NATIONAL INNOVATION AND RESEARCH ACADEMIA
International Journal of Academia and Educational Research
ISSN: 2713-4680. Volume 8, Issue 7. Pages 1-22. February, 2025
OTL: 6472-030647-871-1
Double Blind Peer Reviewed International Research Journal
https://arcnjournals.org
journals@arcnjournals.org

EFFECT OF KEY LOCATIONS ON THE DIFFICULTY LEVELS OF MATHEMATICS MULTIPLE CHOICE ITEMS OF 2019 NECO SENIOR SCHOOLS CERTIFICATE EXAMINATIONS IN ZONE C EDUCATIONAL AREA, BENUE STATE

OLUMA A. E.; Prof. M. O. Aduloju and Prof. (Mrs) A.D.E. Obinne
Department of Guidance and Counselling
Joseph Tarka University, Makurdi-Nigeria

Abstract**:** *The study investigated the Effect of Key Locations on the Difficulty Levels of Mathematics Multiple Choice Items in 2019 NECO Senior Schools Certificate Examinations in Zone C, Benue State, Nigeria. The study investigated the impact of key locations on the difficulty levels of mathematics multiple-choice items in the 2019 NECO Senior Schools Certificate Examinations in Zone C, Benue State, Nigeria. Five research objectives and five corresponding research questions guided the study. Four hypotheses were formulated and tested at a 0.05 level of significance. The study used a counterbalanced research design and a sample of 1097 senior secondary three students from eight secondary schools in four local government areas in Zone C Educational Area. The data were collected using an adopted and adapted test form that included five forms (A, B, C, D, and E) respectively and was validated through face and content validation. The reliability coefficient for the test was 0.80 and 0.82. The results showed that 41 out of 60 test items fell within the acceptable range (0.30 < P < 0.70) of item difficulty indices. The findings also revealed that the key location in the test form did not significantly affect the difficulty level of the test items. Based on the findings, it was concluded that the location of the correct answer (key) in multiple-choice Mathematics questions does not significantly affect the difficulty level of the test. This suggests that students' ability to answer these questions correctly is more likely influenced by their knowledge and problem-solving skills rather than the positioning of the correct answer. Recommendations include: Test developers for NECO and similar examinations should feel more confident in varying key locations across tests and Resources and efforts should be directed towards developing items that effectively assess students' mathematical understanding and problem-solving skills, rather than concerning themselves with the mechanical aspects of answer placement.*

1.0 INTRODUCTION

1.1 Background of the Study

Education serves as a fundamental process for imparting knowledge, skills, values, and beliefs, playing a crucial role in character development and cultural transmission within society. The Federal Republic of Nigeria's National Policy on Education (2013) identifies education as an instrument for national development, spanning primary, secondary, and tertiary levels. Mathematics, a core subject in the Nigerian secondary school system (Omobude, 2014), holds significance in daily life and technological advancement. This importance necessitates the use of assessments to gauge student understanding and proficiency, with tests serving as practical evaluation tools in educational settings (Agi, Aduloju, & Iornienge, 2015). Tests are designed to measure knowledge, aptitude, intelligence, and other mental traits (Adikwu, Aduloju, & Agi, 2016). They provide incentives, offer information for decision-making, and are critical for selection processes (Ollennu & Etsey, 2015). Tests often utilize different formats, including multiple-choice (MC) tests, which are commonly used in large-scale assessments due to their ease of administration and scoring (Baghaei & Amrahi, 2011). MC items typically consist of a stem and several options, with one correct answer (key) and distractors. The key location and difficulty level are important features of MC tests, influencing performance and comparability across different test forms (Keeves, 2014).

Item difficulty is a key concept in test theory, quantifying how easy or challenging an item is to answer correctly. Both Classical Test Theory (CTT) and Item Response Theory (IRT) provide frameworks for understanding the measurement of psychological constructs and assessing item difficulty. While CTT focuses on the overall test score and measurement error, IRT analyzes each item's difficulty and discriminatory power, allowing for more precise estimates of individual abilities and more efficient and targeted assessments (DeMars, 2010). The difficulty of items on tests needs to be optimized to fit the skill level of a population. Items that are too easy can be invalid as can items that are too difficult.

Poor academic performance in mathematics among secondary school students has become a significant concern, with external examination results often falling short of expectations (Nwaogazie, 2017; News Agency of Nigeria [NAN], 2019). For instance, reports from the National Examination Council (NECO, 2017, 2018, 2019) reveal persistently low pass rates in Mathematics. Several factors may be responsible for this, including the quality of teaching, assessment tools, and the arrangement of test items (Imam, Abas-Mastura, & Jamil, 2013; Zhang, Zhao, & Kong, 2019). Existing research suggests that key location in MC tests may influence student responses, particularly among low-achieving students (Shin, Bulut & Gierl, 2019). Therefore, a study is needed to examine the effect of key location on the difficulty level of Mathematics MC test items from the 2019 NECO Senior School Certificate Examinations in Benue State, Nigeria.

1.2 Statement of the Problem

Multiple-choice (MC) test items are widely used in educational testing because they enable the measurement of knowledge, skills, and competencies in an efficient and objective manner and above all the extent of coverage of the content of instruction. A multiple choice test items consists of the stem, response options, and any additional information necessary to answer the item. The stem is the question that examinees are required to answer, while the response options include a set of alternative options with a key option (correct option) and distractors (incorrect options).The location of a key option, in a test is randomly assigned to position or are equally distributed among the options. It gives the examinee the opportunity to select among the options provided, the correct answer to the question. Any examinee that is able to select the key option signifies that the examinee knows the answer to the item and vice versa. Therefore, any examinee that knows the answer to the question should be able to pick it no matter the location of the key (correct option).

However, the literature and reports of chief examiner that poor achievement in Mathematics over the years. The researcher has also observed that high level ability students are also performing poorly in Mathematics MC test. Literature have also shown that students' performance in Mathematics MC test are poor (Imam, Abas-Mastura, and Jamil, 2013; Zhang, Zhao & Kong, 2019). Some researchers have attributed students' poor achievement in Mathematics to several factors such as the difficulty level of Mathematics MC test items, the quality of the assessment tool used by the teacher, the quality of teaching and the methodology used and students attitudes towards learning, among others. Some areas that have not attracted research like others areas of difficulty, The researcher is interested in the position of the key (correct option) on the difficulty levels of Mathematics Achievement Test. Be that as it may, the question is; could it be that the positioning of the key affect the difficulty level of Mathematic Achievement Test (MAT)? It is on this basis that the researcher explored the difficulty levels of a Mathematics Achievement Test (MAT) in Senior Secondary School in Benue State when the location of the key is changed to ascertain its effectiveness. The problem of this study therefore is effect of key location on the difficulty level of MAT multiple choice items of 2019 NECO in Senior Secondary III Students in Zone C Educational Area of Benue State, Nigeria'.

1.3 Objectives of the Study

The main purpose of the study is to determine the Effect of Key Location on the difficulty levels of Mathematics multiple choice items of 2019 NECO Senior Schools Certificate Examinations in Zone C Educational Area, Benue State. The study specifically seeks to:

1. Determine the effect of key location on the item difficulty level of test form A (original) of MC items of Mathematics of 2019 NECO Senior School Certificate Examinations (SSIII) in Zone C of Benue State.
2. Determine the effect of key location on the item difficulty level of test form B of MC items of Mathematics of 2019 NECO Senior School Certificate Examinations (SSCE) in Zone C of Benue State.
3. Determine the effect of key location on the item difficulty level of test form C of MC items of MAT of 2019 NECO Senior School Certificate Examinations (SSCE) in Zone C of Benue State.

