ANALYSIS OF PSYCHOMETRIC PROPERTIES OF 2022 CIVIC EDUCATION QUALIFYING EXAMINATION ITEMS IN JIGAWA STATE, NIGERIA

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Abstract

This paper analyzed the psychometric properties of 2022 Civic Education Qualifying Examination Items in Jigawa State, Nigeria. Three research objectives were stated and three research questions were asked n the study. Survey research design was adopted and the population of the study was 1,809 SSS II students who sat for 2022 Civic Education qualifying examination in public secondary schools in Kafin Hausa Education Zone of Jigawa State. Three hundred six (306) respondents were sampled for the study. The Jigawa State 2022 Civic Education Qualifying Examination was used to collect data with Kuder-Richardson 20 reliability co-efficient of 0.78. The researcher used Item Response Theory for Patient Reported Outcomes (IRTPRO) 2.1 to answer research questions. The result in research question one shows that civic education items for the year 2022 qualifying examination in Jigawa state had difficulty estimate that ranges from -1.53 of item (25) (the easiest item) to 1.52, 1.57 of items 13 and 40 (the most difficult items). Research question two shows that multiple choice Civic Education items of 2022 qualifying examination Jigawa state had discrimination indices that ranges from 0.00 of item (26) (the poor item) to 1.56 of items 20 (the most discrimination item). Research question three items were ranged from 0.00 to 0.43, thirty (30) items (75%) fall within the c-value range of 0.00 to 0.20 which shows that the items were desirable and the probability of getting an answer correctly by mere guessing is low while ten (10) items (25%) fall within the c-value range of 0.21 to 0.40 were not very good and the probability of getting an answer correctly by mere guessing is high. Based on the findings the study recommended among others that, teacher-made Civic Education Achievement Tests used to examine secondary school students' achievement should be made to pass through all the processes of standardization and validation by conducting item analysis to improve their quality.

Keywords: Civic Education, Items, Psychometric Properties, Qualifying Examination,

Introduction

Education is defined as a lifelong learning process that aims to empower individuals with the knowledge, skills, and values necessary to lead fulfilling lives and participate in their communities effectively (UNESCO, 2015). Therefore, it becomes bedrock and indispensable tools for legal, civic, social science, scientific, technological and economic advancement of any nation. It gives the nation the capacity to apply technology for the exploitation of the resources of nature. Likewise Education is a process of facilitating learning, or the acquisition of knowledge, skills, values, beliefs, and habits, emphasizing technology's role in education accessibility and continuity (Wiley, 2016).

Educational assessment refers to the systematic process of documenting and using empirical data on the knowledge, skills, attitudes, and beliefs of learners to refine programs and improve student learning. It involves the collection, analysis, and interpretation of information to aid decision-making related to students, curricula, and educational policies (Brookhart, 2019).

Educational assessment can be formative (ongoing assessments aimed at improving learning) or summative (assessments that evaluate student learning at the end of an instructional unit). It can be conducted through various methods such as tests, quizzes, assignments, portfolios, self-assessments, peer evaluations, and standardized exams (Wiliam, 2018). However, Assessment plays a crucial role in the school system especially in teaching and learning process. Without assessment teachers cannot discover the areas of strengths and weaknesses of their students and the extent of which teaching objectives have been achieved (Olutola, Olatoye & Olatoye, 2016). Assessment is seen as a process of obtaining information that is used for making decision about curricula, programmes and educational policy (Popham, 2020). It shapes students' disposition towards learning and influences their motivation to learn. Assessment involves the system of testing as well as measurement. Assessment is more involving action than either testing or measurement but a less involving term than evaluation. (National Research Council, 2021) further argues that classroom assessment and evaluation provide useful information that helps to optimize learning and improve teaching effectiveness. Educational evaluation involves decisions about policies, students and curricula or programmes.

