAH KURIGI	12	20	32
254	9623	MOH'D ABDULLAHI	14	30	44
255	9787	MOH'D ISAH	16	35	51
256	9640	MOH'D JIBRIN	17	40	57
257	9715	MOH'D USMAN	14	35	49
258	9718	MOH'D MOH'D	10	35	45
259	9768	MOH'D [illegible]	20	40	60
260	9689	MOH'D M [illegible]	17	45	62
261	9708	MUSTAPHA HARUNA	12	30	42
262	9679	MOH'D NDAGI	14	30	44
263	9702	MOH'D N ABDULKADIR	18	40	58
264	9729	MOH'D JIYA	17	40	57
265	9735	MOH'D H HUSSAINI	19	45	64
266	9597	MOH'D USMAN	20	30	50
267	9511	MOH'D NDAMAN	21	30	51
268	10294	MOH'D GIMBA	11	30	41
269	10324	MOH'D MOH'D	13	35	48
270	10387	MOH'D ABDULMALIK	15	35	50
271	10222	MAHMUDA MOH'D	17	40	57
272	9526	SULEIMAN N NAGA	19	40	59
			14	35	49
			20	35	55



9662	HARUNA	SALIHU	13	30	43
9794	HAMIDA	ABDULLAHI	25	45	70
9482	IDRIS	SALIHU	25	35	60
9579	IDRIS	IBRAHIM	12	30	42
9499	IDRIS	IBRAHIM	13	30	43
9613	IBRAHIM	MOH'D	15	40	55
9688	IDRIS	TAUHEED	16	30	46
9476	ISAH	ABDULMALIK	19	45	64
9714	IBRAHIM	MOH'D	11	30	41
9691	IBRAHIM	ABUBAKAR	22	35	57
9797	IDRISU	HASSAN	23	35	58
10304	IBRAHIM	Z MOH'D	25	35	60
10359	ILYASU	SALIHU	26	40	66
10367	ISAH	A NDAKO	17	30	47
9523	JIBRIN	[illegible]	19	35	54
9769	JIBRIN	SALIHU	20	40	60
9502	MOH'D	B MOH'D	22	40	62
9510	MOH'D	KOLO	28	40	68
9618	MOH'D	MOH'D NDAGBA	19	30	49
9598	[illegible]	[illegible]	14	30	44
9597	MOH'D	ISADU	19	35	54
9588	MUSA	IDRISU	17	35	52
9598	MOH'D	ADAMU	18	35	53
9514	MOH'D	SALIHU	20	40	60
9530	MOH'D	[illegible]	19	30	49
9542	MOH'D	A IBRAHIM	22	40	62
9582	MOH'D	N MOH'D	19	35	54
9616	MOH'D	ISAH	23	40	63
9684	MOH'D	USMAN	24	40	64
9534	MOH'D	[illegible]	28	40	68
9799	MOH'D	ZUBAIRU	17	30	47
9796	MOH'D	HASSAN	19	35	49
9711	MOH'D	N MOH'D	16	30	46
9634	MOH'D	ISADU	26	40	66

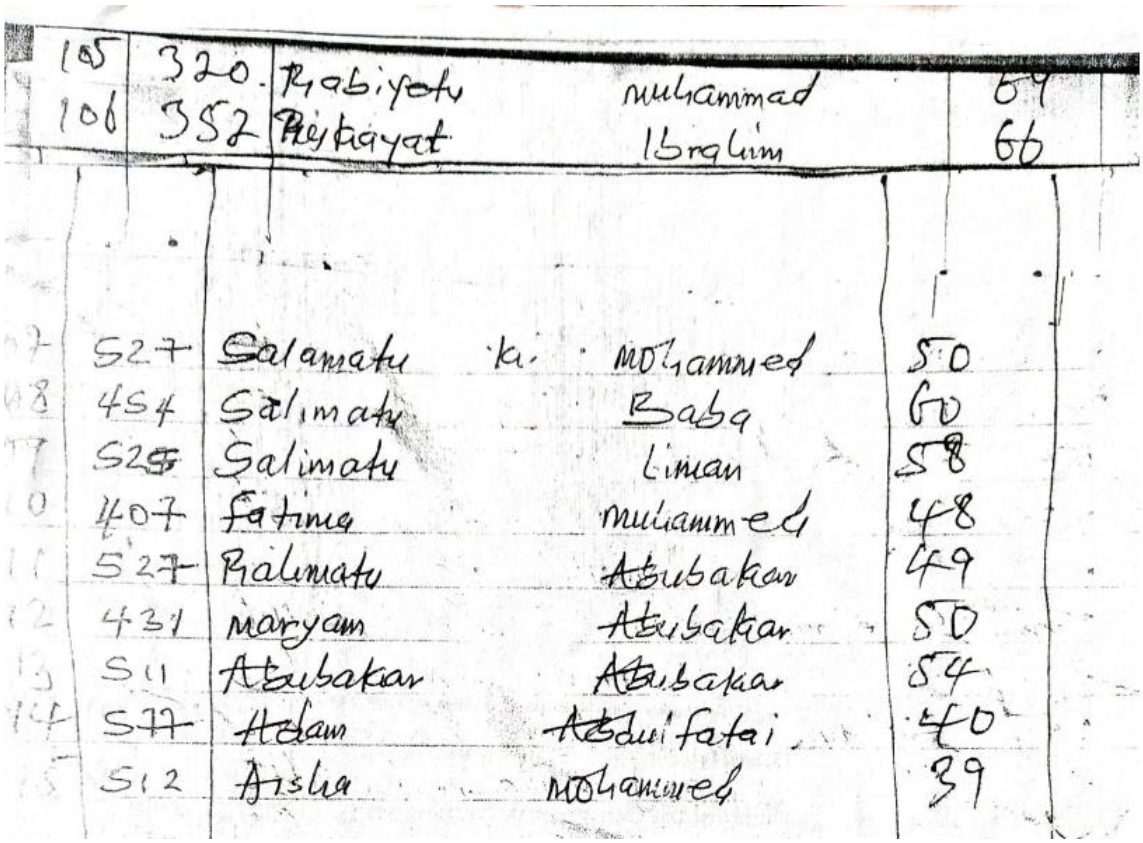


5	9536	IBRAHIM B. AHMED	21	30	51
	9709	IBRAHIM S. IBRAHIM	20	40	60
	10297	IBRAHIM I. MOH'D	11	30	41
	9641	IDRIS [illegible]	13	35	48
	9768	IDRIS [illegible]	10	36	46
	10361	ISYAKU MUSA BALA	9	30	39
	9471	JACOB MAMMAN TSADO	22	40	62
	9598	JOSHUA OLUGBODE	19	30	49
	9149	KOLO ISAH	10	45	55
	8998	KASIMU ALFA	22	35	57
	9518	MOH'D AHMED	16	30	46
	9984	MOH'D MOH'D	11	40	51
	9571	[illegible]	16	30	46
	9584	MOH'D IBRAHIM	12	30	42
	9566	MOH'D MOH'D	16	35	51
	9590	MUSTAPHA ADAMU	12	30	42
	9620	MOHAMMED YAMMA	16	30	46
	9622	MOH'D B. ABUBAKAR	12	32	44
	9524	MOH'D U. USMAN	22	32	54
	9703	MOH'D JIBRIN	21	25	46
	9653	MOH'D D. IBRAHIM	12	20	32
	9521	MOH'D USMAN	16	20	36
	9706	MOH'D [illegible]	16	20	36
	9745	MOH'D [illegible]	18	20	38
	9668	MOH'D [illegible]	19	25	44
	9998	MOH'D MOH'D	20	30	50
	9693	MUSA ABUBAKAR	21	35	56
	9527	MOH'D B. MOH'D	19	30	49
	9647	MOH'D [illegible]	16	20	36
	9691	MOHAMMED [illegible]	20	30	50
	9534	MOH'D A. MOH'D	22	35	57
	10231	MOH'D [illegible]	21	40	61
	10076	MOH'D [illegible]	17	45	62
	10280	MOHAMMED ABDULLAHI	18	45	63