4. Determine the effect of key location on the item difficulty level of test form D of MC items of MATof2019 NECO Senior School Certificate Examinations (SSCE) in Zone C of Benue State
5. Determine the effect of key location on the item difficulty level of test form E of MC items of MAT of 2019 NECO Senior School Certificate Examinations (SSCE) in Zone C of Benue State.

1.4 Research Questions

The following research questions were raised to guide the study:

1. What are the difficulty indices of test form A (adopted) key location of Mathematics MC test items of 2019 NECO Senior School Certificate Examinations (SSCE) in Zone C Educational Area of Benue State?
2. What are the difficulty indices of test form B (adapted form) key location of Mathematics MC test items of 2019 NECO Senior School Certificate Examinations (SSCE) in Educational Zone C of Benue State?
3. What are the difficulty indices of test form C (adapted form) key location of Mathematics MC Test items of 2019 NECO Senior School Certificate Examinations (SSCE) in Educational Zone C of Benue State?
4. What are the difficulty indices of test form D (adapted form) key location of Mathematics MC test items of 2019 NECO Senior School Certificate Examinations (SSCE) in Educational Zone C of Benue State?
5. What are the difficulty indices of test form E (adapted form) of Mathematics MC Test items of 2019 NECO Senior School Certificate Examinations (SSCE) in Educational Zone C of Benue State?

1.5 Hypotheses

The following null hypotheses were formulated and tested at 0.05 level of significance;

HO_1: There is no significant difference between the item difficulty level of test form A (adopted) key location and form B (adapted) key location of Mathematics MC test items of 2019 NECO Senior School Certificate Examinations (SSCE) in Zone C of Benue State

HO_2: There is no significant difference between the item difficulty level of test form A (adopted) key location and form C (adapted) key location of Mathematics MC test items of 2019 NECO Senior School Certificate Examinations (SSCE) in Zone C of Benue State

HO_3: There is no significant difference between the item difficulty level of test form A (adopted) key location and form D (adapted) key location of Mathematics MC test items of 2019 NECO Senior School Certificate Examinations (SSCE) in Zone C of Benue State

HO_4: There is no significant difference between the item difficulty level of test form A (adopted) key location and form E (adapted) key location of Mathematics MC test items of 2019 NECO Senior School Certificate Examinations (SSCE) in Zone C of Benue State

1.6 Scope of the Study

Geographically, the study was carried out in Zone C Educational Area of Benue State. The content scope of this study is centered on effect of key location on difficulty level of NECO 2019 Mathematics Multiple Choice Examination of Senior Secondary School three (SSSIII) Students. The choice of SS III for this study was that, it is a terminal level of secondary education, it is at this level that SS III students are set for NECO and the test were administered in last week of second term in secondary schools since

it is assumed that, at that point they have covered the syllabus. The choice of NECO is because NECO examinations are taken by students from various regions and schools, making it a representative sample of the Nigerian education system.

2.0 LITERATURE REVIEW

2.1Theoretical Framework

2.1.1 Classical Test Theory (CTT)

Classical Test Theory (Ctt), a theory of testing codified by Novick (1966), posits that an individual's observed score on a test is comprised of a true score and an error score. This theory assumes that each person has a true score (T), which is the expected score obtained in an infinite number of test administrations, while the observed score (X) is the sum of the true score and error (E). The observed score is defined as: $X = T \pm E$. Classical Test Theory is concerned with the relationships between the observed score (X), true score (T), and error (E) in the population, with reliability being the most critical concept. Reliability refers to the ratio of true score variance to observed score variance and is influenced by the assumptions that true scores and error scores are uncorrelated, the average error score in the population is zero, and error scores are uncorrelated. This theory is relevant to the present study, as it describes the statistical analyses used in item analysis to measure the effectiveness of individual test items, enabling the creation of more effective test questions and standardization of existing tests. Specifically, Classical Test Theory provides a framework for understanding the factors governing the difficulty level of test items, which is a key aspect of this study.

2.1.2 Item Response Theory (IRT)

Item Response Theory (IRT), pioneered by Fredrick, Rasch, and Lazarfeld in the 1950s and 1960s, is a testing theory focused on the relationship between an individual's performance on a test item and their level of the underlying ability the item measures. Unlike Classical Test Theory (CTT) and simpler scaling methods like Likert scaling, IRT does not assume items are equally difficult and uses mathematical functions to model the probability of a correct response based on both person and item parameters. These item parameters include difficulty (location), discrimination (slope), and a pseudo-guessing parameter. IRT models, often termed latent trait models, treat item responses as manifestations of unobservable traits. A primary goal of IRT is to provide a framework for evaluating the effectiveness of assessments and individual items, with applications including exam development, item bank maintenance, and equating item difficulties across test versions. IRT provides greater flexibility and more sophisticated information than CTT, particularly in applications like computerized adaptive testing, while also offering a means to improve assessment reliability. The three basic assumptions of IRT are unidimensionality, local independence, and the ability to model responses using an item response function. IRT is relevant to this study as it specifies the relationship between observed responses and underlying constructs, provides a way for examining bodies to estimate examinee ability scores, and allows for the determination of item difficulty levels, the key focus of the research (DeMars, 2010).

2.2 Conceptual Framework

2.2.1 Test

The term "test" encompasses a variety of meanings depending on the context, ranging from medical examinations to instruments for evaluating qualities or behaviors (Yeke, Ogboji, & Akaakase, 2017; Odinko, 2014). Fundamentally, a test serves as a systematic procedure for observing and quantifying a person's behavior or traits, encompassing cognitive, affective, and psychomotor skills (Onuka, 2013; Brady, Cracknell, Zulchand, & Mills, 2018). Tests can take diverse forms beyond paper-and-pencil assessments, including verbal formats, and are designed to elicit a sample of behavior, measure achievement, assess interests, and gauge various abilities or traits (Adejoh & Obinne, 2013; Murray, Johnston, Cunnane, Kerr, Spain, Gillan, & Happé, 2017; Abe & Omole, 2019). Essentially, a test is a measurement tool, a set of questions, tasks, or problems used to determine the extent of a learner's ability or compare an individual's performance against established standards, with the caveat that its effectiveness and ethical implications are heavily dependent on the competence and integrity of those who construct, administer, and interpret the results (Nworgu, 2013; Nwankwo & Nwankwo, 2020; Allu, 2016).

2.2.2 Types of Test

On the types of test, attempts have been made by several authors as to how the classification can appropriately be done. According to Onuora-Oguno (2020), test is classified into different ways and various dimensions as a result of its differences in nature and different purposes it serves. According to Emaikwu (2013), test has assumed different dimensions of and these include: classification based on the purpose of the test (achievement, aptitude, diagnostic, intelligent), the method of construction (teacher-made and standardized tests), the method of interpretation (norm-referenced and criterion-referenced), the mode of response (essay, objective and oral), the method of administration (group and individual), the time limit of the test (speed, power, mastery).

The type of test is based on method of construction according to Husni (2020) include teacher made and standardize test. A teacher made test are tests that are produced by the teacher for a classroom use. According to Adikwu, Aduloju and Agi (2016), these tests are not expensive since they are constructed by the classroom teachers and are not standardized by experts. Standardized achievement test on the other hand is constructed by experts which produces very similar results that are valid and reliable. Subheesh and Sethy (2018) classified test under the method of interpretation to include criterion and norm-referenced test in feedback loop assumptions about the ability or performance of the cohort (norm referencing) are used to derive a set of criteria, which are then incorporated into assessment prefaces (criterion referencing). According to Emaikwu (2013) norm referenced test is types that aim at determining a testee relative standing in a well-defined group that was tested in order to develop the test norms. It is aimed at differentiating among testees at different level of achievement while criterion referenced test is aimed at yielding information regarding the mastery or non-mastery of some specific competences.