However, reliable assessment tools such as test should therefore produce dependable repeatable and consistent information about students. Hence, a well standardized test should therefore not be too difficult or too easy. Examination bodies are expected to construct test items in such a manner that items are free from errors, wordiness, irrelevance, offensiveness, and excessive stimulation, so that when an inadequacy exists between groups and examination items scores, the disparity will be attributed to true differences in whatever the test purports to measure in the examinees (OECD, 2021).

Testing has been seen worldwide as a best way to determine the success or failure of the teaching and learning process in the school setting (Olutola, Ogunjimi, Daramola & Sheu, 2017). Test is an indispensable tool in teaching and learning process. This tool helps in the promotion of students from one level or class to another and to diagnose the students who have learning deficiencies (Olutola & Olatoye, 2019). Test is also a tool for measuring or assessing the knowledge, skills, values and abilities of a student or a group of students in the school setting (Olutola & Olatoye, 2019). Owolabi (2019) described a test as an instrument or a tool or systematic procedures for observing and describing one or more characteristics of a student, by using a numerical scale of classification scheme. It is a procedure in form of oral technique used to obtain responses from the students in order to gain information which provides the basis for making value judgment concerning skill, knowledge, and value. Tests are essentially assessment devices, which enables the teacher, the curriculum educational planner to make certain decision (Jigawa Education Resources Department, 2022).

Testing plays a pivotal role in the teaching and learning process, extending beyond its traditional function of measuring student performance. It is a multifaceted tool that not only assesses learning outcomes but also enhances retention, informs instruction, motivates learners, and ensures accountability at both individual and institutional levels. As education systems globally evolve towards data-driven and learner-centered approaches, testing continues to prove indispensable in improving both teaching effectiveness and student achievement.

One of the most profound benefits of testing is its role in enhancing knowledge retention. This phenomenon, widely known as the testing effect, refers to the improved long-term memory that results from actively retrieving information rather than passively reviewing it. Roediger and Butler (2011) emphasize that retrieval practice through testing reinforces memory traces and deepens learning. More recently, Agarwal, Nokes-Malach, and Roediger (2021) have shown that students who engage in frequent, low-stakes testing are more likely to retain information over time and apply it across different contexts. Such practices are particularly effective in promoting higher-order thinking, as they require students to retrieve, organize, and apply knowledge, rather than merely recognize it (Jigawa Education Resources Department, 2022).

There are two major types of tests namely are Essay and Objective test. Multiple's choice test used by all the examination bodies in Nigeria is an example of objective test. According to Abanobi (2013), test such as a multiple-choice test is judged worthwhile when a product of careful item analysis. Thus, item analysis is a procedure that examines students' responses to individual test items to evaluate the importance or value of those items and the test itself. It is particularly valuable in improving items that might be sourced from previous tests, eliminating vague or misleading ones before the test administration. This analysis is also concerned in reviewing of test item content and statistics which describe testees' performance on the item (Orluwene, 2012). Wiersma (2010) stated that when student perform surprisingly low or high, teachers should investigate if the performance level results from errors inherent in the test items, instructions or the students' abilities before appropriate action can be taken. Tests are often constructed and administered by most classroom teachers and test developers with little or no concern for the qualities that every measurement procedure should possess (Jurs, 2010). It is used by the teachers in the school to examine the mastery of students in the subjects there being offering in the school such as civic education, English, mathematics, biology, history and so on. Therefore, this study is guided by item response theory (IRT) because it provides a powerful means to study individual responses to a variety of stimuli and the methodology has been extended and developed to cover many different models of interaction. It has been emphasized that item response theory is the modern theory that describes the students' ability using item by item performance, than the classical test theory. Therefore, the study focused on item response theory to analyze the difficulty index, discrimination power and the plausibility of options in Jigawa State 2022 civic education qualifying examination.