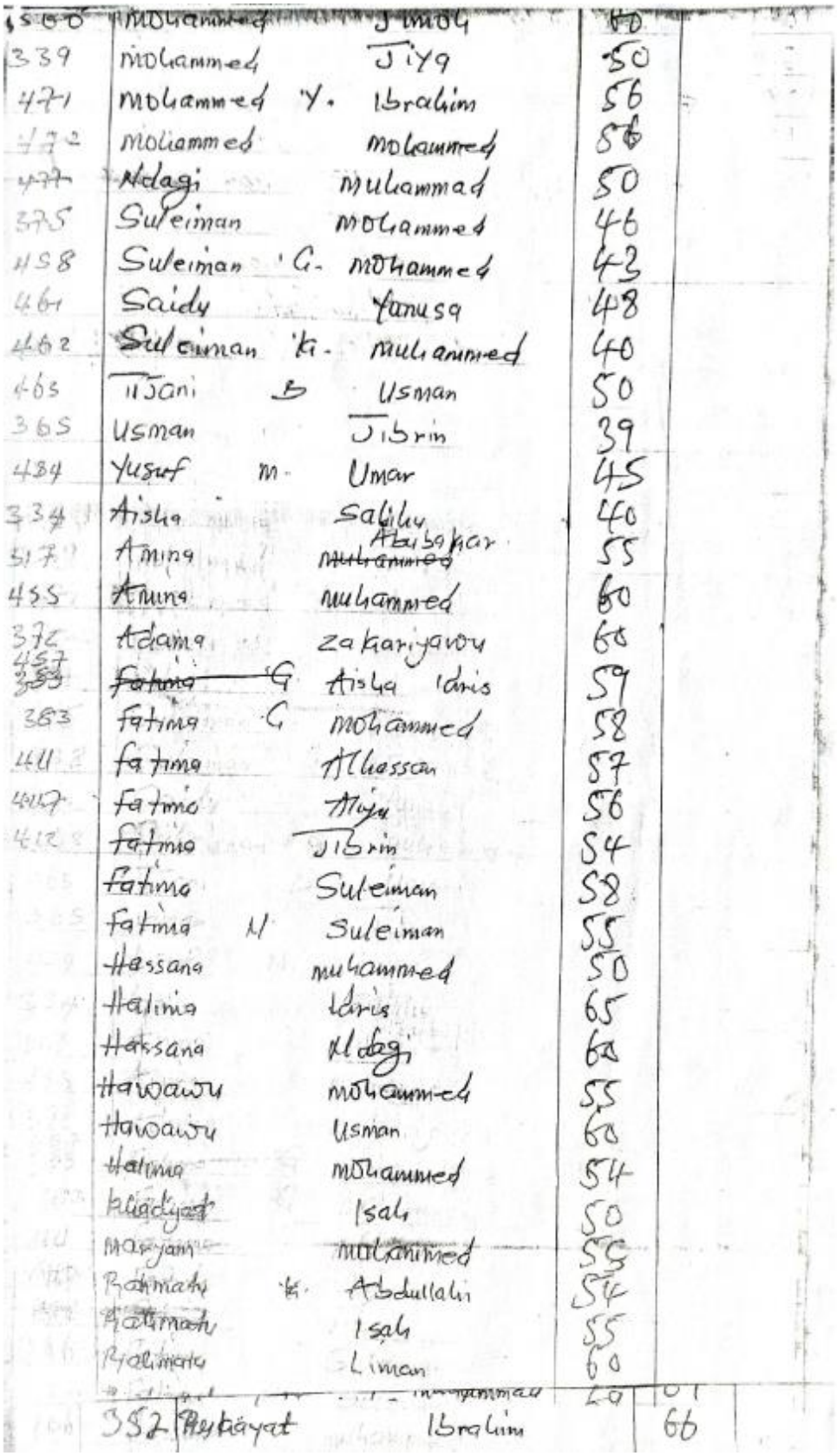


SCHOOL: D.S.S KUIGI
Subject: MATHEMATICS

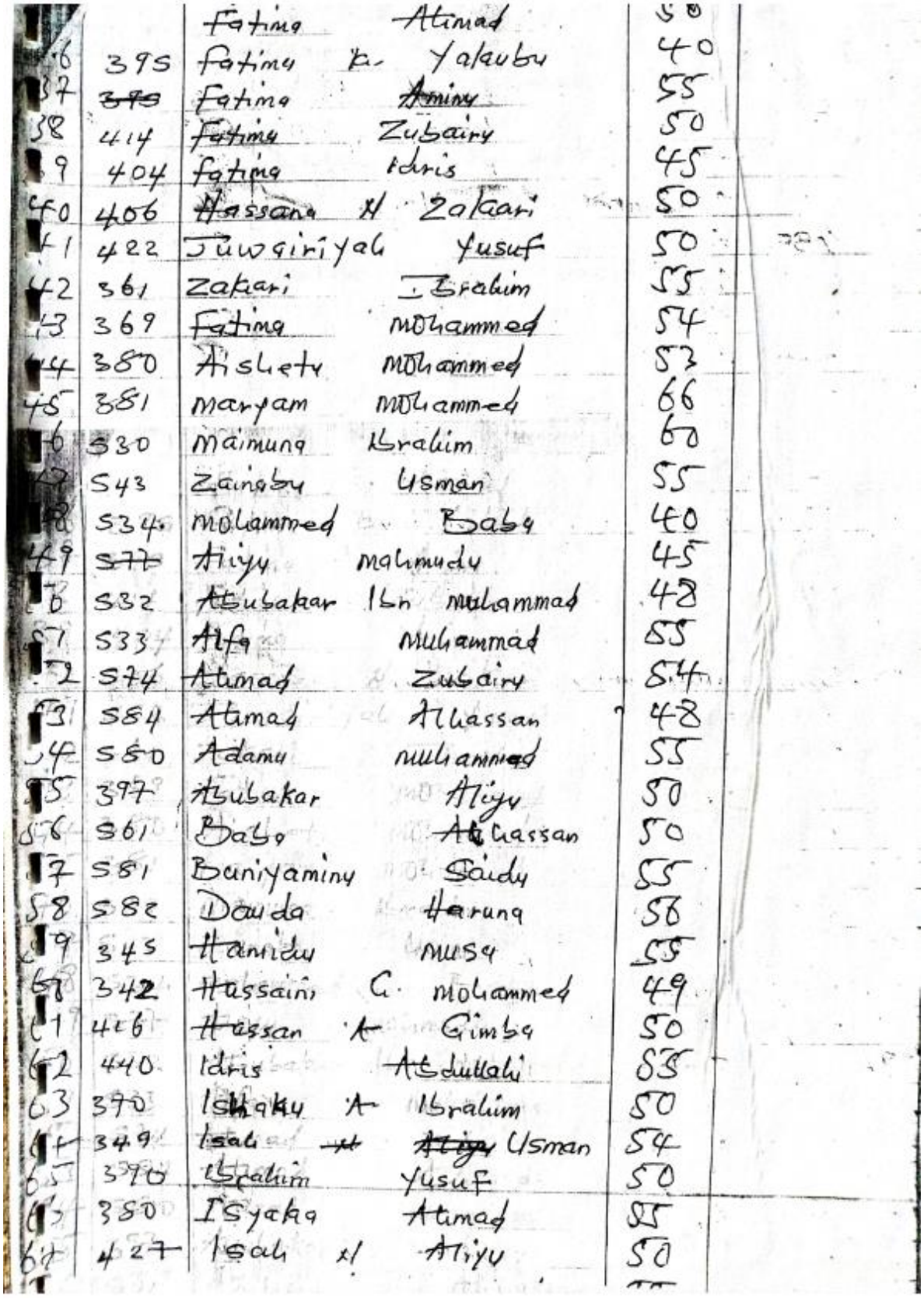
S/N	ADM NO	NAME	C.A	EXAM	TOTAL
1	9478	ALIYU MOH'D	19	50	69
2	9502	ABDULLAHI SAIDU	20	40	60
3	9593	ABDULLAHI MOH'D	19	40	59
4	9604	ABUBAKAR S HASSAN	21	30	51
5	9607	ALIYU S IBRAHIM	23	35	58
6	9769	ABDULLAHI HARUNA	14	40	54
7	9509	ABDULLAHI MOH'D	24	30	54
8	9587	ABDULLAHI SULEIMAN	23	40	63
9	9789	ABUBAKAR IBRAHIM	22	30	52
10	9557	ABDULMALIK IDRIS	18	40	58
11	9535	ABDULLAHI CHADO	14	40	54
12	9677	ABDULLAHI MOH'D	22	40	62
13	9669	ABUBAKAR S MOH'D	26	40	66
14	10388	ALIYU MOH'D	20	40	60
15	10290	ABDULLAHI G ABD[illegible]	21	40	71
16	9522	AHMED JIBRIN	18	42	70
17	10229	ABDULLAHI MUSA	25	45	80
18	9491	ABDULJABAR AHMED	22		
19	10364	AFEEZ OYENIWUNI	21	40	61
20	10306	ABDULLAHI A MOH'D	25	45	80
21	10404	AYOOLA BUKOLA	26	35	61
22	9497	DANIEL ROMOLAF	22	40	62
23	9494	ESTHER JOSEPH	21	30	51
24	9331	HARUNA JIBRIN	22	30	52
25	10388	HARUNA JIBRIN	12	30	42
26	9599	HALIMA YUNUSA	26	40	66
27	9581	HASSAN MOH'D	25	40	65
28	10193	HUSSAINI ABUBAKAR	24	40	64
29	9472	IDRIS ISMAILA	25	45	70
30	9644	ILYASU MOH'D	26	30	56
31	9569	IDRIS JIBRIN	22	30	52
32	9773	IBRAHIM IDRIS	26	40	66
33	9621	IDRIS ADAMU	22	30	52
34	9153	ISAH KOLO	23	40	63



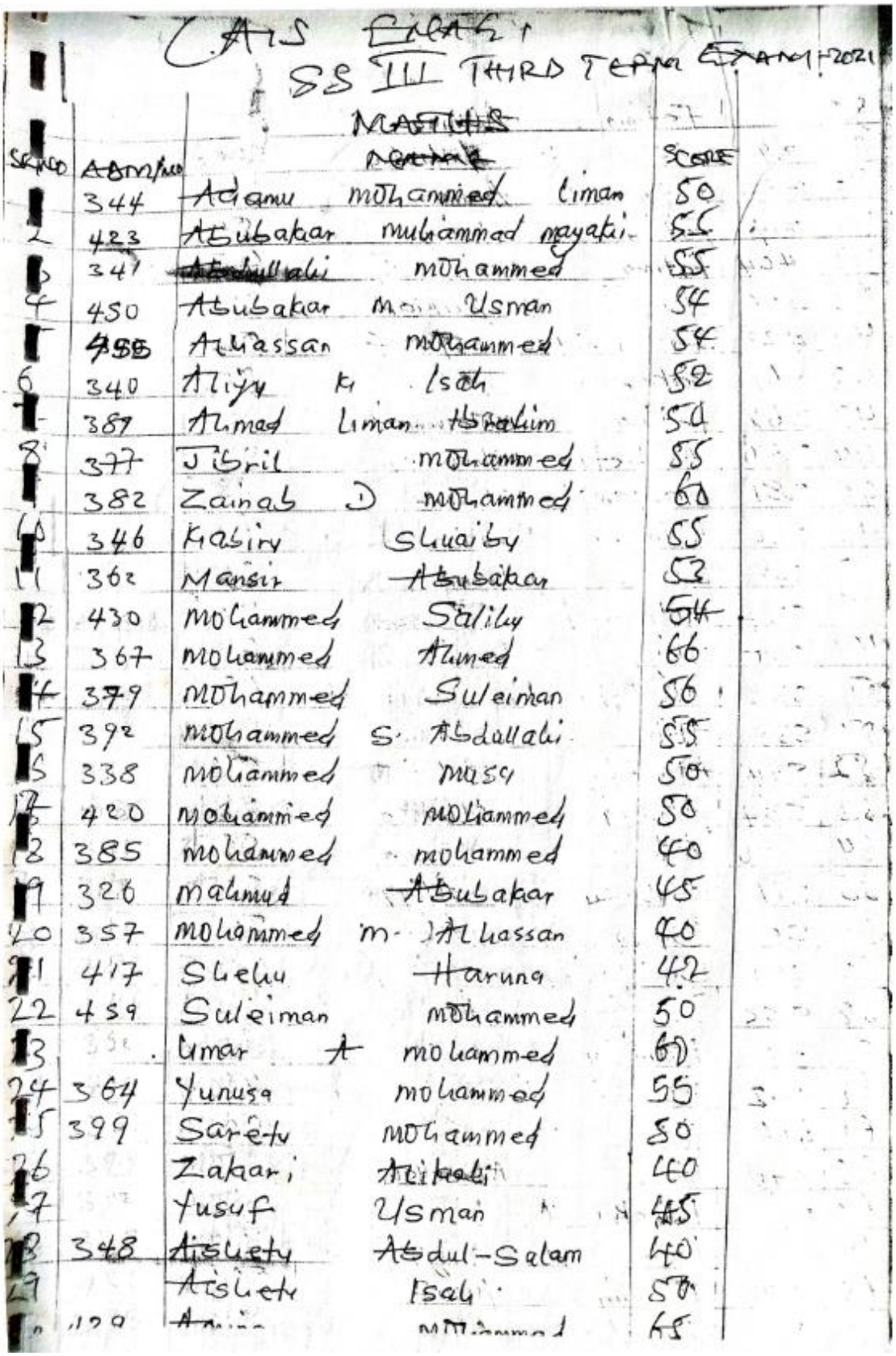
105	320	Rabiyatu	muhammad	69
106	352	Rukayat	Ibrahim	66
107	527	Salamatu	ka. Mohammed	50
108	454	Salimatu	Baba	60
109	525	Salimatu	Liman	58
110	407	fatima	muhammed	48
111	527	Rakiyatu	Abubakar	49
112	431	maryam	Abubakar	50
113	511	Abubakar	Abubakar	54
114	577	Adam	Abdulfatai	40
115	512	Aisha	Mohammed	39



339	Mohammed		Jiya	50
471	Mohammed	Y.	Ibrahim	56
472	Mohammed		Mohammed	56
477	Adagi		Muhammad	50
325	Suleiman		Mohammed	46
458	Suleiman	G.	Mohammed	43
461	Saidy		Yunusa	48
462	Suleiman	ki.	Muhammed	40
465	Usani	B	Usman	50
365	Usman		Jibrin	39
434	Yusuf	M.	Umar	45
334	Aisha		Salihu	40
317	Amina		Abubakar Muhammed	55
455	Amina		Muhammed	60
376	Adama		Zakariyaou	60
457	Fatima	G	Aisha Idris	59
383	Fatima	G	Mohammed	58
441	Fatima		Alhassan	57
447	Fatmo		Maiyu	56
412	Fatmo		Jibrin	54
	Fatima		Suleiman	58
	Fatima	M	Suleiman	55
	Hassana		Muhammed	50
	Halima		Idris	65
	Hassana		Adagi	60
	Hawawu		Mohammed	55
	Hawawu		Usman	60
	Halima		Mohammed	54
	Khadiyat		Isah	50
	Maryam		Muhammed	55
	Rahmatu	K.	Abdullahi	54
	Rahmatu		Isah	55
	Rahmatu		Liman	60
			Muhammed	20
352	Rukayat		Ibrahim	66



		Fatima		Ahmad	50
36	395	Fatima	D.	Yakubu	40
37	~~395~~	Fatima		~~Amiru~~	55
38	414	~~Fatima~~		Zubairu	50
39	404	Fatima		Idris	45
40	406	~~Hassana~~	M	Zakari	50
41	422	Juwairiyah		Yusuf	50
42	361	Zakari		Ibrahim	55
43	369	~~Fatima~~		Mohammed	54
44	380	Aisheta		Mohammed	53
45	381	Maryam		Mohammed	66
46	530	Maimuna		Ibrahim	60
47	543	Zainabu		Usman	55
48	534	Mohammed		Baba	40
49	~~577~~	Hiyu		Mahmudu	45
50	532	Abubakar	Ibn	Muhammad	48
51	533	Alfa		Muhammad	55
52	574	Ahmad		Zubairu	54
53	584	Ahmad		Alhassan	48
54	550	Adamu		Muhammad	55
55	397	Abubakar		Aliyu	50
56	561	Baba		Alhassan	50
57	581	Buniyamin		Saidu	55
58	582	Dauda		Haruna	50
59	345	Hamidu		Musa	55
60	342	Hassaini	G.	Mohammed	49
61	446	Hassan	A	Gimba	50
62	440	Idris		Abdullahi	55
63	390	Ishaku	A	Ibrahim	50
64	349	Isah	M	~~Aliyu~~ Usman	54
65	390	Ibrahim		Yusuf	50
66	380	Isyaku		Ahmad	55
67	427	Isah	M	Aliyu	50



CAS [illegible]
SS III THIRD TERM EXAM 2021
MATHS

SN	ADM/NO	NAME		SCORE
1	344	Adamu	Mohammed Liman	50
2	423	Abubakar	Muhammad Nayaki	55
3	347	[illegible]	Mohammed	55
4	450	Abubakar	M. Usman	54
5	455	Alhassan	Mohammed	54
6	340	Aliyu	K. Isah	52
7	387	Ahmad	Liman Ibrahim	54
8	377	Jibril	Mohammed	55
9	382	Zainab	D. Mohammed	60
10	346	Kabiru	Shuaibu	55
11	362	Mansir	Abubakar	53
12	430	Mohammed	Salihu	54
13	367	Mohammed	Ahmed	66
14	379	Mohammed	Suleiman	56
15	392	Mohammed	S. Abdallahi	55
16	338	Mohammed	Musa	50
17	420	Mohammed	Mohammed	50
18	385	Mohammed	Mohammed	40
19	326	Mahmud	Abubakar	45
20	357	Mohammed	M. Alhassan	40
21	417	Shehu	Haruna	42
22	459	Suleiman	Mohammed	50
23		Umar	A. Mohammed	69
24	364	Yunusa	Mohammed	55
25	399	Sarkin	Mohammed	50
26		Zakari	Abubakar	40
27		Yusuf	Usman	45
28	348	Aishatu	Abdul-Salam	40
29		Aishatu	Isah	50
30	199	Amina	Mohammed	45

S/N	AD/NO		CA1	CA2	CA3	EXAM	TOTAL	REMA
499	9238	NASIRU YAHAYA	10	5	8	37	60	
500	9340	ABDULRAFIU ABDULGANIU	8	9	10	35	62	
501	9340	JOSHUA SODEKO T.	10	9	7	34	60	
502	9434	USMAN KASIM						
503	9361	SA'ADATU SHITTU						
504	7720	MOHAMMED AMIRAH BAKAS						
505	6056	ADAMU ALIYU						
506	9368	SOLOMON EZEWIEI						
507	7815	MOHAMMED HAFSAT						
508	8535	KHADIJAT ISAH ABUBAKAR						
509	7254	HAWAWU MOHAMMED						
510	8281	RAMATU IDRIS						
511	7220	UCHE MIRACLE						
512		UMAR MOHAMMED						
513	7248	JIBRIN HASSAN						
514	7191	ABDULLAHI ALHASSAN						
515	7287	ABDULMALIK MOHAMMED						
516	7192	ALHAJI ZAKARIYAWU	10	3	10	30	53	Pass
517	8982	ABDULLAHI SANI	5	7	10	34	56	
518	7748	FATIMA S MOHAMMED	5	10	9	37	61	
519	9298	ZAINAB K MOHAMMED	4	10	10	39	63	
520	7197	AMINA ISAH	10	9	8	43	70	
521	8147	AYOMIDE OLUWAFEMI						
522	6893	MUSA RAHIMAT						
523	8334	ZAINAB ABDULRAZAK	9	10	8	43	70	
524	8116	AISHA B YUSUF	7	8	10	30	55	
525	7815	HAFSAT MOHAMMED	5	10	15	28	58	
526	7893	FAIZA AHMED	9	10	4	37	60	
527	7338	FATIMA MOHAMMED						
528	7377	SAFIYA MOHAMMED						
529	7340	ABDULLAHI SULEIMAN	10	7	8	43	68	
530	7314	ABDULQADIR MOHAMMED	8	10	9	46	73	
531	7376	AMINA MOHAMMED						