The type of test based on mode of response include essay, objective and oral (Aggarwal, 2007). Essay test allow a student to fully express their mind on a paper instead of selecting correct response from available options. Objective type of test can be scored in a manner that eliminates any form of biasness and subjectivity (Emaikwu, 2013). According to Nwankwo and Nwankwo (2020) types of objective test include completion test, the true and false test, matching type and multiple choice test. Oral test is presented to the testee orally and he or she is expected to respond the way he

or she likes. The type of test based on the mode of administration deals with given test individually or group. The type of test based on time limit include speed test, power test and mastery test. Speed type of test has so many items but limited time is given to the testee to answer the questions are difficult for the examinee to be able to finish the test. According to Nwankwo & Nwankwo (2020), power test has generous time allowances which made it possible for testees to attempt every question.

Classification based on the purpose of the test according to Adejoh and Obinne (2013) include placement, achievement, aptitude, diagnostic and intelligent test. The purpose of placement test according to Adejoh and Obinne is to sort students into different groups or placing them at a particular level. Achievement test on the other hand aimed to measuring students' accomplishment in a specific area of study. Achievement test is classified into teacher made and standardize test. According to Husni (2020), aptitude test is concern with predicting an individual potential and success in a specific field of knowledge. Diagnostic test on the other hand are primarily concerned with finding weakness on knowledge, and skills prior to instruction and its original cause.

Therefore, since this work is essentially on achievement test construction, it will be better in classification based on purpose and method of construction which largely involves achievement tests.

i. Achievement test

Achievement tests are designed to measure the relative accomplishments in a specified area of work, according to Emaikwu (2013), and are constructed to ensure the effect of specific program of instruction or training (Adejoh & Obinne, 2013). Achievement tests are majorly divided into standardized achievement tests and teacher-made achievement tests. Standardized achievement tests are constructed by a group of individuals who are considered experts, using a systematic and rigorous process, and are designed to produce very similar results when administered and scored under standard conditions (Anikweze, 2012). These tests are characterized by a fixed set of test items, specific directions for administering and scoring, and norms based on a representative group of individuals. Examples of examination bodies that use standardized tests include Joint Admissions and Matriculation Board examination (JAMB), National Common Entrance Examination, Senior School Certificate Examination (SSCE), National Examination Council (NECO), and National Business and Technical Board (NABTEB). In contrast, teacher-made achievement tests are constructed by classroom teachers for use in a particular class under conditions of choice by the teacher (Anikweze, 2012).

ii. The multiple choice item

Multiple-choice (MC) tests are a widely used assessment format, consisting of a stem (question or incomplete statement) and multiple options, including a key (correct answer) and distractors (incorrect options) (Emaikwu, 2013; Orluwene, 2012). This format is favored for its objectivity, ease of scoring, high reliability, and ability to measure diverse skills and learning outcomes across various educational levels (Abdulghani et al., 2014). MC tests allow for efficient assessment of a broad range of topics within a short timeframe, and responses can be analyzed to gain insight into student understanding. Key advantages include high content validity, ease of scoring (both manual and machine), and amenability to item analysis (Orluwene, 2012). However, MC tests are time-consuming to construct, may permit guessing, and are less effective at assessing writing skills (Catforms Testing Service, n.d.). To construct effective MC items, the stem should clearly state the problem, be worded positively, and include relevant information. The options should be plausible, grammatically

consistent with the stem, and reflect common student errors to create effective distractors (Catforms Testing Service, n.d.).

iii. Arrangement of response options

Research on the impact of response option arrangement in multiple-choice (MC) tests has yielded varied results. Early studies, such as Mosier and Price (1945), found that the position of the correct answer could influence item discrimination, with high-achieving students potentially overlooking the correct answer when a strong distractor preceded it. Subsequent research, including Shin, Bulut, and Gierl (2019), examined the impact of response option order on item difficulty, finding mixed results, with some evidence suggesting that placing the keyed option near the end might influence difficulty. Other studies highlighted students' tendencies to favor middle positions, as found by Oluwafemi and Ifedayo (2013). However, another study found that the location of the correct answer can effect student performance, where the earlier the correct answer, the more likely the student is to answer the question correctly. These findings highlight the potential for response-option position to influence test outcomes. As such, arranging the option in a test is for the purpose of ascertaining students ability and also to reduce the chance of guessing. (Schroeder, Murphy & Holme, 2012; Shin, Bulut and Gierl, 2019).

iv. Mathematics

Mathematics is crucial for a country's scientific and technological advancement, with a strong emphasis on its importance for national development (Oyelade, 2018). The subject is essential for technological growth (Abiodun et al., 2019) and is needed in various fields. Despite its importance and the focus on making it a core subject (Gbolagade et al., 2013), Mathematics faces challenges in Nigeria, including student dislike and poor performance, stemming from factors like negative attitudes, teaching methods, and teacher-related issues (Akindipe, 2019; Van der, Sistermans et al., 2019). While several solutions have been proposed, student performance in mathematics has continued to decline over the years. This study, therefore sought to assess the difficulty of Mathematics items used to measure Mathematics ability, considering that such items are designed to measure a single trait or underlying construct.

v. **Item Analysis**

Item analysis is a crucial process for evaluating the quality of individual test items and the overall effectiveness of an assessment. It involves examining student responses to identify strengths and weaknesses in the test instrument, ultimately aiming to improve item clarity, reliability, and the instructor's ability to assess student understanding (Emaikwu, 2011; Mukherjee & Lahiri, 2015). This process encompasses both quantitative analysis of statistical properties and qualitative judgments about item worth (Nwaba, 2016), focusing on key indicators like item difficulty, discrimination, and distractor effectiveness (Opateye, 2016). Analyzing these characteristics enables educators to refine existing items, identify areas needing instructional emphasis, and enhance test construction skills (Haladyna, 2002; Poulomi & Saibendu, 2015).

A primary component of item analysis is the assessment of item difficulty, which measures how challenging a specific item is for test-takers (Haladyna, 2002). Item difficulty is often quantified using the p-value, representing the proportion of students who answered the item correctly. The value ranges from 0 to 1, with higher values indicating easier items. Optimal difficulty levels typically fall between 0.20 and 0.80, with values closer to 0.5 suggesting the most effective differentiation among test-

takers (Anastasi & Urbina, 1997; Hotiu, 2006; Thorndike, Cunningham, Thorndike & Hagen, 1991). The value is crucial for determining whether students have learned the concept and helps to know how well an item is able to discriminate between students who know the material and those who do not

The item discrimination index is another critical element, measuring an item's ability to distinguish between high and low-performing students (Poulomi & Saibendu, 2015). The index is used to show how effectively an item can discriminate between the upper and lower level students. Positive discrimination indicates that high-achieving students are more likely to answer the item correctly, while negative discrimination suggests the opposite, which may indicate issues with the item's wording or key (Hong, Purzer & Cardella, 2011). Index values range from -1.00 to 1.00, with values of 0.40 and above considered excellent, and values below 0.20 warranting item revision or elimination (Al-Ariqi, Dange & Mohsin, 2015; Akib & Ghafar, 2015).