Civic Education is one of the subjects offered by students in both junior and senior secondary schools in Nigeria. In its broadest definition, "civic education" means all the processes that affect people's beliefs, commitments, capabilities, and actions as members or prospective members of communities. Civic education needs not be learnt intentional or deliberate; institutions and communities transmit values and norms within the society. It may not be beneficial all the time, sometimes people are civically educated in ways that disempowered them or impart harmful values and goals. It is certainly not limited to formal education of children and youth. Families, governments, religions, and mass media are just some of the institutions involved in civic education which is understood as a lifelong process (Svetina,, 2020).

Item analysis is a systematic procedure designed to obtain specific information about each item of a test (Euroro, 2015). Item analysis is designed primarily for use with objective test (especially multiple-choice items). In item analysis, the test constructors are concerned with item difficulty level, discrimination power of item and the effectiveness of the distracters. Item analysis is a statistical technique which is used for selecting and rejecting the items of the test on the basis of their difficulty values, discrimination power/index and plausibility of the distracters/decoys (Olutola & Olatoye, 2019).

Item difficulty is simply the percentage of students who answered an item correctly. In the proportions of probability that candidate will answer a test item correctly. Item discrimination power refers to the ability of an item to differentiate among students on the basis of how well they know the material being tested. Is the extent, to which an item differentiates between the brilliant students and the poor students, it is also the ability of the item to differentiate between brilliant students and weak examinees.

Distractors is used for discriminating between the informed (know the correct a nswer/response) and uninformed students (not knowing the correct response). Therefore, distractors or incorrect response options, play an important role in determining the quality of Multiple-Choice questions/items and providing diagnostic information about test performance. Items can be analyzed qualitatively in terms of their content, and quantitatively in terms of their statistically properties. Qualitative analysis includes consideration of content validity as well as the evaluation item in terms of item writing procedures. Quantitative analysis on the other hand includes principally the measurement of item difficulty level and item discrimination power. The benefits of item analysis are numerous both to the test constructor and test users. Item analysis provides diagnostic information for determining the quality of test items (Euroro, 2015). Hence, the role of item analysis in determining the quality of test items cannot underestimate.

Therefore, the study analyzed the item parameter of 2022 Jigawa State Civil Education qualified examinations in Kafin Hausa Education Zone. It focused on the item parameters such as item difficulty, discrimination power, and plausibility of distractors.

Statement of the Problem

Students' low levels of academic achievement in various subjects at secondary schools' level is worrisome and continues to attract the attention of stakeholders in education. Jigawa State Education Resource Department JERDA (2022) revealed that student's performance in Civic Education from the year 2016 to 2020 was very poor especially at senior secondary school level which is proved by their qualifying examination results. This has continued to attract the attention of stakeholders in the state

Therefore, it has been observed that, researches have been conducted on item analysis in many subject areas to find out the desirability of that items being constructed in measure of their difficulty, discrimination power and functionality of options. However, no similar study has been conducted in civic education qualifying examination in Kafin Hausa Education Zone of Jigawa state to ascertain the quality of the items being used. Therefore, it is against these highlighted problems that the study analyzed civic education qualifying examination 2022 developed by Jigawa Education Resource Department.

Objective of the Study

The main objective of this study is to analyze the psychometric properties of 2022 Civic Education Qualifying Examination in Kafin Hausa Education Zone Jigawa State, Nigeria. Specifically, the objectives of the study are to:

1. find out the item difficulty index of multiple-choice Civic Education item (2022) qualifying examination in Kafin -Hausa Education Zone, Jigawa State, Nigeria;

2. determine the discrimination power of multiple-choice Civic Education item of 2022 qualifying examination in Kafin-Hausa Education Zone, Jigawa State, Nigeria;

3. examine the functionality or plausibility in options of multiple-choice Civic Education item in 2022 of qualifying Examination in Kafin-Hausa Education Zone, Jigawa State, Nigeria.

Research Questions

The following research questions were answered in the study:

1. What is the difficulty index of multiple – choice Civic Education item (2022) qualifying examination in Kafin-Hausa Education Zone Jigawa state, Nigeria?

2. What is the discrimination power of multiple – choice Civic Education item of 2022 qualifying examination in Kafin Hausa Education Zone Jigawa state, Nigeria?