S/N	AD/NO		CA1	CA2	CA3	EXAM	TOTAL	REMARK
465.	9229	AMINA SALIHU						
466.	7824	ABDULMUMINI MAYAKI						
467.	8240	MOHAMMED ALHAJI ZUBAIRU						
468.	8239	MUSA ALHAJI ZUBAIRU						
469.	7257	AISHA ABUBAKAR	10	10	5	25	50	
470.	7235	AHMED ADAM						
471.	7226	MARYAM MOHAMMED						
472.	7253	HAWAWU IBRAHIM						
473.	7223	SALAWU KOLO NIMROD	7	3	10	56	81	
474.	8984	FATIMA MOHAMMED						
475.	7226	SANI MOHAMMED WACHIN	10	7	5	35	57	
476.	6044	MOHAMMED LIMAN JIMAH	9	10	5	37	56	PASS
477.	7338	FATIMA MOHAMMED						
478.	7313	ABDULQADIR MUHAMMAD						
479.	7008	YAHAYA UMAR	6	10	10	37	63	
480.		NAGYA SULEIMAN	9	10	10	44	73	
481.	8312	FARIDAT ZAKARIYA	8	5	9	52	74	
482.	8349	JAMIU ZUBAIRU	7	8	10	44	69	
483.	9223	SALAWU KOLO NMA	10	9	9	56	84	
484.	9229	MOHAMMED KOLO ZAINAB						
485.	9240	RIDWAN ABDULGANIU						
486.	8727	MOHAMMED YAHAYA MAMUM						
487.	2888	ALHASSAN HAUWA	8	4	5	39	56	
488.	7227	HASSAN MOHAMMED						
489.	7184	SHUAIBU SANI						
490.	9272	SAFULAH SHUAIBU	10	8	7	50	75	
491.	9298	TAIYE ADELANA	8	5	9	32	54	
492.	9301	MOHAMMED IDRIS						
493.	7227	HASSAN MOHAMMED						
494.	9314	SABIU AYUBA	5	19	7	25	56	
495.	9315	UMAR FARUQ SHITTU						
496.	9317	ZURKAINAINI ALIYU	4	9	10	31	54	
497.	9318	ISMAILA ABUBAKAR	5	8	9	37	59	
498.	9324	YUSUF RUKAYAT						

S/N	AD/NO		CA1	CA2	CA3	EXAM	TOTAL	REMARK
431.	7632	SULEIMAN SHERIFDEEN	8	9	10	38	65	Pass
432.	7091	SODIQ NDAKO						
433.	7226	SANI MOHAMMED WACHI						
434.	7244	SALIHU UMAR DASSUN						
435.	8862	ABDULMUMINU ABDULLAHI	10	5	7	31	53	Pass
436.	8863	UMAR SULEIMAN						
437.	7180	ALIYU KOLO TIKA	6	10	9	41	66	pass
438.	7181	MOHAMMED KOLO TIKA	10	5	10	32	57	pass
439.	8870	ZUBAIRU ABDULLAHI	7	8	9	30	54	pass
440.	8871	USMAN B ABUBAKAR	8	10	7	36	61	Pass
441.	8875	UMAR NASIRU	10	5	10	32	57	pass
442.	5099	MOHAMMED SAIDU ADAMS						
443.	5055	ELIJAH YISA	2	10	10	35	57	pass
444.	8885	RABIU SANI	10	5	10	38	63	pass
445.	8886	BUHARI MANASARA	7	8	9	30	54	pass
446.		ALHASSAN ABDULLAHI NAGENU						
447.	8889	ABDULLAHI USMAN ALIYU						
448.	8900	SAIFULA ISAH						
449.	8901	ABUBAKAR MUSA						
450.	8903	MOHAMMED B ABUBAKAR						
451.	5088	ADAMU USMAN	7	8	10	29	54	pass
452.	6066	MOHAMMED N SAIDU						
453.	7252	ISAH ALHASSAN	6	10	7	35	58	pass
454.	7338	FATIMA MOHAMMED						
455.	2542	MARYAM MOHAMMED						
456.	6079	SAIDU K AHMADU						
457.	7507	DAVID A HEZEKIAH						
458.	7869	ABUBAKAR FATIMA						
459.	8291	OYEDEPO SAMSON						
460.	8464	ABRAHAM I MOSES						
461.	7477	PROSPER LUCKY						
462.	8939	NNAMDI FAVOUR						
463.	7974	SEGUN DAVID	16	7	15	20	50	Pass
464.	7250	AISHA MOHAMMED						

S/N	AD/NO		CA1	CA2	CA3	EXAM	TOTAL	REMARK
398.	8472	SALIHU ABDULLAHI	7	8	10	28	53	Pass
399.	7240	SUNDAY DAVID ITODU	10	9	9	54	82	Pass
400.	8457	SAMINU IDRIS	7	10	10	44	71	Pass
401.	6090	SA,ADAT UMAR	10	10	10	50	80	Pass
402.	6094	SAIDU ALHAJI SAIDU	5	10	10	35	60	Pass
403.	6022	SUKURAT SANI	10	9	8	40	67	pass
404.	6088	SALAMATU BABA MOHAMMED	8	7	10	45	70	pass
405.	6083	SARETU MOHAMMED SULEIMANM	3	9	9	39	60	Pass
406.	7067	SADIYA ABDULLAHI	5	7	8	34	54	Pass
407.	7178	SAIDU ASMAU						Pass
408.	7198	RUKAYAT ALHASSAN	8	9	10	36	63	Pass
409.	7229	SARETU IBRAHIM						
410.	7259	MOHAMMED B MOHAMMED						
411.	6084	SADIYA IDRIS	10	9	7	40	66	Pass
412.	8754	SIKIRU ABDULSAMIU						
413.	7073	OLUYELEKE MARY	9	8	9	27	53	Pass
414.	7974	OLUWASEGUN DAVID						
415.	7245	OKE GABRIEL	10	10	10	50	80	Pass
416.	7214	ROFIA MURTALA	9	8	9	47	73	Pass
417.	6077	RAMATU ALHASSAN	9	7	10	43	69	Pass
418.	7989	ROKIBAT MURTALA	8	5	9	32	54	Pass
419.	7270	RAHEEM JAMIU	6	7	10	32	55	pass
420.	6076	RUTH PETER	5	10	4	25	44	pass
421.	6078	RACHEIL MATHEW	10	7	9	48	74	Pass
422.	7190	ROSELINE JOHNSON	8	7	10	27	52	pass
423.	8415	RAMATU USMAN JABBA	8	10	9	28	55	Pass
424.	8582	RASAQ RASEED						
425.	7322	RAHINATU MOHAMMED	5	10	9	30	54	Pass
426.	7313	STEPHEN YISA						
427.	7215	SULEIMAN SALIHU						
428.	6017	SODIQ ALIYU						
429.	8427	SODIQ ABDULAZEEZ						
430.	8540	SODIQ YAKUBU	9	10	7	45	71	Pass

S/N	AD/NO		CA1	CA2	CA3	EXAM	TOTAL	REMARK
365.	7969	ISAHKU YAKUBU						
366.	8676	RUKAYA MOHAMMED	8	9	7	47	71	Pass
367.	8335	KHADIJAT ISAH ABUBAKAR	2	10	5	30	47	Pass
368.	8654	MOHAMMED ABUBAKAR	9	7	10	37	63	PASS
369.	7191	SUZANA JOHNSON	10	10	10	42	72	Pass
370.	7226	GABRIEL OLADAPO						
371.	8379	TOBI JOSEPH	10	10	10	56	86	Pass
372.	6096	TEMITOPE J OLUWAYOMI						
373.	8277	TINAN JONATHAN	10	8	9	53	80	Pass
374.	7290	TUNMISE ADEWALE	8	10	7	25	50	Pass
375.	7335	TOAFEEQ ISMAIL						
376.	8685	TANKO IDRIS MOHAMMED						
377.	8713	UMAR MOHAMMED	9	10	8	43	80	Pass
378.	8783	USMAN MOHAMMED						
379.	7261	UMAR MOHAMMED						
380.	7221	USMAN YAHAYA	7	6	5	23	41	Pass
381.	8883	USMAN MOHAMMED						
382.	8368	USMAN MOHAMMED TYABO	10	8	10	50	78	Pass
383.	7589	USMAN MOHAMMED SABA						
384.	8677	USMAN A NAGYA	9	8	9	46	72	Pass
385.	7005	USMAN BABA						
386.	7362	USMAN MOHAMMED						
387.	8798	UMAR ALIYU						
388.	8617	USMAN UMAR						
389.	7273	WASIU AFOLABI						
390.	7013	YAHAYA MOHAMMED						
391.	7377	SAFIYA MOHAMMED	5	7	9	27	48	Pass
392.	7269	SADIK ABDULLAHI	10	10	9	21	50	Pass
393.	8624	SARETU IBRAHIM						
394.	8703	SADIQ M ABUBAKARB						
395.	7209	SAMAD FALOLA	10	5	7	20	42	pass
396.	8089	SAMIYAT AHMED	8	10	9	35	62	Pass
397.	7286	SANI ISAH IDRIS						

S/N	AD/NO		CA1	CA2	CA3	EXAM	TOTAL	REMARK
331.	7255	BINTA .F. YAHAYA						
332.		MOHAMMED AMINA						
333.	7279	KOLO AMINA						
334.	8847	HABIBA BAKO						
335.	8848	ABUBAKAR TAUHEED						
336.	8849	YUNUSA NDAKOSTU	7	8	10	32	57	pass
337.	8850	ISYAKA ABUBAKAR	8	10	9	26	53	Pass
338.	8817	MOHAMMED ALHASSAN	9	5	10	37	61	pass
339.	8888	SHAIBU MOHAMMED	10	7	8	30	55	pass
340.	8902	YAHAYA FATIMA	9	8	9	28	58	pass
341.	7338	MOHAMMED FATIMA	7	9	10	25	51	pass
342.	7286	ADAMU MOHAMMED						
343.	8800	ABDULLAHI MOHAMMED ZHIWU						
344.	8838	ABDULLAHI JIDA MOHAMMED						
345.	7253	HAWAWU IBRAHIM						
346.	8759	FAITH FRIDAY						
347.	7352	YAHUZA .A. KOLO	3	10	10	34	57	pass
348.		YAHAYA J ISAH						
349.	7969	YUSUF HASSAN						
350.	7014	YUSUF MOSHOOD	5	10	10	25	50	Pass
351.	7171	YUSUF Y MALLAM						
352.	7013	YAHAYA MOHAMMED	10	8	9	30	57	Pass
353.	8495	YAHAYA UMAR						
354.	9319	YAHAYA MOHAMMED	7	10	10	25	52	Pass
355.	8399	YUNUSA NDAGI						
356.	8746	YUSUF WOLI						
357.		YUSUF JIDA USMAN						
358.	7071	ZAINAB ADAMU	5	7	10	30	52	Pass
359.	6018	ZAINAB ATTAHIRU	7	8	9	32	56	Pass
360.	7335	ZUWAIRA ABUBAKAR	9	5	6	40	60	pass
361.	7021	ZAINAB IDRIS						
362.	7534	ZAKARI HARUNA	5	10	9	44	68	Pass
363.	6070	RUTH N. SHABA	8	7	10	58	83	Pass
364.	7251	MOHAMMED BAIWA	10	8	9	32	59	Pass

S/N	AD/NO		CA1	CA2	CA3	EXAM	TOTAL	REMARK
297.	7177	MOHAMMED B MOHAMMED	8	10	9	40	67	Pass
298.	8468	MADINAT MOHAMMED	7	8	10	38	63	pass
299.	8486	MOHAMMED ZAKARI						
300.	6054	MOHAMMED ALHAJI SALIHU	7	10	10	20	47	pass
301.	8607	MOHAMMED MOHAMMED						
302.	7342	MOHAMMED USMAN						
303.	8804	ISAH A MOHAMMED						
304.	7342	MOHAMMED SAIDU						
305.	8812	MOHAMMED ISAHKA						
306.	7657	MOHAMMED ZALIYAT	9	10	10	41	70	pass
307.	3047	HABIBU MOHAMMED						
308.	8821	UMARU ADAMU						
309.	7231	AISHA ABUBAKAR						
310.	8822	MUSA HUSSAINI						
311.	8826	USMAN MOHAMMED						
312.	8830	ADAMA NDAGI						
313.	7523	YAHAYA .D. YAHAYA						
314.	7230	YAHAYA ALHASSAN						
315.	7220	GABREIL OLADAPO						
316.	6066	HALIRU LABARAN	10	5	4	32	51	pass
317.	8737	HAFSATU ABUBAKAR						
318.	7279	FATIMA KOLO						
319.	8842	SADIYA ABUBAKAR	5	7	9	30	51	Pass
320.	7168	SEGUN IDRIS	7	9	10	32	58	pass
321.	8855	ANATU MOHAMMED GORO						
322.	8856	MARYAM IBRAHIM						
323.	5782	SALIHU ALIYU						
324.	8861	MUSA MOHAMMED						
325.	6077	RAMATU ALHASSAN	9	7	10	25	51	Pass
326.	7226	MARYAM MOHAMMED						
327	8846	USMAN B ADAMU						
328.	7366	MOHAMMED AISHA EMIGI						
329.	8842	ABUBAKAR SADIYA						
330.	7183	IDRIS MUSA						