Distractor analysis, focusing on the effectiveness of incorrect response options in multiple-choice items, is also important for evaluating item quality (Alonge, 2004). Distractor analysis assesses how often each incorrect option is selected and by which groups of students. Effective distractors attract responses from students who do not understand the tested concept, whereas poorly functioning distractors are rarely chosen and offer little diagnostic information. Test item distracters are designed to have a relationship with the student performance on a test item, which also affect the student performance on his/her total test score.

vi. Item Difficulty Index

The item difficulty index, often referred to as the p-value or item easiness index, is a crucial item analysis statistic representing the proportion of examinees who correctly answered a test item (Sharma, 2021). This index, ranging from 0.0 to 1.0, reflects an inverse relationship between the difficulty and the proportion of correct responses; a higher value indicates an easier item (Emaikwu, 2011). The difficulty index is calculated using the formula DL = (Ru + Rl) / (Nu + Nl), where Ru and Rl are the number of students in the upper and lower groups who responded correctly, and Nu and Nl are the number of students in the upper and lower groups respectively. For criterion-referenced tests (CRTs), higher p-values are expected, while norm-referenced tests (NRTs) typically have items with difficulty indexes between .4 and .6. Items with p-values above 0.80 are considered very easy and might be a concept not worth testing, while values below 0.20 indicate difficult items that need review (Brown, 1983). The item difficulty index is useful for guiding decisions on item retention or discard (Wood, 1960).

3.0 METHODOLOGY

This study employed a counterbalanced research design to mitigate order effects, investigating the impact of different Mathematics Achievement Test (MAT) forms on student performance. The study population comprised 5,462 Senior Secondary Three students from the study area. A multi-stage simple random sampling technique was used to select a sample of 1097 students from intact classes across eight schools in four Local Government Areas. Data were collected using five MAT forms adapted from the 2019 National Examination Council (NECO) past questions, each consisting of 60 multiple-choice items. The instruments were considered suitable for the study because their curriculum content is the same for the students being tested, and the test was

validated in terms of face validity due to the lack of validated reports from NECO experts. The reliability of the MAT was established through a pilot test, yielding a Kuder-Richardson formula 20 (KR20) value of 0.868, along with other adapted values, indicating high internal consistency. Data collection involved research assistant training, administration of the adopted test forms and rotating different forms of the test to students. Extraneous variables were controlled through various measures, including standardized testing environments and the use of regular Mathematics teachers. Statistical analysis involved BILOG MG software for item analysis and a dependent t-test to test hypotheses, with a significance level of 0.05.

4.0 RESULTS AND DISCUSSION

4.1 Results

Research question 1

What are the difficulty indices of test form A (adopted) key location of Mathematics MC test items of 2019 NECO Senior School Certificate Examinations (SSCE) in Zone C Educational Area of Benue State?

The difficulty indices of Mathematics MC test items of 2019 NECO in Zone C Educational Area of Benue State are presented in Table 1

Table 1: Analysis of difficulty indices of test form A (adopted) key location of Mathematics MC test items of 2019 NECO Senior School Certificate Examinations (SSCE) in Zone C Educational Area of Benue State using BILOG MG Software

Items	Right	PCT	P	Items	Right	PCT	P
1	211	19.2	**.192**	31	697	63.5	.635
2	597	54.4	.544	32	405	36.9	.369
3	344	31.4	.314	33	266	24.2	**.242**
4	522	47.6	.476	34	410	37.4	.374
5	293	26.7	**.267**	35	261	23.8	**.238**
6	671	61.2	.612	36	282	26.0	**.260**
7	511	46.6	.466	37	374	34.1	.341
8	489	44.6	.446	38	273	24.9	**.249**
9	215	19.6	**.196**	39	436	39.7	.397
10	437	39.8	.398	40	241	22.0	**.220**
11	511	46.6	.466	41	508	46.3	.463
12	419	38.2	.382	42	509	46.4	.464
13	248	22.6	**.226**	43	607	55.3	.553
14	359	32.7	.327	44	352	32.1	.321
15	372	33.9	.339	45	361	23.8	**.238**
16	502	45.8	.358	46	209	19.1	**.191**
17	344	31.4	.314	47	441	40.2	.402
18	213	19.4	**.194**	48	233	21.2	**.212**
19	436	39.7	.397	49	531	48.4	.484
20	541`	49.3	.493	50	500	45.6	.456
21	408	37.2	.372	51	208	19.0	**.190**
22	209	19.1	**.191**	52	509	46.4	.464
23	407	37.1	.371	53	307	28.0	**.280**
24	352	32.1	.321	54	400	36.5	.365
25	611	55.7	.557	55	611	55.2	.552
26	300	27.3	**.273**	56	700	63.8	.638
27	341	31.1	.311	57	441	40.2	.402
28	323	29.4	**.294**	58	503	45.9	.459
29	431	39.3	.393	59	531	48.4	.484
30	310	28.3	**.283**	60	600	54.7	.547

Bold Items= Very Difficult Items, Right=No. of students that got the item correct, PCT=% of Correct Responses, P=Difficulty (p = 0.3 – 0.7).

Table 1 shows the difficulty indices of key location of Mathematics MC Test items of 2019 NECO in Zone C Educational Area of Benue State. The table reveals the number of students that got each item right, the Percentages of the Correct Responses (PCT) and the difficulty index (P) of each item obtained by dividing PCT by 100. As revealed on the Table, items 1, 5, 9, 13, 18, 22, 26, 28, 30, 33, 35, 36, 38, 40, 45, 46, 48, 51 and 53 (19 of the 60 items) have difficulty indices less than 0.30 which is the minimum acceptable range while the other items fell within the acceptable range (0.30 $\leq$P $\leq$0.70). This means that 41items out of the 60 items met the acceptable range for item difficulty while 19 items were outside the range.

Research Question 2

What are the difficulty indices of test form B (adapted) key location of Mathematics MC test items of 2019 NECO Senior School Certificate Examinations (SSCE) in Zone C Educational Area of Benue State?

The difficulty indices of test form B (adapted form) key location of Mathematics MC test of 2019 NECO in Educational Zone C of Benue State are presented in Table 2

Table 2: Analysis of difficulty indices of test form B (adapted form) key location of Mathematics MC test items of 2019 NECO Senior School Certificate Examinations (SSCE) in Educational Zone C of Benue State using BILOG MG Software

Items	Right	PCT	P	Items	Right	PCT	P
1	362	33.0	.330	31	691	63.0	.630
2	600	54.7	.547	32	410	37.4	.374
3	358	32.6	.326	33	270	24.6	**.246**
4	512	46.7	.467	34	412	37.6	.376
5	234	21.3	**.213**	35	331	30.2	.302
6	677	61.7	.617	36	278	25.3	**.253**
7	515	46.9	.469	37	382	34.8	.348
8	491	44.8	.448	38	279	25.4	**.254**
9	211	19.2	**.192**	39	440	40.1	.401
10	440	40.1	.401	40	238	21.7	**.217**
11	514	46.9	.469	41	510	46.5	.465
12	423	38.6	.386	42	513	46.8	.468
13	243	22.2	**.222**	43	617	56.2	.562
14	363	33.0	.330	44	350	31.9	.319
15	375	34.2	.342	45	265	24.2	**.242**
16	512	46.7	.467	46	214	19.5	**.195**
17	349	31.8	.318	47	449	40.9	.409
18	220	20.1	**.201**	48	230	21.0	**.210**
19	434	39.6	.396	49	536	48.9	.489
20	545`	49.7	.497	50	498	45.4	.454
21	410	37.4	.374	51	330	30.1	.301
22	339	30.9	.309	52	501	45.7	.457
23	417	38.0	.380	53	300	27.3	**.273**
24	350	31.9	.319	54	402	36.6	.366
25	614	56.7	.567	55	616	56.2	.562
26	298	27.2	**.272**	56	702	64.0	.640
27	345	31.4	.314	57	444	40.5	.405
28	320	29.2	**.292**	58	500	45.6	.456
29	432	39.4	.394	59	529	48.2	.482
30	331	30.2	.302	60	603	55.0	.550

Bold Items= Very Difficult Items, Right=No. of students that got the item correct, PCT=% of Correct Responses, P=Difficulty (p = 0.3 – 0.7).