3. To what extent does the option supply by multiple – choice Civic Education item in 2022 of qualifying Examination in Kafin Hausa Education Zone Jigawa state Nigeria is functional?

Methodology

This study adopted descriptive Survey research design; the population of the study was 1,809 comprising 1169 male and 640 female SSS II students who sat for 2022 civic education qualifying examination in public secondary schools in Kafin Hausa Education Zone of Jigawa State. Kafin Hausa Education Zone is made up of schools located in rural and urban settlements. A sample size of 306 respondents was used for the study. The sample size was estimated based on the Research Advisor (2006) recommendation table for determining sample size. Simple random sampling technique was employed using lottery method and sample size was non-proportionally shared among the thirteen public secondary schools in Kafin-Hausa Education zone. The instrument for data collection was Jigawa State 2022 Civic Education Qualifying Examination. It is designed to prepare students for the senior secondary school certification examination (WAEC, NECO & NABTEB) usually taken at the end of secondary school education. In Jigawa State, qualifying examination is constructed and administered by Jigawa Education Resources Department (JERD). The examination consists of forty (40) multiple choice items. In order to ensure reliability of the research instrument, the researcher conducted a pilot study at   Government unity commercial Secondary School Dutse, Jigawa State. The Kuder-Richardson 20 coefficient method of establishing reliability was used and the reliability coefficient of 0.78 was obtained. The researcher seek permission of relevant authorities for the administration of test in the 13 public senior secondary schools in the zone.

In this study item analysis and statistical analysis was performed. Item analysis was carried out using Item Response Theory for Patient Reported Outcomes (IRTPRO) 2.1 for window (student's version). Data obtained for the study were analyzed using Scheuneman modified chi-square and logistic regression statistics for the research questions, the data collected was processed with the aid of statistical package of social sciences (SPSS).

Results

Research Question One: What is the difficulty index of multiple–choice Civic Education item (2022) qualifying examination in Kafin-Hausa Education Zone Jigawa state, Nigeria?

Table 1: Difficulty Index of Multiple–Choice Civic Education item (2022) Qualifying Examination in Kafin-Hausa Education Zone Jigawa state, Nigeria based on Model of IRT

Items	Difficulty Estimates	Items	Difficulty Estimates
1	-0.94	21	0.43
2	1.13	22	-0.24
3	0.92	23	0.63
4	0.01	24	-0.06
5	-0.39	25	-1.53
6	-0.24	26	0.46
7	-0.97	27	0.16
8	-0.98	28	1.02
9	-0.50	29	0.76
10	-0.88	30	0.04
11	-0.50	31	-0.42
12	0.92	32	-0.27
13	1.52	33	-0.94
14	-0.39	34	-0.84
15	-0.24	35	-0.55
16	-0.97	36	-0.47
17	-0.98	37	-0.85
18	-0.50	38	0.54
19	0.43	39	-0.66
20	0.92	40	1.57
	Mean = -0.096		**SD = 0.779**

The results in table 1 showed that items for the year 2022 State qualifying examination in Kafin-Hausa Education Zone Jigawa state, Nigeria had difficulty estimate that ranges from -1.53 of item (25) (the easiest item) to 1.52, 1.57 of items 13 and 40 (the most difficult items). Within this range, twenty-four items had negative difficulty estimate which means twenty-four items are fairly easy items. Also, sixteen items had positive difficulty estimate which implies fairly difficult questions.

Data also showed that 30 items which constitutes 75% of total test items with difficulty estimates below 0.5 as easy items; and also, 10 items constituting 25% of the total items with difficulty estimates above 0.51 were presented as difficult items. Based on this information, it can be deduced that 75% of the items were made too easy to even the lower ability examinees to have performed well. The mean of the estimate distribution is -0.096 which suggest that fairly easy items balance fairly difficult items. The difficulty indices are desirable since both the positive and negative range, are close to -0.096 and the standard deviation is low 0.779.