S/N	AD/NO		CA1	CA2	CA3	EXAM	TOTAL	REMARK
263.	8448	MOHAMMED MOHAMMED						
264.	7856	MAHMUD USMAN DUKUN						
265.	6053	MOHAMMED ISAH JEBBA	10	10	10	48	78	pass
266.	8345	MOHAMMED ABDUL KADIR	8	9	7	45	69	pass
267.	8456	MOHAMMED NDAGI	6	10	9	46	71	pass
268.	84685	MOH'D IYAL ABDULLAHI	8	5	10	35	58	pass
269.	8549	MOHAMMED USMAN	10	8	9	57	84	pass
270.	7316	MOHAMMED Z. MOHAMMED	8	10	10	22	50	pass
271.	7178	MOHAMMED ABDULLAHI	10	5	7	37	59	pass
272.	8696	MOHAMMED MOH'D GORO						
273.	7357	MUSA IBRAHIM						
274.	8812	MOHAMMED ISHAKU						
275.	8777	MASAUDU ABUBAKAR						
276.	7259	MOHAMMED B. MAHMUD						
277.	8712	MOHAMMED IMRANA						
278.	7352	MARIAM DANJUMA	10	8	9	50	77	pass
279.	7212	MARIAM ABDULLAHI	7	10	5	34	56	pass
280.	7243	MUJIDAT ABDULAZEEZ	5	10	10	27	52	pass
281.	7699	MAIMUNAT ABDULSALAM						
282.	7009	MOHAMMED YAHAYA						
283.	8490	MOHAMMED KUDU MOHAMMED						
284.	7130	MOHAMMED KUDU KUSOGI	8	9	10	30	57	pass
285.	6058	MADU MOHAMMED	10	6	10	29	55	pass
286.	7354	MOHAMMED USMAN						
287.	7333	MOHAMMED HARUNA						
288.	8712	MOHAMMED IMRANA						
289.	7341	MOHAMMED ZAKARI						
290.	8731	MOHAMMED MOHAMMED						
291.	7783	MOH.D LIMAN ABUBAKAR						
292.		MOHAMMED IBRAHIM						
293.	8721	MOHAMMED M DAUDA						
294.	7686	MARYAM AHMED						
295.	7331	MOHAMMED IDRIS						
296.	6064	MOHAMMED LIMAN JIYA						

S/N	AD/NO		CA1	CA2	CA3	EXAM	TOTAL	REMA
229.	8387	JAMIU KAMALDEEN	8	9	10	30	57	pas
230.		JIBRIN MAHMUD						
231.	4858	JIBRIN MAHMUD GORO						
232.	8578	JIYA MARK	7	8	10	30	55	pas
233.	6023	KENE CHUKWU CHEKELUBA	8	9	10	51	78	pas
234.	7297	KHADIJAT MOHAMMED	7	10	8	35	60	pass
235.	7830	KAOSARAT MURFTAN	10	5	10	26	51	pass
236.	6075	KEMI JOSEPH	10	5	10	30	55	pas
237.	6071	MARYAM .K. AHMED						
238.	8202	MOHAMMED IDRIS AHMED						
239.		MOHAMMED NDANA	7	8	9	30	54	pass
240.	7304	MOH'D HARUNA TATABU	8	9	10	32	59	pas
241.	6055	MOH'D TSADO IBRAHIM						
242.	6059	MOHAMMED MOHAMMED						
243.	7022	MOHAMMED MOHAMMED						
244.	6056	MOHAMMED IBRAHIM						
245.	7357	MUSA IBRAHIM	10	9	7	28	54	pass
246.	7193	NATHANIEL USMAN GANA						
247.	8777	NAZIRU SANI						
248.	7179	NAFISAT ISAH						
249.	8530	NURA MOHAMMED						
250.	6071	NWEKE UBASINACHE	10	7	9	40	66	pass
251.	6069	NWEKE UZO	10	9	8	57	84	pass
252.	7173	MAIMATU ADEWUNJI						
253.	7058	NCHE NAH D. STEPHEN	8	10	9	35	62	pass
254.	7315	NAFISAT MOHAMMED	10	7	8	40	65	pass
255.	8857	OCHE OYEGWA KINO	8	9	7	30	54	pass
256.	8371	OLADUNE AMOS	10	7	10	35	62	pas
257.	6072	OLAYI OLAPETER	10	8	9	53	79	pass
258.	7340	OHZAINAT BUSARI	9	7	10	30	56	pass
259.	7266	KEDEMA .M. SABA						
260.	7597	KOLO AGNESS	10	10	10	53	83	pass
261.	6048	LYDIA ABRAHAM	7	5	8	35	55	pas
262.	7217	LIMAN ALIYU						

S/N	AD/NO		CA1	CA2	CA3	EXAM	TOTAL	REMARK
195.	8570	IBBRAHIM SIDI ISAH	5	8	9	36	58	pass
196.	8806	IDRIS MOHAMMED						
197.	7355	ILIYASU IBRAHIM						
198.	7755	IBRRAHIM MOHAMMED						
199.		ISAH ALIYU						
200.	7206	ISAH SALIHU	5	10	10	27	52	pass
201.	8449	IBRAHIM ABDULKAREEM						
202.	8608	IBRAHIM DAUDA						
203.	8606	IDRIS MOHAMMED						
204.	8639	ISAH UMAR	8	9	9	30	56	pass
205.		IDRIS MOHAMMED						
206.	7255	IBRAHIM MOHAMMED						
207.	7250	ISAH MOHAMMED						
208.	6041	IBRAHIM USMAN						
209.	8529	IDRIS ISAH						
210.	7310	IDRIS ALIYU						
211.	7667	ISLAMIAT BELLO	10	9	7	36	62	pass
212.	7383	ISAH ISAH KUPE						
213.	7323	ILIYASU IBRAHIM						
214.	8698	ISAH A. ISAH						
215.	7352	ILIYASU IBRAHIM						
216.		ISAH MOHAMMED						
217.	6028	GODIYA EZEKIEL	7	8	10	35	60	pass
218.	8581	JIBRIN SIDI ISAH	10	7	10	26	53	pass
219.	7216	JIYA JULIYANA KAKA	9	7	8	41	65	pass
220.	2888	HAUWA ALHASSAN						
221.	6045	JAMES LUCKY	10	10	10	44	74	pass
222.	7228	JIBRIN MOHAMMED	9	8	7	39	63	pass
223.	7023	JUNIOR J. OLUWAYOMI						
224.	7830	JEMIMAN KAURA						
225.	7374	JACOB BABA DANIEL						
226.	7267	JONAH .N. YISA	10	9	10	40	69	pass
227.	6046	JIBRIN AUDU						
228.	7299	JIBRIN AUDU	9	7	9	30	55	pass

S/N	AD/NO		CA1	CA2	CA3	EXAM	TOTAL	REMARK
161.	7295	FATIMA ADAMU						
162.	6027	FATIMA IBN ABASS	10	08	10	24	52	
163.	7250	FABIHI ELIJAH	10	9	7	26	51	
164.	7315	FATIMA MOHAMMED						
165.	6092	FATIMA ABUBAKAR	9	10	9	25	53	
166.	7345	FATIMA MOHAMMED GORO						
167.	6030	GAFARU BALOGUN	9	7	10	48	74	
168.	8554	GIDEON YISA	10	10	10	46	76	
169.	6031	GANIYAT ABDULRAZAQ						
170.	7350	GANIYAT OWOLABI	10	8	7	36	61	
171.	7258	GODFRY DAVID						
172.	8328	HARUNA ABUBAKAR	9	10	9	42	70	
173.	8390	HABIBULAH ABDULYEKEN	8	7	10	43	68	
174.	7229	HAUWA MOHAMMED TAYI	4	10	10	43	67	
175.	8444	HADIZA JIBRIN						
176.	7556	HADIZA AHMED	5	10	7	38	60	
177.	7287	HAUWA .B. MOHAMMED	7	8	9	30	54	
178.	8671	HUSSAINA SANI						
179.	6033	HAFSAT MOHAMMED	8	10	9	30	57	
180.	7205	HAFSAT ADAMU	8	9	10	35	62	
181.	7277	HAUWAWU ISAH						
182.	8307	HADIZA IBRAHIM						
183.	8620	HAJARA CHEKA	10	6	7	30	53	
184.		HUSSAINI SANI						
185.	6033	HABIBAT IBN ABASS	10	10	10	20	50	
186.	7772	HADIZA AWAL	5	9	10	27	51	
187.	7239	HAUWAWU MOH'D SAKPE	7	8	10	32	57	
188.	7384	HUSSAINI ALHASSAN						
189.	8473	IBRAHIM USMAN						
190.	6068	ISAH MUSLYNDEEN	8	9	10	33	60	
191.	7024	ISMAILA .S. USMAN	10	7	5	36	58	
192.	6056	IFE ADENIRAN	5	10	9	40	64	
193.	7224	ISREAL VICTOR	7	6	9	49	70	
194.	8424	IBRAHIM YAKUB						

S/N	AD/NO		CA1	CA2	CA3	EXAM	TOTAL	REMARK
127.	1540	BALKISU BELLO	9	9	10	32	60	pass
128.	8384	BLESSING FRANCIS						
129.	6020	BINTA .F. ABDULLAHI	7	10	10	51	78	pass
130.	7172	BASHIRAT AMOBI	10	5	9	57	80	pass
131.	7188	BLESSING RUFUS	8	9	10	46		
132.	7160	BUKOLA GBOLGADE						
133.	8484	BINTA MOHAMMED	8	9	10	31	58	pass
134.	6015	BAYO PAUL						
135.	7680	BASIRAT YAKUB						
136.	6070	BALKISU IDRIS	9	10	10	22	51	pass
137.	8275	BASIRAT BELLO						
138.	7275	COLLINS MAGRET	10	9	10	53	82	pass
139.	8561	DANIEL OKAFO						
140.	7255	DIMANS .N. SABA						
141.	6006	ADEWILE ELIJAH	8	7	10	55	82	pass
142.	8403	EMMANUEL I MOSES	10	10	7	52	79	pass
143.	6024	ESTHER FABUMI	9	7	10	50	76	pass
144.	8486	FAMOUS DANIEL	5	8	9	48	70	pass
145.	8319	FAIZA JIMOH	10	9	10	49	78	pass
146.	8230	FATIMA MOHAMED	10	4	7	39	60	pass
147.	8539	FATIMA MOHAMMED	7	8	10	30	55	pass
148.	8049	FATIMA IDRIS						
149.	6026	FAIZA UMAR	7	10	5	35	57	pass
150.	8539	FATIMA MOHAMMED						
151.	7307	FATIMA MOH'D EDATI						
152.	7263	FATIMA LIMAN	10	5	10	40	65	pass
153.	7242	FATIMA MOH'D MAJIN	7	9	8	37	61	pass
154.	8700	FATIMA SHUAIBU	9	8	9	30	56	pass
155.	8575	FATIMA .A. ALIYU	10	5	9	33	57	pass
156.	7305	FALOLA ISMAILA	9	7	9	26	51	pass
157.	7294	FATIMA SALIHU						
158.	8415	FAHAD HUSSAINI	2	10	10	36	58	pass
159.	8557	FATIMA .C. MOHAMMED	7	10	9	25	51	pass
160.	7008	FATIMA ISAH						

S/N	AD/NO		CA1	CA2	CA3	EXAM	TOTAL	REMARK
93.	7235	ABUBAKAR NURA						
94.	7218	AISHA MOHAMMED						
95.	7238	AISHA MOHAMMED						
96.	6021	ABDULLAHI HASSAN	7	10	10	29	56	Pass
97.	7211	AHMED .N. JIBRIN	10	7	16	20	53	Pass
98.		ABEL ISIAH						
99.	8656	AHMED IBRAHIM						
100.	7236	ABDULJALIL ABDULGANIU	10	8	9	30	57	Pass
101.	8753	ABUBAKAR USMAN						
102.	8644	ABUBAKAR MOHAMMED	9	10	10	22	51	pass
103.	7336	AMINA ALIYU	10	10	9	21	50	PASS
104.	7306	ALHASSAN ABDULLAHI	10	8	9	26	53	Pass
105.	7306	AMINA UMAR	9	7	10	25	51	Pass
106.	8678	ADAMU USMAN YAHAYA						
107.	8699	AISHA MOHAMMED CHEKA	10	10	8	22	50	Pass
108.	8765	AISHA ABDULMALIK	7	10	9	25	51	Pass
109.	5094	AISHA SONFADA	9	7	10	26	52	Pass
110.	7218	AISHA MOHAMMED						
111.	7345	AMINA ISAH	10	8	9	28	55	pass
112.	7309	ABUBAKAR HARUNA						
113.	71271	ADAMU ISHAKU						
114.	8085	AUDU ALIYU						
115.	7545	AMINA ISAH						
116.	7175	ABUBAKAR HARUNA	6	7	10	33	56	pass
117.	8720	ABUBAKAR KOLO						
118.	8663	ALIYU MOHAMMED						
119.	7280	AISHA MOHAMMED NDAKO						
120.	8768	AHMED ISAH						
121.	6016	ABDULATEEF MOHAMMED	10	9	8	42	69	pass
122.	8538	ABUBAKAR AHMED						
123.	8743	ABUBAKAR MOHAMMED						
124.	6005	ABDULLAHI ABUBAKAR						
125.	7338	BULUS DANTENI	5	10	10	30	55	Pass
126.	6019	BOLAKALE RAFIU						

S/N	AD/NO		CA1	CA2	CA3	EXAM	TOTAL	REMARK
60	8790	ABBA HUSSAINA	9	10	8	46	73	Pass
61	7260	ADAMA B MAHMUD	10	10	10	30	60	Pass
62	7281	ABDULLAHI YUNUSA	7	8	9	44	68	Pass
63	7268	ABDULLAHI YAHAYA	10	7	10	30	57	Pass
64	8375	ABDULKADIR MOHAMMED						
65	8327	ADEJUNA MARYAM	8	10	9	39	66	Pass
66	8318	AHMED HAH	10	9	10	22	51	Pass
67	7988	ALIYU IDRIS						
68	7348	ABDULRASAQ HABIB	6	7	10	38	61	Pass
69	8291	AHMADU A BUBAH	10	10	9	25	54	Pass
70	8295	AISHA IBRAHIM						
71	7992	AWOLU MOHAMMED						
72	7989	AHMED SULEIMAN	5	10	6	29	50	Pass
73	7956	AHMED HADIZA	7	9	5	38	59	Pass
74	6002	ABDULLAHI JIBRIN	9	9	10	24	52	Pass
75	8047	ABBAH BELLO						
76	7339	ADAMU ALIYU	10	7	9	35	61	Pass
77	8477	ABDULKADIR MOHAMMED						
78	7237	ALHAJI ABDULLAHI						
79	7000	ADAMU ABDULLAHI						
80	7362	ABDULMALIK ABDULFATAI						
81	6008	ADAMU ABDULLAHI						
82	7291	AISHA MOHAMMED						
83	6019	AHMAD K SAIDU						
84	7222	AHMED A SHEHU						
85	6008	AHMED ABUBAKAR						
86	7525	AMINA MAIN						
87	7333	AISHETU ABDULLAHI	7	9	10	28	54	Pass
88	6011	AISHETU A SHEHU						
89	6010	ALIYU ISAH KOCHE						
90	7368	ABDULLAHI HASSAN	10	10	10	46	76	Pass
91	7276	ABDULLAHI MUSA						
92	7376	AMINA MKOHAMMED	8	7	10	26	51	Pass