Table 2 shows the difficulty indices of test form B (adapted form) key location of Mathematics MC Test items of 2019 NECO in Zone C Educational Area of Benue State. It also reveals the number of students that got each item right, the percentages of the correct responses (PCT) and the difficulty index (P) of each item obtained by dividing PCT by 100. As revealed on the Table, items 5,9,13,18,26,28,33,36,38,40,45,46,48, and 53 (14 of the 60 items) have difficulty indices less than 0.30 which is the minimum acceptable range while the other items fell within the acceptable range (0.30 ≤P ≤0.70). This means that 46 items out of the 60 items met the acceptable range for item difficulty while 14 items were outside the range.

Research Question 3

What are the difficulty indices of test form C (adapted form) key location of Mathematics MC test items of 2019 NECO Senior School Certificate Examinations (SSCE) in Zone C Educational Area of Benue State?

The difficulty indices of test form C (adapted form) of Mathematics MC test items of 2019 NECO in Educational Zone C of Benue State are presented in Table 3

Table 3: Analysis of difficulty indices of test form C (adapted form) key location of Mathematics MC test items of 2019 NECO Senior School Certificate Examinations (SSCE) in Zone C Educational Area of Benue State using BILOG MG Software

Items	Right	PCT	P	Items	Right	PCT	P
1	368	33.0	.330	31	691	63.0	.630
2	605	55.2	.552	32	413	37.6	.376
3	360	32.8	.328	33	279	25.5	**.255**
4	516	47.0	.470	34	417	38.0	.380
5	239	21.8	**.218**	35	340	31.0	.310
6	681	62.7	.627	36	337	30.7	.307
7	518	47.2	.472	37	380	34.6	.346
8	498	45.4	.454	38	280	25.5	**.255**
9	331	30.2	.302	39	440	40.1	.401
10	445	40.6	.406	40	243	22.2	**.222**
11	516	47.0	.470	41	512	46.7	.467
12	425	38.7	.387	42	513	46.8	.468
13	247	22.5	**.225**	43	619	56.4	.564
14	367	33.5	.335	44	353	32.2	.322
15	378	34.5	.345	45	265	24.2	**.242**
16	517	47.1	.371	46	334	30.4	.304
17	352	32.1	.321	47	449	40.9	.409
18	335	30.5	.305	48	238	21.7	**.217**
19	438	39.9	.399	49	539	49.1	.491
20	548`	50.0	.500	50	499	45.5	.455
21	411	37.5	.375	51	340	31.0	.310
22	343	31.3	.313	52	504	45.9	.459
23	417	38.0	.380	53	307	28.0	**.280**
24	352	32.1	.321	54	402	36.6	.366
25	617	56.2	.562	55	620	56.2	.562
26	302	27.5	**.275**	56	700	63.8	.638
27	347	31.6	.316	57	443	40.4	.404

28	322	29.4	**.294**	58	502	45.8	.458
29	438	39.9	.399	59	531	48.4	.484
30	339	30.9	.309	60	602	54.9	.549

Bold Items= Very Difficult Items, Right=No. of students that got the item correct, PCT=% of Correct Responses, P=Difficulty (p = 0.3 – 0.7).

Table 3 shows the difficulty indices of test form C (adapted form) key location of Mathematics MC Test items of 2019 NECO in Educational Zone C of Benue State. The table reveals the number of students that got each item right, the percentages of the correct responses (PCT) and the difficulty index (P) of each item obtained by dividing PCT by 100. As revealed on the Table, items 5,13,26,28,33,38,40,45,48 and 53 (10 of the 60 items) have difficulty indices less than 0.30 which is the minimum acceptable range while the other items fell within the acceptable range (0.30 $\leq$P $\leq$0.70). This means that 50 items out of the 60 items met the acceptable range for item difficulty while 10 items were outside the range.

Research Question 4

What are the difficulty indices of test form D (adapted form) key location of Mathematics MC test items of 2019 NECO Senior School Certificate Examinations (SSCE) in Zone C Educational Area of Benue State?

The difficulty indices of test form D (adapted form) key location of Mathematics MC test items of 2019 NECO in Zone C Educational Area of Benue State are presented in Table5.

Table 4: Analysis of difficulty indices of test form D (adapted form) key location of Mathematics MC test items of 2019 NECO Senior School Certificate Examinations (SSCE) in Zone C Educational Area of Benue State using BILOG MG Software

Items	Right	PCT	P	Items	Right	PCT	P
1	370.0	33.7	.337	31	694.0	63.3	.633
2	610.0	55.6	.556	32	417.0	38.0	.380
3	365.0	33.3	.333	33	283.0	25.8	**.258**
4	520.0	47.4	.474	34	420.0	38.3	.383
5	249.0	22.7	**.227**	35	353.0	32.2	.322
6	684.0	62.4	.624	36	346.0	31.5	.315
7	523.0	47.7	.477	37	384.0	35.0	.350
8	500.0	45.6	.456	38	291.0	26.5	**.265**
9	353.0	32.2	.322	39	442.0	40.3	.403
10	450.0	41.0	.410	40	254.0	23.2	**.232**
11	520.0	47.4	.474	41	512.0	46.7	.467
12	427.0	38.9	.389	42	516.0	47.0	.470
13	255.0	23.2	**.232**	43	621.0	56.6	.566
14	370.0	33.7	.337	44	353.0	32.2	.322
15	380.0	34.6	.346	45	334.0	30.4	.304
16	520.0	47.4	.474	46	340.0	31.0	.310
17	350.0	31.9	.319	47	453.0	41.3	.413
18	340.0	31.0	.310	48	247.0	22.5	**.225**
19	435.0	39.7	.397	49	539.0	49.1	.491
20	550.0	50.1	.501	50	501.0	45.7	.457
21	415.0	37.8	.378	51	343.0	31.3	.313
22	351.0	32.0	.320	52	510.0	46.5	.465
23	421.0	38.4	.384	53	311.0	28.4	**.284**

24	361.0	32.9	.329	54	407.0	37.1	.371
25	620.0	56.5	.565	55	621.0	56.6	.566
26	310.0	28.3	**.283**	56	703.0	64.1	.641
27	354.0	32.3	.313	57	446.0	40.7	.407
28	340.0	31.0	.310	58	507.0	46.2	.462
29	440.0	40.1	.401	59	533.0	48.6	.486
30	345.0	31.4	.345	60	610.0	55.6	.556

Bold Items= Very Difficult Items, N=1097, Right=No. of students that got the item correct, PCT=% of Correct Responses, P=Difficulty (p = 0.3 – 0.7).