Research Question 2: What is the discrimination power of multiple – choice Civic Education item of 2022 qualifying examination in Kafin Hausa Education Zone Jigawa state, Nigeria?

Table 2: Discrimination Power of Multiple–Choice Civic Education Item of 2022 Qualifying Examination in Kafin Hausa Education Zone Jigawa state, Nigeria Based on Model of IRT

Items	Discrimination Indices	Items	Discrimination Indices
1	1.10	21	1.10
2	0.29	22	0.28
3	0.77	23	1.09
4	0.93	24	0.05
5	0.33	25	0.18
6	1.16	26	0.00
7	1.12	27	1.10
8	0.37	28	0.86
9	0.29	29	0.38
10	1.16	30	0.86
11	1.10	31	0.21
12	0.24	32	1.10
13	0.36	33	1.23
14	0.27	34	0.11
15	0.26	35	1.16
16	0.01	36	1.01
17	0.78	37	0.87
18	0.72	38	0.93
19	0.37	39	1.38
20	1.56	40	0.20
Mean = 0.69		**SD = 0.44**	

The results in table 2 showed that multiple – choice Civic Education item of 2022 qualifying examination in Kafin Hausa Education Zone Jigawa state had discrimination indices that ranges from 0.00 of item (26) (the poor item) to 1.56 of items 20 (the most discrimination item).

Table 2 also showed that the discrimination indices of test items in multiple – choice Civic Education item of 2022 qualifying examination computed had five (5) out of the forty (40) tests items have low discrimination indices between (0.00 - 0.18); eight (8) items have moderate discrimination (i.e., 0.19 - 0.29); five (5) items showed high discrimination (i.e. 0.30 -0.39); and, twenty-two (22) items with a very high discrimination indices (0.40 and above).

The mean of the estimate distribution is 0.69 which suggest that low discrimination items balance high discrimination items. The discrimination indices are desirable since both the low and high range, are close to 0.69 and the standard deviation is low 0.44.

Research Question Three: To what extent does the option supplied by multiple – choice Civic Education item in 2022 of qualifying Examination in Kafin Hausa Education Zone Jigawa state Nigeria is functional?

Table 3: the Options Supplied by Multiple–Choice Civic Education Item in 2022 of Qualifying Examination in Kafin Hausa Education Zone Based on (3PL) Model of IRT

Items	Asymptote	Items	Asymptote
1	0.07	21	0.03
2	0.00	22	0.26
3	0.04	23	0.07
4	0.43	24	0.03
5	0.11	25	0.35
6	0.29	26	0.11
7	0.22	27	0.20
8	0.00	28	0.00
9	0.02	29	0.04
10	0.25	30	0.05
11	0.02	31	0.21
12	0.00	32	0.00
13	0.03	33	0.05
14	0.27	34	0.00
15	0.16	35	0.03
16	0.01	36	0.13
17	0.00	37	0.23
18	0.23	38	0.00
19	0.18	39	0.12
20	0.15	40	0.20
	Mean = 0.11		**SD = 0.11**

Table 3 showed the guessing (asymptote) values of the multiple – choice Civic Education item in 2022 of qualifying Examination in Kafin Hausa Education Zone Jigawa state Nigeria based on three parameter models. The data revealed that items were ranged from 0.00 to 0.43. Based on the data in Table 4.3, thirty (30) items (75%) that is items 1, 2, 3, 5, 8, 9, 11,12, 13, 15, 16, 17, 19, 20, 21, 23, 24, 26, 27, 28, 29,30, 32, 33, 34, 35, 36, 38, 39 and 31 fall within the c-value range of 0.00 to 0.20 which shows that the items were desirable and the probability of getting an answer correctly by mere guessing is low while ten (10) items (25%) fall within the c-value range of 0.21 to 0.40 that is items 4, 6, 7, 10, 14, 18, 15, 22, 31, and 37 which shows that the items were not very good and the probability of getting an answer correctly by mere guessing is high. It implies that the option supplied by multiple – choice Civic Education item in 2022 of qualifying Examination in Kafin Hausa Education Zone Jigawa state Nigeria is functional to a high extent.