S/N	AD/NO		CA1	CA2	CA3	EXAM	TOTAL	REMARK
26.	6014	ABDULSALAM MASHOOD	9	10	5	44	68	Pass
27.	6013	AHMED .M. KABIRU	8	7	10	37	62	Pass
28.	6009	AHMED ADAMU	10	5	8	33	56	Pass
29.	8701	AHMADU ZUBAIRU						
30.	8552	ABUBAKAR .S. ABDULLAHI	8	10	9	35	62	Pass
31.	7314	ABDULLAHI JIBRIN	9	7	10	43	69	Pass
32.	8671	ALHASSAN SANI						Pass
33.	8580	ALHAJI SIDI ISAH	9	5	9	31	54	Pass
34.	8704	AHMADU ALIYU	5	7	10	33	55	Pass
35.	8477	ABDULKADIR MOHAMMED						
36.	7264	ADAMU .A. LIMAN	9	10	9	42	70	Pass
37.	7260	ADAMU .B. MOHAMMED	10	10	10	30	60	Pass
38.	7043	ADAMU KABIRU						
39.	7095	ADAMU IDRIS						
40.	8656	ADAMU IBRAHIM						
41.	8411	ABBAS ZAYANU	10	10	10	40	70	Pass
42.	5092	AZEEZ JAMIU	9	10	10	39	68	Pass
43.	5693	ABDULLAHI YAKUBU						
44.	8318	ABDULBASIT JIMOH	10	9	10	49	78	Pass
45.	7224	ABDUL .B. IBRAHIM						
46.	8477	ABDULKADIR MOHAMMED						
47.	7231	AISHA ABUBAKAR	8	10	10	44	72	Pass
48.	5094	AISHA JIBRIN	10	9	8	45	71	Pass
49.	8361	ASMAU MOHAMMED	8	10	7	40	65	Pass
50.	7293	AISHA MAHMUD						
51.	6025	AISHA .N. SLAIHU	10	7	8	31	51	Pass
52.	7523	AISHA .D. MOHAMMED	9	10	9	50	78	Pass
53.	8295	AISHAT IBRAHIM						
54.	7200	AISHA IDRIS	9	7	10	42	68	Pass
55.	7177	AMINA ISAH						
56.	7230	AKOLADE BLESSING	10	7	5	34	56	Pass
57.	7195	AJAYI ODUNAYO						
58.	6979	AMINA ABUBAKAR	10	10	10	20	50	Pass
59.	7174	AISHA MOHAMMED TANAPA	6	8	9	27	50	Pass

HAKIMI ALIYU DAY SECONDARY SCHOOL, MOKWA, NIGER STATE.

SS II

Promotion Assessment Input Form

Subject: MATHEMATICS
Term: THIRD TERM
Teachers: M. Abdullahi Moh'd

Class: SS II
Year: 2020/2021
Signature: MAB

S/N	AD/NO	NAME	CA1	CA2	CA3	EXAM	TOTAL	REMARK
1.	8912	OMOKORE MOYIN OLUWA	10	9	8	42	69	V. Good
2.	8913	ISAH AMINAT	8	10	7	31	56	Pass
3.	8932	MOSES DZAMA						
4.	8964	SALIHU MOHAMMED						
5.	8966	ABDULMUTALIB ALIYU	10	10	4	30	54	Pass
6.	8971	DINAH TSADO	8	10	9	41	68	V. Good
7.	8979	ABUBAKAR RABIYATU	9	8	10	41	68	V. Good
8.	8981	OKUBUMOTODE GRACE	10	9	7	34	60	V. Good
9.	8984	MOHAMMED FATIMA	8	7	9	30	54	Pass
10.	8998	SHAMLA YAKUBU	10	9	10	46	74	Pass
11.	9002	FATIMA Y. IDRIS	9	7	8	37	61	Pass
12.	9014	ESTHER OMENYI OBEY	5	8	9	34	57	Pass
13.	8987	AISHA ADAMU	8	8	10	31	57	Pass
14.	9004	SALIHU IBRAHIM	9	7	10	43	69	Pass
15.	9053	AHMED B. ABUBAKAR						
16.	9015	ABDULHADI MOHAMMED	5	10	7	34	56	Pass
17.	9071	MUSA YAKUBU	7	5	9	28	50	Pass
18.	9101	NASIRU ABDULLAHI	10	8	7	36	61	Pass
19.	9120	AHMED SALIHU	10	9	8	32	59	Pass
20.	9128	JIYA STEPHEN						
21.	9129	JIYA SILAS						
22.	9130	JIYA MAGEATE						
23.	9165	MUSA MOHAMMED	9	8	10	30	57	Pass
24.	9180	ABUBAKAR SAIDO HARUNA						
25.	9310	ABDULANLADI HASSALAM	7	8	10	49	74	Pass

NIGER STATE MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY

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ZONE

PAPER

			THEORY		
1	1704	ADAMA ZUBAIRU	31	40	71
2	1832	IAHAJA ISAH	33	29	62
3	1702	JOHN PETER	29	25	54
4	1703	VICTORIA SAMSON	25	30	55
5	1556	MOHAMMED SANI	29	35	64
6	1695	TSADO ZUBAIRU	31	35	66
7	1702	MOHAMMED MUSA	32	40	72
8	1695	DAUDA SALAWU	33	35	68
9	1699	FATI USMAN A.	34	36	70
10	1687	ALHAJI ABDULLAHI	38	37	75
11	1698	GARBA YUSUF	31	29	60
12	1619	ABDULLAHI USMAN	32	31	63
13	1688	IAHAJA IBRAHIM	31	40	71
14	1691	FATIMA UMARU	29	30	59
15	1683	AISHA K. ABUBAKAR	36	31	67
16	1690	SULEIMAN ABDULLAHI	40	31	71
17	1684	HAMZA ADAMU	28	30	58
18	1689	AMOLUWA OWOYE	39	40	79
19	1681	MOHAMMED AHMED	28	30	58
20	1706	ABDULRAHMAN AHMED	31	40	71
21	1710	ABUBAKAR MOHAMMED C	34	28	62
22	1709	AISHA MOHAMMED C	35	35	70
23	1708	ABDULRAHMAN YAKUBU C	30	40	70
24	1707	IDRIS - SAIDU CHIJI	32	31	63
25	89	FAKAR A. MARY	31	30	61
		A. HASSAN MOHAMMED	33	20	53

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SCHOOL ZONE

SUBJECT/PAPER

			EXAM SCORE		
			THEORY		
151	1669	YAHAYA T. MOHAMMED	25	30	55
152	1667	JIBRIN MOHAMMED K.	30	25	55
153	1667	MOHAMMED ISYAKU	34	38	72
154	1661	MARYAM MOHAMMED	35	37	72
155	1676	IDRISU ISAH	31	34	65
156	1674	MOHAMMED MUSA	25	26	51
157	1662	MUSA MARYAM	29	30	59
158	1677	YAHAYA UMARU	20	46	66
159	1663	BALKISU ISAH	39	40	70
160	1657	JOHN EMMANUEL	30	40	70
161	1659	ABDULRAHMAN YUSUF	41	20	61
162	1678	MOHAMMED YAKUBU	25	27	52
163	1658	ABUBAKAR MOHAMMED	30	34	64
164	1675	YUNUSA ABUBAKAR	35	40	75
165	1673	YAHAYA MOHAMMED	37	30	67
166	1670	SALAMATU MOHAMMED	41	35	76
167	1674	UMARU ADAMU	43	31	74
168	1665	AISHA - YUNUSA	20	42	62
169	1671	HADIZA MOHAMMED	30	32	62
170	1660	LAWAL YUNUSA	35	31	66
171	1672	SAMSON EMMANUEL	29	31	60
172	1666	JAMES DANIEL	30	35	65
173	1655	ABUBAKAR AUDU	32	40	72
174	1650	MOHAMMED ABDULRAHMAN	20	32	52
175	1702	MOHAMMED MOHAMMED	31	31	62
176	1685	RAMATU MOHAMMED	32	40	70
177	1692	YAHAYA YUNUSA	39	20	59
178	1701	ZUBAIRU ISAH	31	40	70
179	1693	ABUBAKAR ABDULLAHI	33	41	74
180	1694	USMAN FATI KUSU	39	30	69

EXAMINER ADJ

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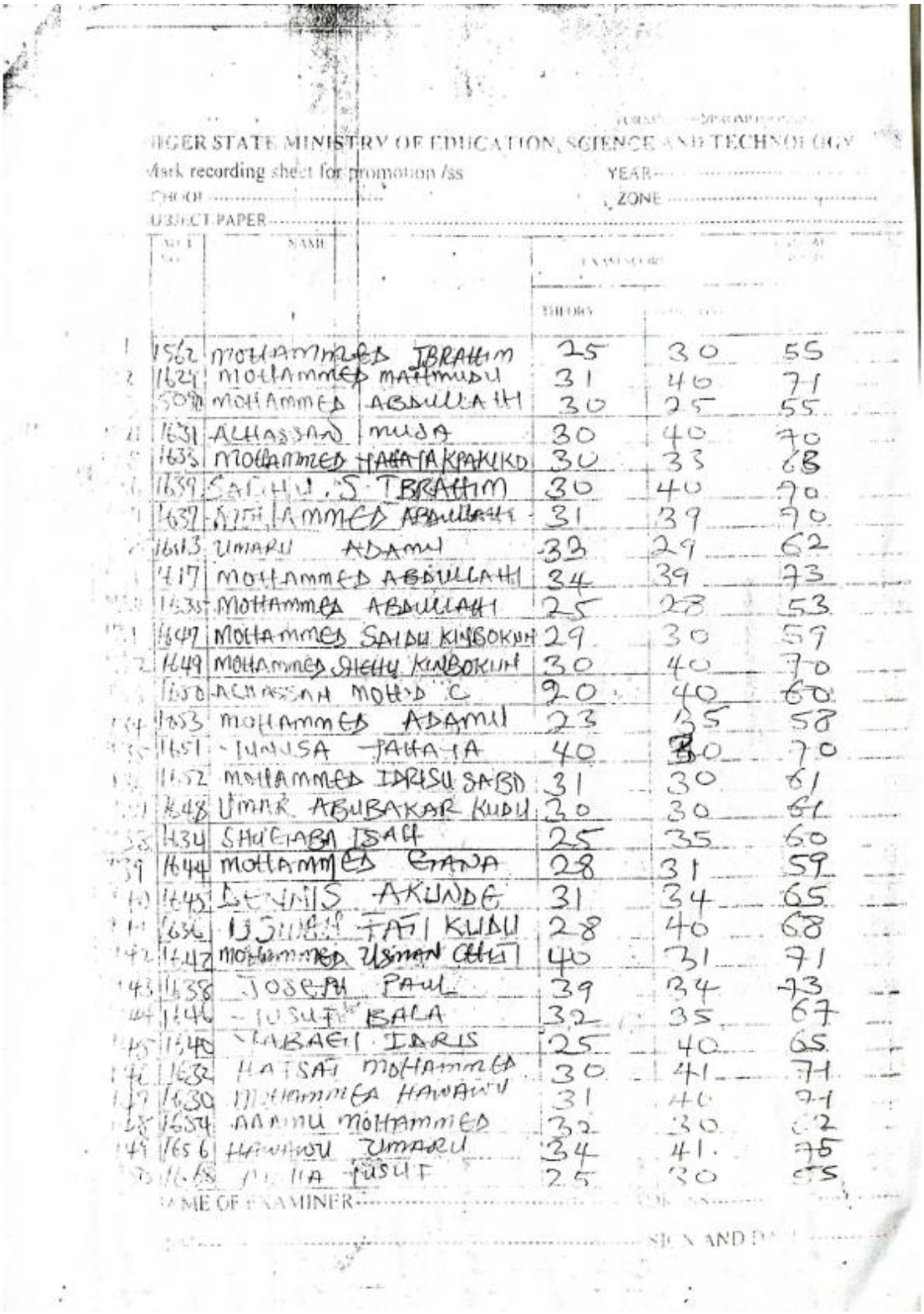