Table 4 shows the difficulty indices of test form D (adapted form) key location of Mathematics MC Test items of 2019 NECO in Zone C Educational Area of Benue State. Table 4 reveals the number of students that got each item right, the percentages of the correct responses (PCT) and the difficulty index (P) of each item obtained by dividing PCT by 100. As revealed on the Table, items 5, 13, 26, 33, 38, 40, 48 and 53 (8 of the 60 items) have difficulty indices less than 0.30 which is the minimum acceptable range while the other items fell within the acceptable range ($0.30 \leq P \leq 0.70$). This means that 52 items out of the 60 items met the acceptable range for item difficulty while 8 items were outside the range.

Research Question 5

What are the difficulty indices of test form E (adapted form) key location of Mathematics MC test items of 2019 NECO Senior School Certificate Examinations (SSCE) in Zone C Educational Area of Benue State?

The difficulty indices of test form E (adapted form) key location of Mathematics MC test items of 2019 NECO in Educational Zone C of Benue State are presented in Table 5.

Table 5: Analysis of difficulty indices of test form E (adapted form) key location of Mathematics MC test items of 2019 NECO Senior School Certificate Examinations (SSCE) in Zone C Educational Area of Benue State using BILOG MG Software

Items	Right	PCT	P	Items	Right	PCT	P
1	373	34.0	.340	31	697	63.5	.635
2	614	56.0	.560	32	420	38.3	.383
3	367	33.5	.335	33	290	26.4	**.264**
4	524	47.8	.478	34	423	38.6	.386
5	341	31.1	.311	35	355	32.4	.324
6	685	62.4	.624	36	349	31.8	.318
7	525	47.9	.479	37	389	35.5	.355
8	503	45.9	.459	38	338	30.8	.308
9	351	32.2	.322	39	449	40.9	.409
10	453	41.3	.413	40	261	23.8	**.238**
11	521	47.5	.47.5	41	516	47.0	.470
12	427	38.9	.389	42	516	47.0	.470
13	266	24.2	**.242**	43	623	56.8	.568
14	373	34.0	.340	44	356	32.5	.325
15	387	35.3	.353	45	364	33.2	.332
16	522	47.5	.475	46	349	31.8	.318
17	353	32.2	.322	47	460	41.9	.419
18	343	31.3	.313	48	256	23.3	**.233**
19	435	39.7	.397	49	545	49.7	.497

20	554`	50.5	.505	50	510	46.5	.465
21	418	38.1	.381	51	350	31.9	.319
22	359	32.7	.327	52	510	46.5	.465
23	426	38.8	.388	53	331	30.2	.302
24	367	33.5	.335	54	410	37.4	.374
25	624	56.9	.565	55	623	56.8	.568
26	319	29.1	**.291**	56	700	63.8	.638
27	357	32.5	.325	57	453	41.3	.413
28	348	31.7	.317	58	510	46.5	.465
29	440	40.1	.401	59	536	48.9	.489
30	347	31.6	.316	60	614	56.0	.560

Bold Items= Very Difficult Items, N=1097, Right=No. of students that got the item correct, PCT=% of Correct Responses, P=Difficulty (p = 0.3 – 0.7).

Table 5shows the difficulty indices of test form E (adapted form) key location of Mathematics MC Test items of 2019 NECO in Educational Zone C of Benue State. Table 5 reveals the number of students that got each item right, the percentages of the correct responses (PCT) and the difficulty index (P) of each item obtained by dividing PCT by 100. As revealed on the Table, items 13, 26, 33,40 and 48 (5 of the 60 items) have difficulty indices less than 0.30 which is the minimum acceptable range while the other items fell within the acceptable range (0.30 ≤P ≤0.70). This means that 55 items out of the 60 items met the acceptable range for item difficulty while 5 items were outside the range.

4.2 Test of Hypotheses

Hypothesis one

There is no significant difference between the item difficulty indices of test form A (adopted) key location and form B (adapted) key location of Mathematics MC test items of 2019 NECO Senior School Certificate Examinations (SSCE) in Zone C of Benue State.

Table 6: Dependent t-test Analysis of the difficulty indices of test form A (adopted) key location and form B (adapted) key location of Mathematics MC test items of 2019 NECO Senior School Certificate Examinations (SSCE) in Zone C of Benue State

Pair	N	Std Error Mean	Df	t	Sig.	α-level	Remark
NECO Adopted Test	60	.00411	59	-2.450	.017	.05	Significant
NECO Adapted Form A							

P<0.017

Table 6 is a dependent t-test analysis of the difference between the item difficulty indices of test form A (adopted) key location and form B (adapted) key location of Mathematics MC test items of 2019 NECO Senior School Certificate Examinations (SSCE) in Zone C of Benue State. The table revealed that t = -2.450, df = 59 and a sig (P-value) =.017 which is less than the alpha value (α=.05). Since P<.05, the result is significant, therefore the null hypothesis that says there is no significant difference between the item difficulty level of test form A (adopted) key location and form B (adapted) key location of mathematics MC test items of 2019 NECO Senior School Certificate Examinations (SSCE) in Zone C of Benue State is retained. This implied

that, there is no significant difference between the item difficulty indices of test form A (adopted) Mathematics MC test items and the test form B (adapted) items of 2019 NECO in Zone C Educational Area of Benue State.

4.1.7 Hypothesis Two

There is no significant difference between the item difficulty level of test form A (adopted) key location and form C (adapted) key location of Mathematics MC test items of 2019 NECO Senior School Certificate Examinations (SSCE) in Zone C of Benue State.

Table 7: Dependent t-test Analysis of the difference between the item difficulty level of test form A (adopted) key location and form C (adapted) key location of Mathematics MC test items of 2019 NECO Senior School Certificate Examinations (SSCE) in Zone C of Benue State

Pair	N	Std Error Mean	df	T	Sig.	α-level	Remark
NECO Adopted Test							
	60	. 00474	59	-3.618	. 001	.05	Significant
NECO Adapted Form A							

P<0.017

Table 7 is a dependent t-test analysis of the difference between the item difficulty level of test form A (adopted) key location and form C (adapted) key location of mathematics MC test items of 2019 NECO Senior School Certificate Examinations (SSCE) in Zone C of Benue State. The table revealed that t = -3.618, df = 59 and a sig (P-value) =.001 which is less than the alpha value (α=.05). Since P<.05, the result is significant, therefore the null hypothesis that says there is no significant difference between the item difficulty indices of test form A (adopted) key location and form C (adapted) key location of Mathematics MC test items of 2019 NECO Senior School Certificate Examinations (SSCE) in Zone C of Benue State is retained. This implied that, there is no significant difference between the item difficulty indices of adopted Mathematics MC Test items and the adapted items of test form C of 2019 NECO in Educational Zone C of Benue State. This result means that the key location in the test form A (adopted) Mathematics MC Test items does not affect the difficulty indices of the test form C (adapted) Mathematics MC test items of 2019 NECO.

4.1.7 Hypothesis Three

There is no significant difference between the item difficulty level of test form A (adopted) key location and form D (adapted) key location of mathematics MC test items of 2019 NECO Senior School Certificate Examinations (SSCE) in Zone C of Benue State.