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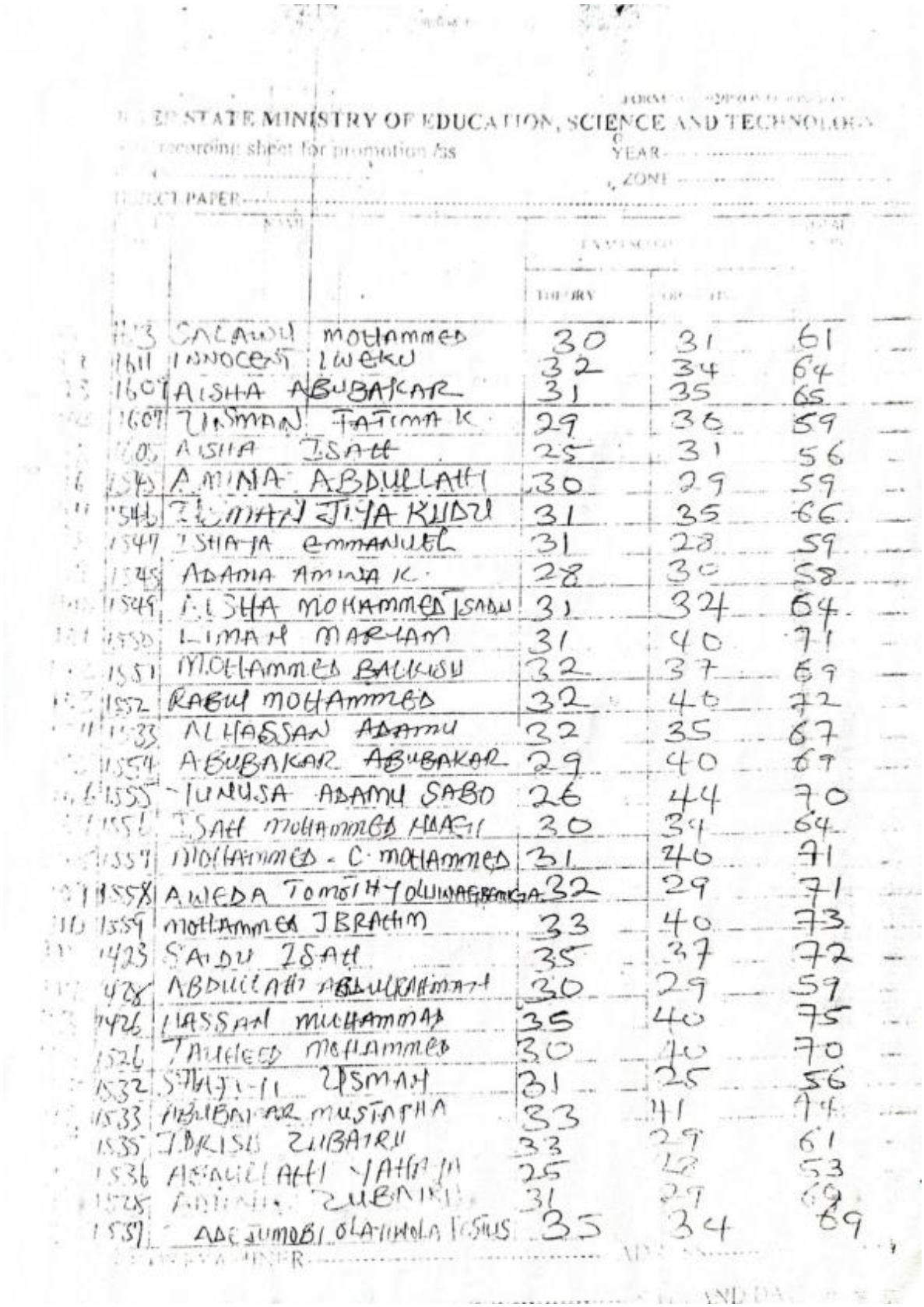
SCHOOL ZONE

SUBJECT PAPER

S/N	NAME		THEORY		
1	1562	MOHAMMED IBRAHIM	25	30	55
2	1624	MOHAMMED MAHMUDU	31	40	71
	5098	MOHAMMED ABDULLAHI	30	25	55
	1631	ALHASSAN MUSA	30	40	70
	1633	MOHAMMED HAMAKPAKUKO	30	38	68
	1639	SAIDU S IBRAHIM	30	40	70
	1637	AMMED ABDULLAHI	31	39	70
	16613	UMARU ADAMU	33	29	62
	417	MOHAMMED ABDULLAHI	34	39	73
	1635	MOHAMMED ABDULLAHI	25	28	53
	1647	MOHAMMED SAIDU KUBOKUO	29	30	59
	1649	MOHAMMED SHEHU KUBOKUO	30	40	70
	1650	ACHASSAN MOHD C	20	40	60
	1653	MOHAMMED ADAMU	23	35	58
	1651	IDRISA JAHAJA	40	30	70
	1652	MOHAMMED IDRISU SABO	31	30	61
	1648	UMAR ABUBAKAR KUDU	30	30	61
	1434	SHUAIBA ISAH	25	35	60
	1644	MOHAMMED GANA	28	31	59
	1645	DENNIS AKUNDE	31	34	65
	1636	IJUMBU FATI KUDU	28	40	68
	1647	MOHAMMED USMAN ALI	40	31	71
	1638	JOSEPH PAUL	39	34	73
	1646	YUSUF BALA	32	35	67
	1640	SABAGI IDRIS	25	40	65
	1632	HATSAT MOHAMMED	30	41	71
	1630	MOHAMMED HAMAN	31	40	71
	1654	AMINU MOHAMMED	32	30	62
	1656	HAMMAU UMARU	34	41	75
	1658	[illegible] YUSUF	25	30	55

NAME OF EXAMINER SIGN AND DATE



STATE MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY

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YEAR

ZONE

SUBJECT PAPER

			THEORY		
1613	SALAWU	MOHAMMED	30	31	61
1611	INNOCENT	IWEKU	32	34	64
1607	AISHA	ABUBAKAR	31	35	65
1609	USMAN	FATIMA K	29	30	59
1610	AISHA	ISAH	25	31	56
1545	AMINA	ABDULLAHI	30	29	59
1546	[illegible]	[illegible]	31	35	66
1547	ISHAYA	EMMANUEL	31	28	59
1548	ADAMA	AMINA K	28	30	58
1549	AISHA	MOHAMMED ISAH	31	34	64
1550	LIMAN	MARYAM	31	40	71
1551	MOHAMMED	BALKISU	32	37	69
1552	RABI	MOHAMMED	32	40	72
1553	ALHASSAN	ADAMU	32	35	67
1554	ABUBAKAR	ABUBAKAR	29	40	69
1555	IUNUSA	ADAMU SABO	26	44	70
1556	ISAH	MOHAMMED HAFIZ	30	34	64
1557	MOHAMMED	C MOHAMMED	31	40	71
1558	AWEDA	TOMOTHY OLUWAGBEMIGA	32	29	71
1559	MOHAMMED	IBRAHIM	33	40	73
1423	SADU	ISAH	35	37	72
1428	ABDULLAHI	ABDULRAHMAN	30	29	59
1426	HASSAN	MUHAMMAD	35	40	75
1526	TAHIR	MOHAMMED	30	40	70
1532	SHAFI'I	USMAN	31	25	56
1533	ABUBAKAR	MUSTAPHA	33	41	74
1535	IBRISU	ZUBAIRU	33	29	61
1536	ABDULLAHI	YAHAYA	25	28	53
1538	[illegible]	ZUBAIRU	31	29	60
1557	ADEJUMOBI	OLAWOLA JESUS	35	34	69

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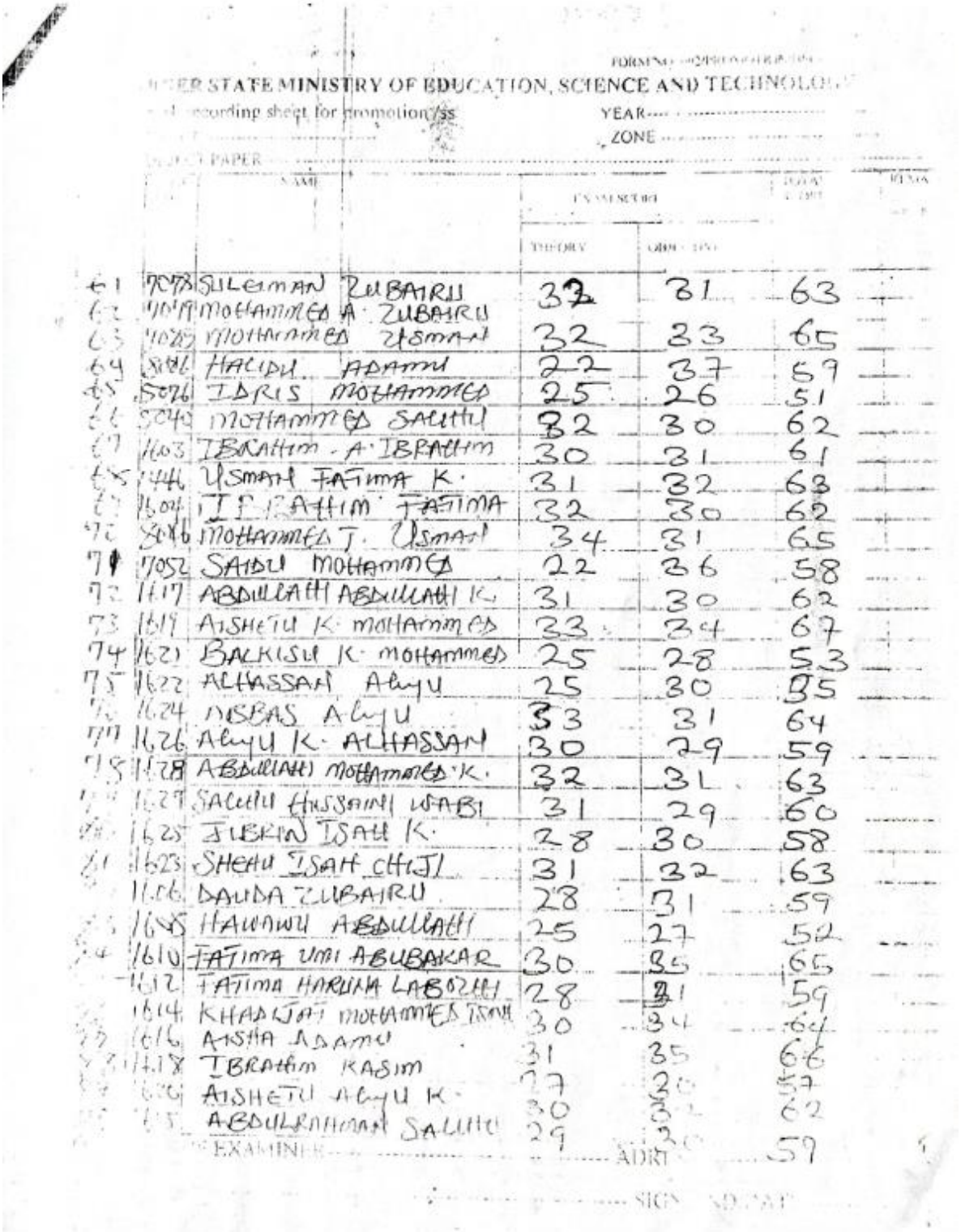


FORM NO. ...

...ER STATE MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY

...cording sheet for promotion/ss

YEAR.....

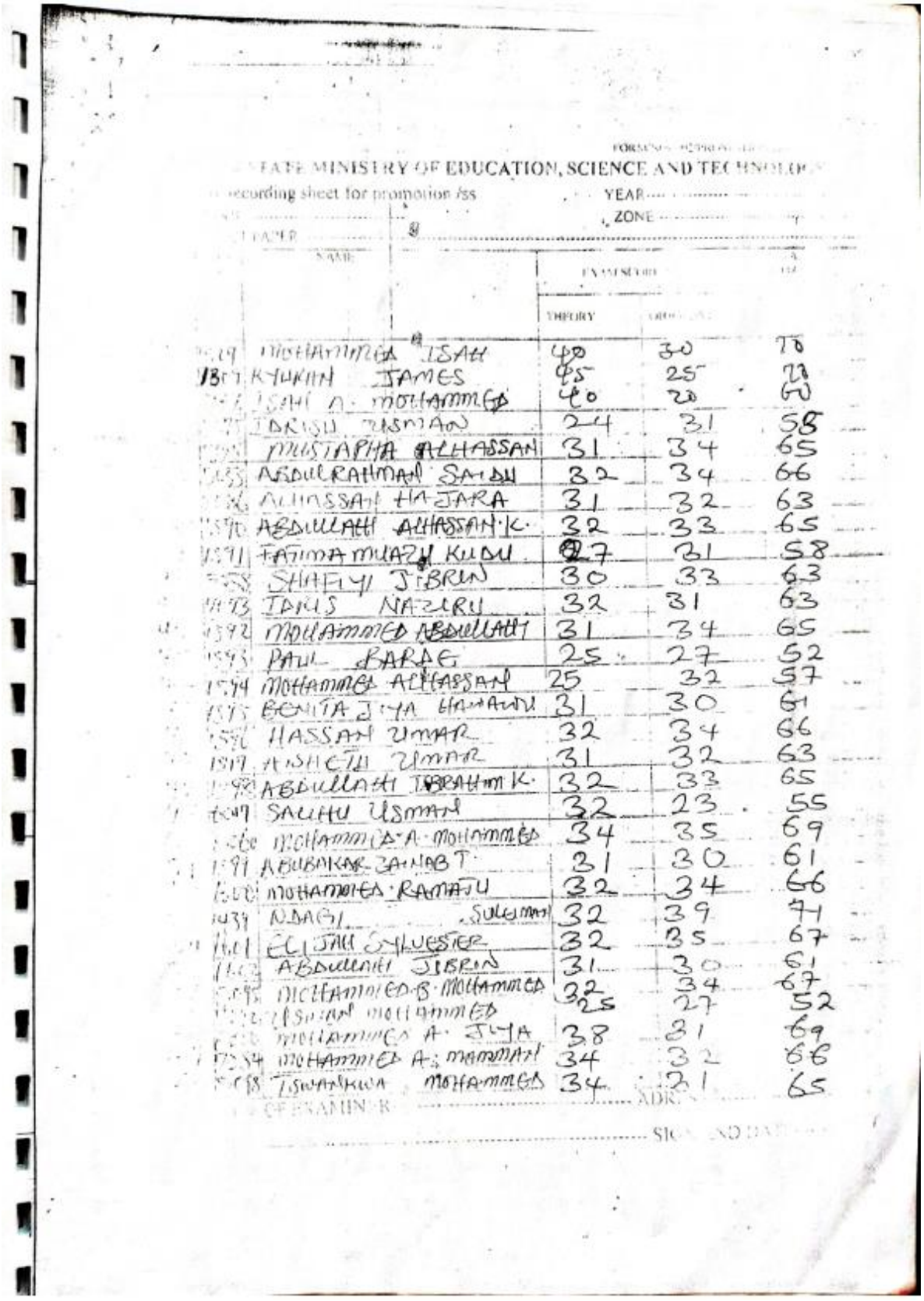
ZONE.....

...PAPER

		NAME	EXAMINED		TOTAL	REMARKS
			THEORY	ORAL/PRACTICAL		
61	7078	SULEIMAN ZUBAIRU	32	31	63	
62	7077	MOHAMMED A. ZUBAIRU				
63	1082	MOHAMMED USMAN	32	33	65	
64	5086	HALIDU ADAMU	22	37	59	
65	5076	IDRIS MOHAMMED	25	26	51	
66	5042	MOHAMMED SALIHU	32	30	62	
67	1603	IBRAHIM A. IBRAHIM	30	31	61	
68	1446	USMAN FATIMA K.	31	32	63	
69	1604	IBRAHIM FATIMA	32	30	62	
70	5046	MOHAMMED J. USMAN	34	31	65	
71	7052	SAIDU MOHAMMED	22	36	58	
72	1617	ABDULLAHI ABDULLAHI K.	31	30	62	
73	1619	AISHETU K. MOHAMMED	33	34	67	
74	1621	BALKISU K. MOHAMMED	25	28	53	
75	1622	ALHASSAN ALIYU	25	30	55	
76	1624	NISBAS ALIYU	33	31	64	
77	1626	ALIYU K. ALHASSAN	30	29	59	
78	1628	ABDULLAHI MOHAMMED K.	32	31	63	
79	1629	SALIHU HUSSAINI USAINI	31	29	60	
80	1625	JUBRIN ISAH K.	28	30	58	
81	1623	SHEHU ISAH CHIJI	31	32	63	
82	1606	DAUDA ZUBAIRU	28	31	59	
83	1605	HAUWAU ABDULLAHI	25	27	52	
84	1610	FATIMA UMI ABUBAKAR	30	35	65	
85	1612	FATIMA HARUNA LABOZHI	28	31	59	
86	1614	KHADIJAT MOHAMMED ISAH	30	34	64	
87	1616	AISHA ADAMU	31	35	66	
88	1618	IBRAHIM KASIM	27	30	57	
89	1620	AISHETU ALIYU K.	30	32	62	
90	1615	ABDULRAHMAN SALIHU	29	30	59	

EXAMINER..... ADIRI.....

..... SIGN ...DATE...



STATE MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY

recording sheet for promotion /ss YEAR ..... ZONE .....

PAPER ..... SUBJECT .....

	NAME	EXAMINED		
		THEORY		
1529	MOHAMMED ISAH	40	30	70
1530	KYUKIH JAMES	45	25	70
1531	ISAH A. MOHAMMED	40	20	60
1532	IDRISU USMAN	24	31	55
1533	MUSTAPHA ALHASSAN	31	34	65
1534	ABDULRAHMAN SAIDU	32	34	66
1535	ALHASSAN HAJARA	31	32	63
1536	ABDULLAHI ALHASSAN K.	32	33	65
1537	FATIMA MUAZU KUDU	27	31	58
1538	SHAFIU JIBRIN	30	33	63
1539	IDRIS NAZIRU	32	31	63
1540	MUHAMMED ABDULLAHI	31	34	65
1541	PAUL BARAE	25	27	52
1542	MOHAMMED ALHASSAN	25	32	57
1543	BONITA JIYA HAMADU	31	30	61
1544	HASSAN UMAR	32	34	66
1545	AISHETU UMAR	31	32	63
1546	ABDULLAHI IBRAHIM K.	32	33	65
1547	SALIHU USMAN	32	23	55
1548	MOHAMMED A. MOHAMMED	34	35	69
1549	ABUBAKAR ZAINAB T.	31	30	61
1550	MOHAMMED RAMATU	32	34	66
1551	NDAGI SULEIMAN	32	39	71
1552	ELIJAH SYLVESTER	32	35	67
1553	ABDULLAHI JIBRIN	31	30	61
1554	MOHAMMED B. MOHAMMED	32	34	67
1555	ISMAIL MOHAMMED	25	27	52
1556	MOHAMMED A. JIYA	38	31	69
1557	MOHAMMED A. MAMMAN	34	32	66
1558	TSWANKWA MOHAMMED	34	31	65

NAME OF EXAMINER ..... ADDRESS .....

..... SIGNATURE AND DATE .....

FORM NO: 02/PROMOTION/REC

NIGER STATE MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY

Mark recording sheet for promotion/ss YEAR.....

SCHOOL G.D.S.S. KUDU ZONE.....

SUBJECT PAPER MATHEMATICS

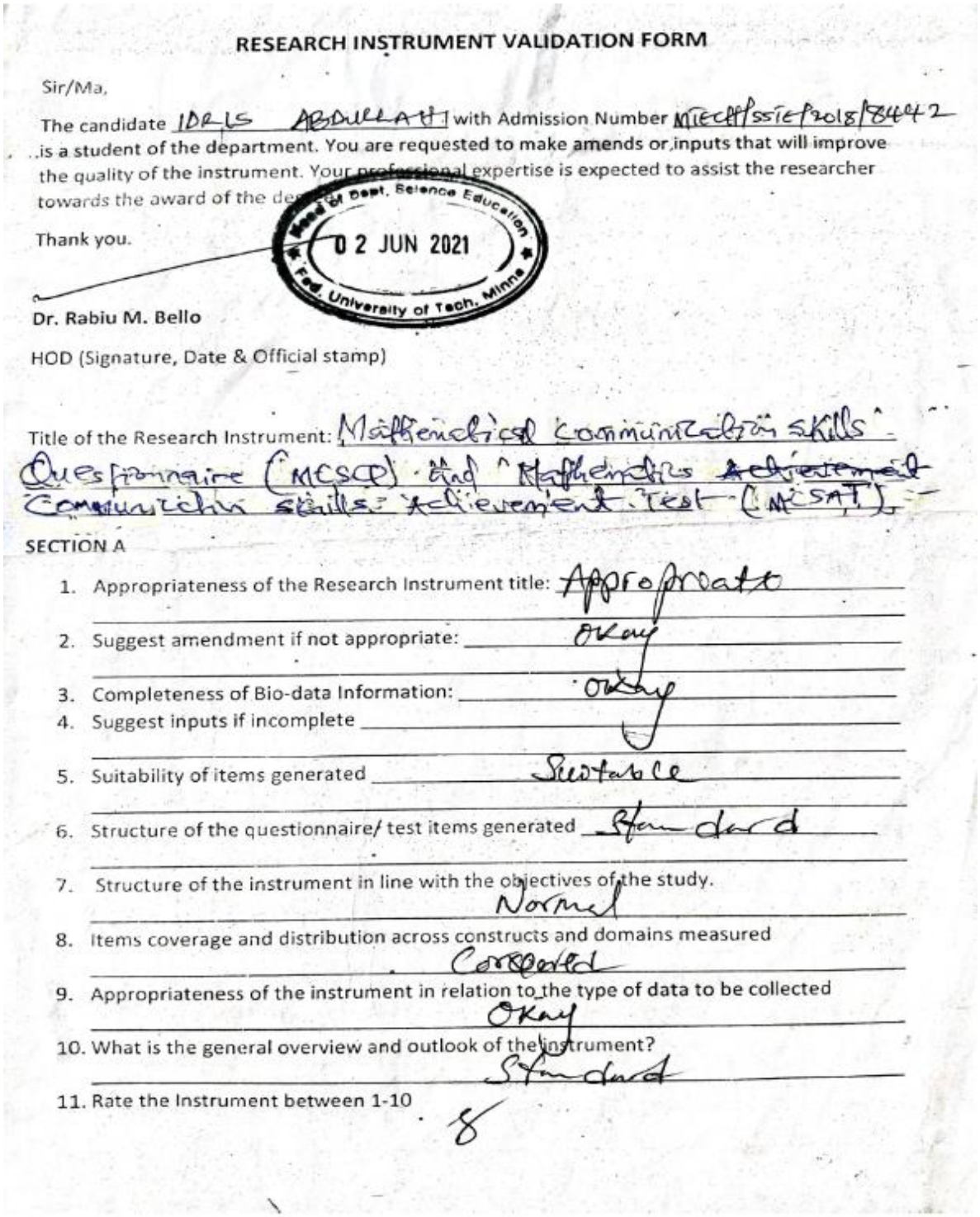
S/N	EXAM NO	NAME	EXAM SCORE		TOTAL SCORE	REMARK (IF ANY)
			THEORY	OBJECTIVE		
1.	1368	ADAMU SALIHU	30	40	70	
2.	8035	ADAMU MOHAMMED LWAFU	35	34	69	
3.	8018	AJO-ADE EZEKIEL	35	30	65	
4.	5045	ABDULRAHMAN SULYAT	31	40	71	
5.	7097	AISHETU. UMAR	22	30	60	
6.	5064	AISHETU M. IBRAHIM	30	31	60	
7.	8034	ADAMU SALAWU LWAFU	30	29	59	
8.	5047	ABUBAKAR K. HAMZAT	30	32	62	
9.	1110	ABDULRAHMAN ABDULLAHI	29	32	61	
10.	1363	ABDULBASHEER KALUSARAT	25	30	55	
11.	1323	ANEBA T. ABRAHAM	35	22	57	
12.	1055	ADEJUMO SAMUEL	31	31	61	
13.	5033	ALHASSAN ADAMA	32	33	65	
14.	5087	ABUBAKAR ZUBAIRU	31	30	61	
15.	5367	AHMED ISAH	32	31	62	
16.	7523	ANTHONY MATHIAS	40	30	70	
17.	1006	ABDULLAHI AHMED	33	35	68	
18.	7038	ALHAJI ADAMU	40	29	69	
19.	1583	SALIHU HUSSAINI LUPO	39	31	70	
20.	1589	MOHAMMED FATIMA SABO	31	31	62	
21.	7076	OYELEKE ISRAEL	32	38	70	
22.	1243	ISHAYA JEREMIAH	40	24	64	
23.	1655	YUNUSA JIBRIN SAKPE	31	32	63	
24.	1552	SHUAIBU MOHAMMED	30	25	55	
25.	5075	ZUBAIRU MOHAMMED	30	31	61	
26.	7116	MOHAMMED YAKUBU	31	23	63	
27.	1353	MOHAMMED RABIU	25	26	51	
28.	1553	IPINLAYE ENIOLA	34	22	56	
29.	5071	NUHU ABEL	30	31	63	
30.	1335	HARUNA MOHAMMED	25	27	52	

NAME OF EXAMINER..... ADRESS.....

SIGN..... SIGN AND DATE.....

APPENDIX H

Research Instrument Validation Form A



RESEARCH INSTRUMENT VALIDATION FORM

Sir/Ma,

The candidate IDRIS ABDULLAHI with Admission Number MTECH/SSTE/2018/8442 is a student of the department. You are requested to make amends or inputs that will improve the quality of the instrument. Your professional expertise is expected to assist the researcher towards the award of the de

Thank you.

Head of Dept. Science Education Fed. University of Tech. Minna 02 JUN 2021

Dr. Rabiu M. Bello

HOD (Signature, Date & Official stamp)

Title of the Research Instrument: Mathematical Communication Skills Questionnaire (MCSQ) and Mathematics Achievement Communication Skills Achievement Test (MCSAT).

SECTION A

1. Appropriateness of the Research Instrument title: Appropriate
2. Suggest amendment if not appropriate: Okay
3. Completeness of Bio-data Information: Okay
4. Suggest inputs if incomplete
5. Suitability of items generated Suitable
6. Structure of the questionnaire/ test items generated Standard
7. Structure of the instrument in line with the objectives of the study. Normal
8. Items coverage and distribution across constructs and domains measured Corrected
9. Appropriateness of the instrument in relation to the type of data to be collected Okay
10. What is the general overview and outlook of the instrument? Standard
11. Rate the Instrument between 1-10 8

SECTION B

Name of the validator: Nura Sabiu

Designation/Rank: Education Officer II

Name of institution: Police Secondary School, Kaduna

Department/ School: Mathematics / Science

Telephone No/GSM No: 08030557662

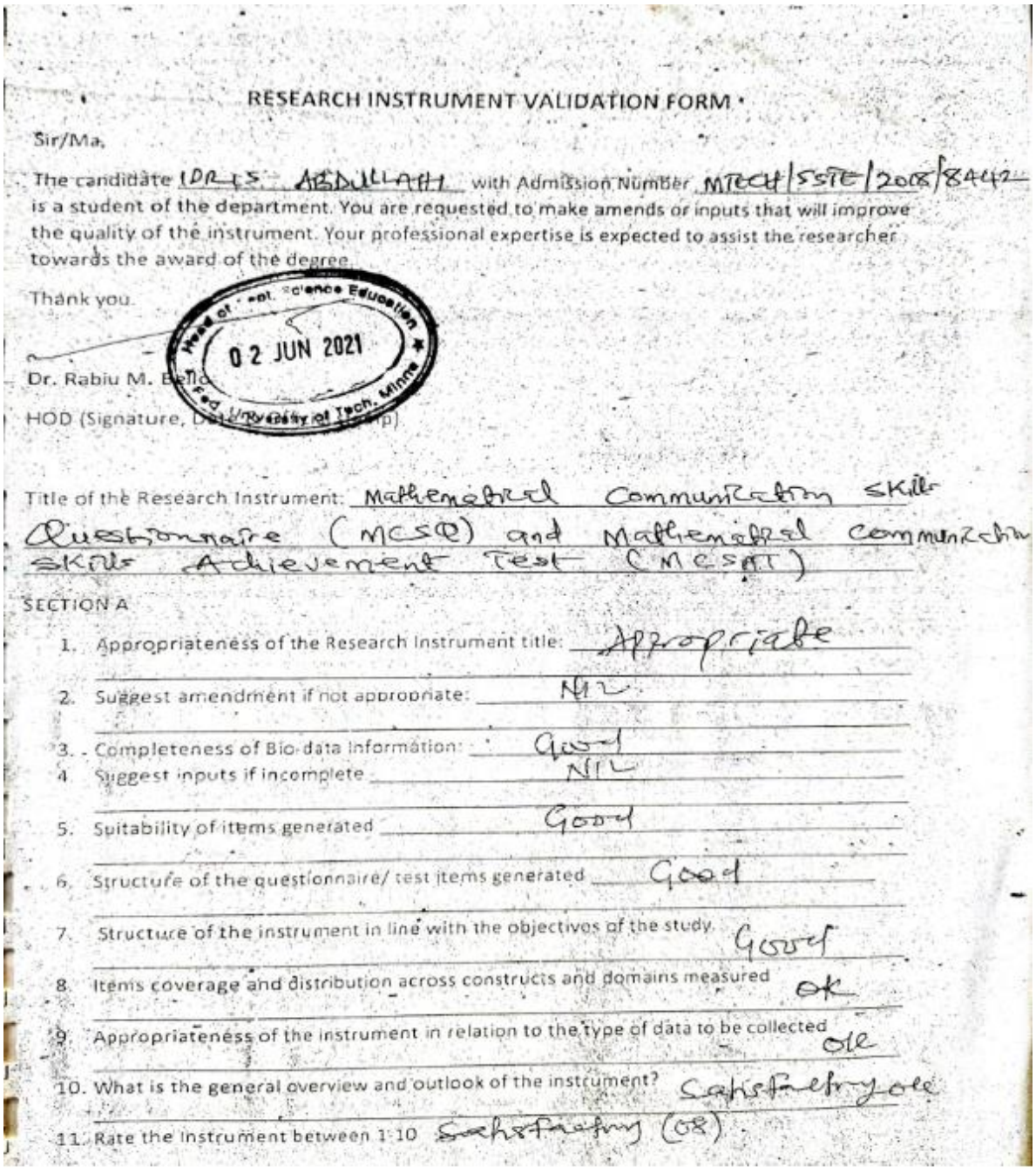
E-Mail Address: _____

27/08/2024

Signature, Date and stamp (if available)

APPENDIX I

Research Instrument Validation Form B



RESEARCH INSTRUMENT VALIDATION FORM

Sir/Ma,

The candidate IDRIS ABDULLAHI with Admission Number MTECH/SSTE/2008/8442 is a student of the department. You are requested to make amends or inputs that will improve the quality of the instrument. Your professional expertise is expected to assist the researcher towards the award of the degree.