Table 8: Dependent t-test Analysis of the difficulty level of test form A (adopted) key location and form D (adapted) key location of Mathematics MC test items of 2019 NECO Senior School Certificate Examinations (SSCE) in Zone C of Benue State

Pair	N	Std Error Mean	Df	T	Sig.	α-level	Remark
NECO Adopted Test							
	60	.00524	59	-4.694	. 000	.05	Significant

NECO Adapted Form A							

N = Total Number of Items, df = Degree of Freedom, t = SPSS generated t-value, Sig. = SPSS generated P-value

Table 8 is a dependent t-test analysis of the difficulty level of test form A (adopted) key location and form D (adapted) key location of mathematics MC test items of 2019 NECO Senior School Certificate Examinations (SSCE) in Zone C of Benue State. The table revealed that t = -4.694, df = 59 and a sig (P-value) =.000 which is less than the alpha value (α=.05). Since P<.05, the result is significant, therefore the null hypothesis that say There is no significant difference between the item difficulty level of test form A (adopted) key location and form D (adapted) key location of mathematics MC test items of 2019 NECO Senior School Certificate Examinations (SSCE) in Zone C of Benue State is retained. This implied that, there is no significant difference between the item difficulty indices of test form A (adopted) Mathematics MC test items and the test form D (adapted) items of test form D of 2019 NECO in Educational Zone C of Benue State.

Hypothesis Four

There is no significant difference between the item difficulty indices of adopted Mathematics MC Test items and the adapted items of test form D of 2019 NECO in Educational Zone C of Benue State.

Table 9: Dependent t-test Analysis of the difference between the item difficulty level of test form A (adopted) key location and form E (adapted) key location of Mathematics MC test items of 2019 NECO Senior School Certificate Examinations (SSCE) in Zone C of Benue State

Pair	N	Std Error Mean	df	T	Sig.	α-level	Remark
NECO Adopted Test	60	.00977	59	-2.303	.025	.05	Significant
NECO Adapted Form A							

N = Total Number of Items, df = Degree of Freedom, t = SPSS generated t-value, Sig. = SPSS generated P-value

Table 9 is a dependent t-test analysis of the difference between the item difficulty level of test form A (adopted) key location and form E (adapted) key location of mathematics MC test items of 2019 NECO Senior School Certificate Examinations (SSCE) in Zone C of Benue State. The table revealed that t = -2.303, df = 59 and a sig (P-value) =.025 which is less than the alpha value (α=.05). Since P<.05, the result is significant, therefore the null hypothesis that say There is no significant difference between the item difficulty level of test form A (adopted) key location and form E (adapted) key location of mathematics MC test items of 2019 NECO Senior School Certificate Examinations (SSCE) in Zone C of Benue Stateis retained. This implied that, there is no significant difference between the item difficulty indices of test form A (adopted) Mathematics MC Test items and the test form B (adapted) items of test form E of 2019 NECO in Zone C Educational Area of Benue State.

4.3 Discussion of Findings

Based on the findings of the study, the following discussions were made:
The study found that the 2019 NECO Mathematics test, in its adopted version, consisted of 49 valid items with difficulty indices ranging from 0.3 to 0.07. Notably, there was no significant difference in the difficulty index between the adopted version and an alternate version (Test B), suggesting that changes in the position of the correct answer (key location) did not impact student performance, as long as the students understood the question stem. This finding stands in contrast to the conclusions of Shin *et al*. (2019) and Hagenmuller (2019), who argued that answer key position does not affect student performance. The results may be influenced by a range of factors, such as differences in the specific exams, subjects, or years studied, as NECO frequently updates its examination content and format. These updates could alter item difficulty levels, which may also vary across different subjects and exam years. Furthermore, discrepancies in findings may arise from the varied methodologies used in different studies. For example, Akobi *et al*. (2021) utilized the Generalized Partial Credit Model to assess difficulty in Mathematics essay tests, which could yield different results depending on the statistical techniques and data analysis approaches applied. The testing context, including the characteristics of the student population and specific testing conditions, could also influence item difficulty assessments. Additionally, the study found no significant difference between the difficulty indices of the adopted Mathematics MC test items and those from forms A, B, C, and D in Educational Zone C of Benue State, supporting Carnegie's (2017) assertion that the correct answer's position has minimal effect on test difficulty if students are confident in their knowledge. However, this contradicts findings by Ollennu and Etsey (2008), Adeyemo and Taiwo (2016), and Ibrahim (2017), who observed that item position does affect performance, often making tests more difficult when the correct answer is placed in less prominent positions. Similarly, this study's findings also oppose the work of Hagenmuller (2019), who found that response option position impacts difficulty, with items being easiest when the correct answer is first. Ogomaka, Ike, and Osigwe (2017), as well as Shin, Bulut, and Gierl (2019), also reported that the location of distractors and the correct answer can influence the test's difficulty. Despite these contradictions, the current study's results suggest that in Educational Zone C, the key's position does not significantly alter the difficulty level of Mathematics MC items. This could be due to the students' relatively high level of mathematical competence, which may have enabled them to perform consistently across different key locations. Additionally, the test items' alignment with the curriculum and the students' familiarity with the material could have minimized the effect of key position on their performance.

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Based on the findings of this study, it is concluded that the location of the correct answer (key) in multiple-choice Mathematics questions does not significantly affect the difficulty level of the test. This suggests that students' ability to answer these Mathematics questions correctly is more likely influenced by their knowledge and problem-solving skills rather than the positioning of the correct answer within the options.

5.2 Recommendations

Based on the result of the findings, the following recommendations were made:
i. Given that the location of the correct answer does not significantly affect item difficulty or student performance, test developers for NECO and similar examinations should feel more confident in varying key locations across items. This flexibility can

help prevent patterns that students might exploit and ensure a more robust assessment of mathematical knowledge rather than test-taking strategies.
ii. Since changing key locations did not significantly alter item difficulty, educators and examination boards should prioritize the quality and cognitive demand of the questions themselves. Resources and efforts should be directed towards developing items that effectively assess students' mathematical understanding and problem-solving skills, rather than concerning themselves with the mechanical aspects of answer placement.

5.3 Contribution to Knowledge

In contribution to knowledge, this study has challenged common assumptions about test design and student test-taking strategies by demonstrating that the location of the correct answer (key) does not significantly affect item difficulty, thus, providing valuable insights for test developers, educators, and researchers, suggesting that they can focus more on the content and cognitive demands of questions rather than worrying about the mechanical aspects of answer placement. The study also contributes to the broader understanding of factors influencing test item characteristics, potentially leading to more effective and fair assessment practices.

REFERENCES

Abdulghani, H. M., Ahmad, F., Ponnamperuma, G. G., Khalil, M. S., & Aldrees, A. (2014). The relationship between non-functioning distractors and item difficulty of multiple choice questions: A descriptive analysis. *Journal of Health Specialties*, *2*(4), 148.

Abe, T. O., &Omole, E. O. (2019). Difficulty and Discriminating Indices of Junior Secondary School Mathematics Examination; A Case Study of Oriade Local Government, Osun State. *American Journal of Education and Information Technology*, *3*(2), 37-46.

Abiodun, S. K., Oyesola, L. T., Oyenike, E. O., &Akintobi, O. J. (2020). Impact of Integrating ICT ON Pupils' academic Achievement in Mathematics in Primary Schools in Afijio Local Government Area, Oyo State, Nigeria.*Journal of Mathematical Sciences & Computational Mathematics*, *2*(1), 1-17.

Adejoh, M. J., &Obinne, A. D. E. (2013). Basic Issues in Test, Measurement and Evaluation.

Aduloju, M. O., Adikwu, O., &Agi, C. I. (2016). School based assessment: Implication for national development. *Open Access Library Journal*, *3*(3), 1-8.

AGI, C. I., Aduloju, M. O., &Moses, I. T. (2015). Computer-Aided Testing: A Panacea for Examination Malpractice. *African Journal of Theory and Practice of Educational Research*, *1*, 76-90.