Thank you.

Dept. of Science Education Federal University of Tech. Minna 02 JUN 2021

Dr. Rabiu M. Bello

HOD (Signature, Date & Stamp)

Title of the Research Instrument: Mathematical Communication Skills Questionnaire (MCSQ) and Mathematical communication Skills Achievement Test (MCSAT)

SECTION A

1. Appropriateness of the Research Instrument title: Appropriate
2. Suggest amendment if not appropriate: Nil
3. Completeness of Bio-data Information: Good
4. Suggest inputs if incomplete: Nil
5. Suitability of items generated: Good
6. Structure of the questionnaire/ test items generated: Good
7. Structure of the instrument in line with the objectives of the study: Good
8. Items coverage and distribution across constructs and domains measured: ok
9. Appropriateness of the instrument in relation to the type of data to be collected: ole
10. What is the general overview and outlook of the instrument? Satisfactory ole
11. Rate the instrument between 1-10 Satisfactory (08).

SECTION B

Name of the validator: SABA IBRAHIM KABIR

Designation/Rank: LECT. II

Name of institution: FCE COLLEGE OF EDUCATION, ZUBA-ABUJA

Department/ School: MATHEMATICS / SCIENCES

Telephone No/GSM No: 08037476428

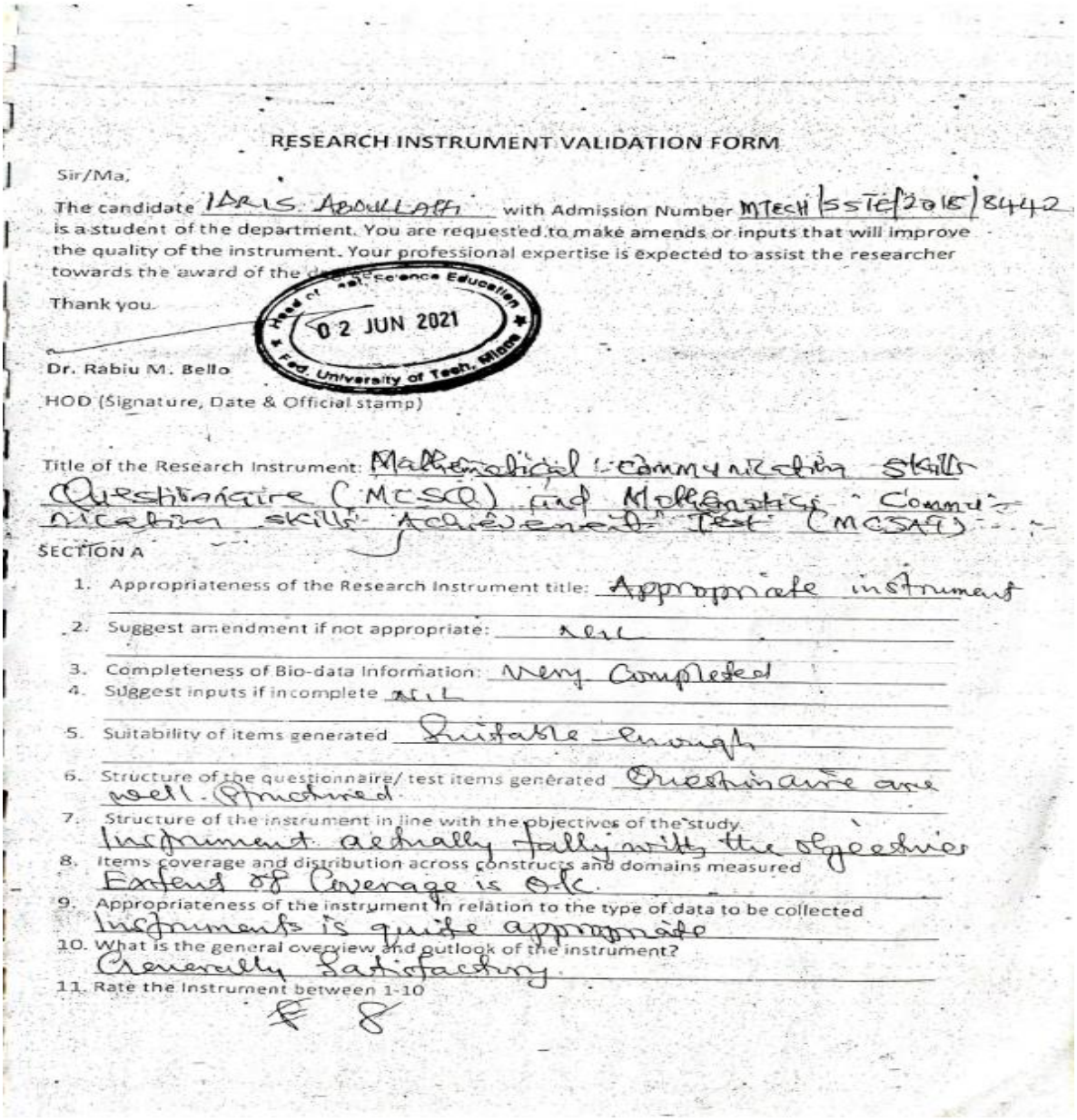
E-Mail Address: kabirbuzhi28@gmail.com

17/06/2021

Signature, Date and stamp (if available)

APPENDIX J

Research Instrument Validation Form C



RESEARCH INSTRUMENT VALIDATION FORM

Sir/Ma,

The candidate IDRIS ABDULLAHI with Admission Number MTECH/SSTE/2018/8442 is a student of the department. You are requested to make amends or inputs that will improve the quality of the instrument. Your professional expertise is expected to assist the researcher towards the award of the d... Science Education

Thank you.

Head of ... Science Education
02 JUN 2021
Fed. University of Tech. Minna

Dr. Rabiu M. Bello

HOD (Signature, Date & Official stamp)

Title of the Research Instrument: Mathematical Communicating Skills Questionnaire (MCSQ) and Mathematics Communication skills Achievement Test (MCSAT)

SECTION A

1. Appropriateness of the Research Instrument title: Appropriate instrument
2. Suggest amendment if not appropriate: Nil
3. Completeness of Bio-data Information: Very Completed
4. Suggest inputs if incomplete Nil
5. Suitability of items generated Suitable enough
6. Structure of the questionnaire/ test items generated Questionaire are well structured
7. Structure of the instrument in line with the objectives of the study. Instrument actually tally with the objectives
8. Items coverage and distribution across constructs and domains measured Extend of Coverage is O.K.
9. Appropriateness of the instrument in relation to the type of data to be collected Instruments is quite appropriate
10. What is the general overview and outlook of the instrument? Generally Satisfactory
11. Rate the Instrument between 1-10 8

SECTION B

Name of the validator: Dr. Babagana Mohammed

Designation/Rank: L.I.

Name of institution: F.U.T. Minna

Department/ School: Science Education / SSTE

Telephone No/GSM No: 08066553470

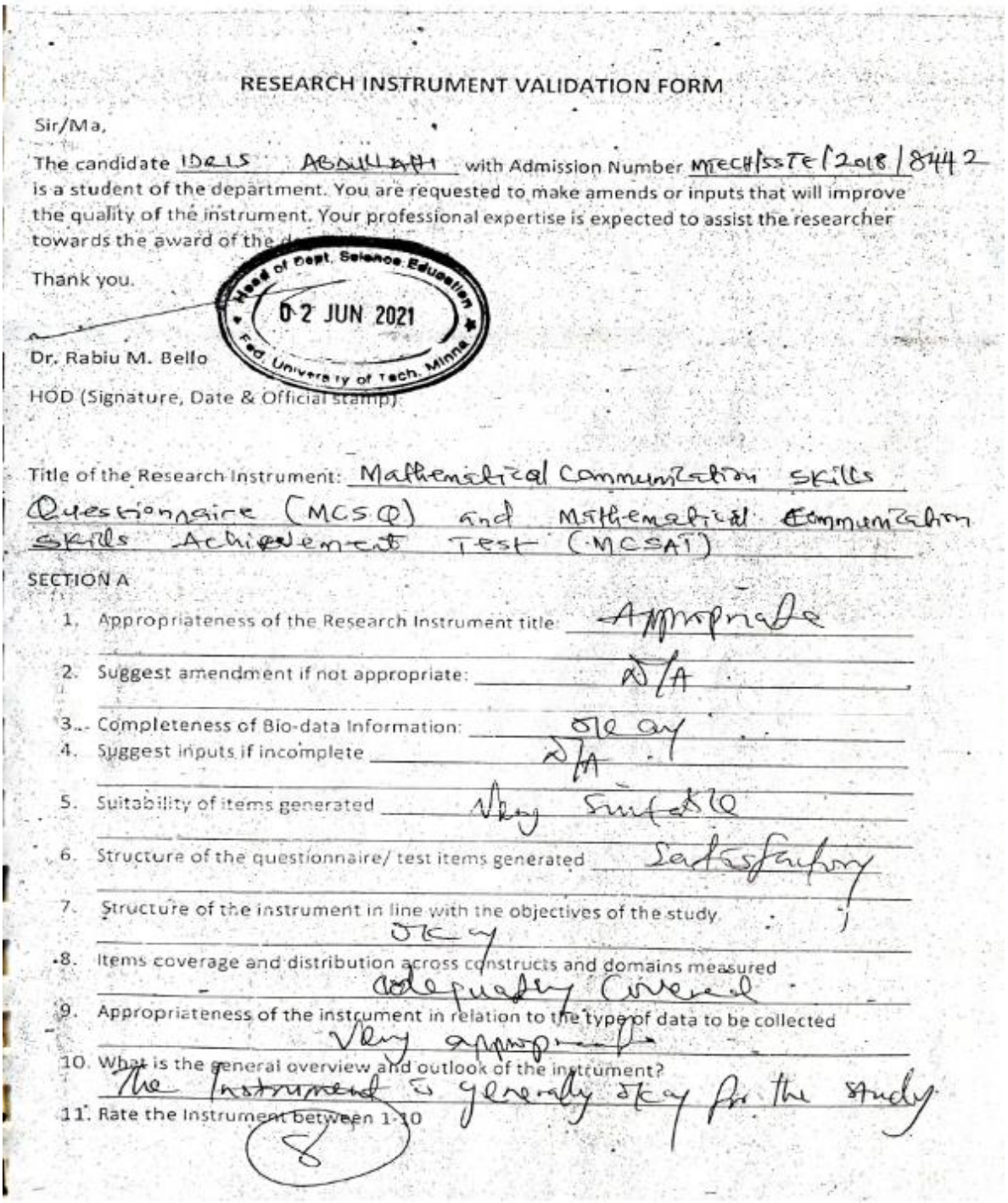
E-Mail Address: mohd.bgana@futminna.edu.ng

Bana 21/06/21

Signature, Date and stamp (if available)

APPENDIX K

Research Instrument Validation Form D



RESEARCH INSTRUMENT VALIDATION FORM

Sir/Ma,

The candidate IDRIS ABDULLAHI with Admission Number MTECH/SSTE/2018/8442 is a student of the department. You are requested to make amends or inputs that will improve the quality of the instrument. Your professional expertise is expected to assist the researcher towards the award of the d

Thank you.

Head of Dept. Science Education
02 JUN 2021
Fed. University of Tech. Minna

Dr. Rabiu M. Bello

HOD (Signature, Date & Official stamp)

Title of the Research Instrument: Mathematical Communication Skills Questionnaire (MCSQ) and Mathematical Communication Skills Achievement Test (MCSAT)

SECTION A

1. Appropriateness of the Research Instrument title: Appropriate
2. Suggest amendment if not appropriate: N/A
3. Completeness of Bio-data Information: Okay
4. Suggest inputs if incomplete N/A
5. Suitability of items generated Very Suitable
6. Structure of the questionnaire/ test items generated Satisfactory
7. Structure of the instrument in line with the objectives of the study Okay
8. Items coverage and distribution across constructs and domains measured adequately Covered
9. Appropriateness of the instrument in relation to the type of data to be collected Very appropriate
10. What is the general overview and outlook of the instrument? The instrument is generally okay for the study
11. Rate the Instrument between 1-10 8

SECTION B

Name of the validator: Dr. A.U. Bashir Yankuzo

Designation/Rank: LII

Name of institution: F.U.T. MINNA

Department/ School: SCIENCE EDUCATION

Telephone No/GSM No: 08065542625

E-Mail Address: bashir.au@futminna.edu.ng

17/06/2021

Signature, Date and stamp (if available)