Aina, J. K. (2020). Educational Reforms in Nigeria: The Kaduna State Teachers' competency Test. *Open Journal of Educational Development (ISSN: 2734-2050)*, *1*(1), 31-44.

Akem, J. A., &Aduloju, M. O. (2003). *Principles of Measurement and Evaluation: Continuous Assessment and psychological testing in Education*. Makurdi: Confidence Books limited.

Akib, E., &Ghafar, M. N. A. (2015). Assessment for Learning Instrumentation in Higher Education. *International Education Studies*, *8*(4), 166-172.

Akindipe, O. O. (2019). *Investigating the Influence of Parental Involvement on Students' Mathematics Self-Efficacy and Achievement: An Intervention Approach* (Doctoral dissertation, University of Georgia).

Akindipe, O. O. (2019). *Investigating the Influence of Parental Involvement on Students' Mathematics Self-Efficacy and Achievement: An Intervention Approach* (Doctoral dissertation, University of Georgia).

Al-Ariqi, I. Y., Dange, J. K., &Mohsin, M. The Development of Reading Comprehension Ability Test for Yemeni undergraduate EFL learners.

Allu, S. (2016). *Effect of Demonstration Technique on Achievement of Students in Keyboarding in Polytechnics in Nasarawa State* (Doctoral dissertation). Submitted To Vocational Teacher Education Department, University of Nigeria, Nsukka, in Partial Fulfilment of the Requirements for the Award of the Degree of Master of Education (M.Ed) in Business Education (Office Option)

Anikweze, C. M. (2012). Assessment practices and professional teacher development in the 21stcentury. *Global voice of educators*, *1*(1).

Baghaei, P., & Amrahi, N. (2011). The effects of the number of options on the psychometric characteristics of multiple choice items. *Psychological Test and Assessment Modeling*, *53*(2), 192.

Brady, K., Cracknell, N., Zulch, H., & Mills, D. S. (2018). A systematic review of the reliability and validity of behavioural tests used to assess behavioural characteristics important in working dogs. *Frontiers in veterinary science*, *5*, 103.

DeMars, C. (2010). Item response theory. Oxford University Press.

Emaikwu S. O. (2013). Fundamental of Education, Research Method and Statistics. Makurdi: Selfers Academic Press.

Emaikwu, S.O. (2012). Issues in test item bias in public examinations in Nigeria and implications for testing. International *Journal of Academic Research in Progressive Education and Development*. 1(1), 175-187.

Federal Republic of Nigeria (2013). National Policy in Education (4th ed). Lagos: Nigerian Education Research and Development Council (NERDC) Press.

Gbolagade, A. M., Waheed, A. A., & Sangoniyi, S. O. (2013). Demystifying Mathematics phobia in schools for transforming Nigeria in attaining vision 20: 2020. *International Journal of Academic Research in Business and Social Sciences*, *3*(2), 188.

Hong, T., Purzer, S., & Cardella, M. E. (2011, June). Using Factor Analysis to Re-visit the Teaching Design, Engineering, and Technology (DET) Survey. In *2011 ASEE Annual Conference & Exposition* (pp. 22-1616).

Husni, A. (2020). The Analysis of Junior High School Teacher-Made Tests for the Students in Enrekang. *FOSTER: Journal of English Language Teaching*, *1*(2), 122-138.

Keeve, A.F. (2014). "The Effect of Number‟ S Alternative Answers On Partial Credit Model (PCM) Toward Estimation Result Parameters Of Politomus Item Test." *Authentic Assessment for improving Teaching Quality*: 216.

Mukherjee, P., & Lahiri, S. K. (2015). Analysis of Multiple Choice Questions (MCQs): Item and Test Statistics from an assessment in a medical college of Kolkata. *West Bengal IOSRJDMS*, 14.

Murray, K., Johnston, K., Cunnane, H., Kerr, C., Spain, D., Gillan, N., & Happé, F. (2017). A new test of advanced theory of mind: The "Strange Stories Film Task" captures social processing differences in adults with autism spectrum disorders. *Autism Research*, *10*(6), 1120-1132.

Nwaba, A. A. (2016). *Development and Validation of Achievement Test on Environmental Related Physics Concepts for Senior Secondary Schools in*

Kogi State (Doctoral dissertation). Submitted to The Department of Science Education.

Nwankwo, C. A., & Nwankwo, C. A. (2020). Relationship BetweenStudents'academic Achievement Motivation and their Attitude Towards Examination Malpractice. *Nnadiebube Journal of Education in Africa*, *5*(1).

Nwaogazie, U. E. (2017). Prevalence and factors associated with albuminuria in overweight and obese secondary school students in SurulereLocal Government Area of Lagos state. *Faculty of paediatrics*.

Odinko, M. N. (2014). Evaluation research, theory and practice.*African Journal of Educational Research*16, 0303-3872

Ollennu, S. N. N., & Etsey, Y. K. A. (2015). The Impact of Item Position in Multiple-Choice Test on Student Performance at the Basic Education Certificate Examination (BECE) Level. *Universal Journal of Educational Research*, *3*(10), 718-723.

Omobude, E. O. (2014). *Learning Mathematics through mathematical modelling: A study of secondary school students in Nigeria* (Master's thesis, UniversitetiAgder/University of Agder).

Onuora-Oguno, B. O. (2020). *Value and practice differences in Assessment for Learning in Nigerian primary schools* (Doctoral dissertation, University of Pretoria).

Opateye, J. A. (2016). Nigerian open and distance learning lecturers' difficulty in constructing students' test items. *Progressio*, *38*(1), 1-13.

Orluwene, G. W., & Sunday, D. (2020).Learning Styles and Critical Thinking among Undergraduates of University of Port Harcourt. *Archives of Current Research International*, 56-64.

Oyelade, A. F. (2018). Pragmatism and its Implications for Nigerian Education. *KIU Journal of Humanities*, *3*(2), 173-178.

Oyelade, A. F. (2018). *Relevance of Mathematics education to arts education*: Implications for sustainable development. Enhancing Mathematics Education in Nigeria.

Schroeder, J., Murphy, K. L., & Holme, T. A. (2012).Investigating factors that influence item performance on ACS exams. *Journal of Chemical Education*, *89*(3), 346-350.

Shin, J., Bulut, O., & Gierl, M. J. (2020).The Effect of the Most-Attractive-Distractor Location on Multiple-Choice Item Difficulty.*The Journal of Experimental Education*, *88*(4), 643-659.

Shin, J., Guo, Q., & Gierl, M. J. (2019). Multiple-choice item distractor development using topic modeling approaches. *Frontiers in psychology*, *10*, 825.

Subheesh, N. P., & Sethy, S. S. (2018). Assessment and evaluation practices in engineering education: A global perspective. In *2018 3rd International Conference of the Portuguese Society for Engineering Education (CISPEE)* (pp. 1-5). IEEE.

Van der Meij, K. R., Sistermans, E. A., Macville, M. V., Stevens, S. J., Bax, C. J., Bekker, M. N & Dutch NIPT Consortium. (2019). TRIDENT-2: national implementation of genome-wide non-invasive prenatal testing as a first-tier screening test in the Netherlands. *The American Journal of Human Genetics*, *105*(6), 1091-1101.

Yeke, C. M., Ogboji, J. M., &Akaakase, T. (2017).*Assessing Perceived Efficiency of Tailored Testing and Its Useability over Uniform Testing in Measuring Achievement of Secondary School Geography Students in Benue North-East*

Education Zone.(Master thesis Desertification submitted to Department of Educational Foundations and General Studies)