Discussion of Findings

The study showed that items for the year 2022 State qualifying examination in Kafin-Hausa Education Zone Jigawa State, Nigeria had difficulty estimate that ranges from -1.53 of item (25) (the easiest item) to 1.52, 1.57 of items 13 and 40 (the most difficult items). Within this range, twenty-four items had negative difficulty estimate which means twenty-four items are fairly easy items. Also, sixteen items had positive difficulty estimate which implies fairly difficult questions. The study revealed that Data also showed that 30 items which constitutes 75% of total test items with difficulty estimates below 0.5 as easy items; and also, 10 items constituting 25% of the total items with difficulty estimates above 0.51 were presented as difficult items. Based on this information, it can be deduced that 75% of the items were made too easy to even the lower ability examinees to have performed well. The mean of the estimate distribution is 0.00

which suggest that fairly easy items balance fairly difficult items. The difficulty indices are desirable since both the positive and negative range, are close to 0.00 and the standard deviation is low 0.65. The finding is in line with the finding of Moyinoluwa (2015) who revealed a fairly high proportion of the test items have appropriate difficulty index i.e., within ranges 0.25 - 0.75. Validity of test batteries used was fairly good. Other psychometric characteristics were found to be generally acceptable.

The study showed that multiple – choice Civic Education item of 2022 qualifying examination in Kafin Hausa Education Zone Jigawa State had discrimination indices that ranges from 0.00 of item (26) (the poor item) to 1.56 of items 20 (the most discrimination item). The study revealed that the discrimination indices of test items in multiple – choice Civic Education item of 2022 qualifying examination computed had five (5) out of the forty (40) tests items have low discrimination indices between (0.00 - 0.18); eight (8) items have moderate discrimination (i.e., 0.19 - 0.29); five (5) items showed high discrimination (i.e., 0.30 -0.39); and, twenty-two (22) items with a very high discrimination indices (0.40 and above). The study found out that the mean of the estimate distribution is 0.69 which suggest that low discrimination items balance high discrimination items. The discrimination indices are desirable since both the low and high range, are close to 0.69 and the standard deviation is low 0.45. The finding is in line with the finding of Olutola (2015) who that 2008 SSCE biology multiple choice test had mean difficulty index of 0.42 and this is slightly higher than NECO biology multiple choice test with mean difficulty index of 0.40 and 2008 SSCE in biology had a discriminating power of 0.39.

The study revealed that items were ranged from 0.00 to 0.43. Based on the data in Table 4.3, thirty (30) items (75%) that is items 1, 2, 3, 5, 8, 9, 11,12, 13, 15, 16, 17, 19, 20, 21, 23, 24, 26, 27, 28, 29,30, 32, 33, 34, 35, 36, 38, 39 and 31 fall within the c-value range of 0.00 to 0.20 which shows that the items were desirable and the probability of getting an answer correctly by mere guessing is low while ten (10) items (25%) fall within the c-value range of 0.21 to 0.40 that is items 4, 6, 7, 10, 14, 18, 15, 22, 31, and 37 which shows that the items were not very good and the probability of getting an answer correctly by mere guessing is high. It implies that the option supplied by multiple – choice Civic Education item in 2022 of qualifying Examination in Kafin Hausa Education Zone Jigawa State Nigeria is functional to a high extent. The finding is in line with the finding of Ugodulunwa and Barko (2015) who revealed that the examination has low content validity but has reliability coefficient of 0.74, which was moderate. It was concluded that the items were not properly generated and arranged.

Recommendations

Based on the above findings the following recommendations were made:

1. The teacher-made Civic Education Achievement Tests used to examine secondary school students' achievement should be made to pass through all the processes of standardization and validation by conducting item analysis to improve their quality.

2. Psychometricians, test developers and teachers involved in test development should be trained in Item Response Theory Framework. This will enable the advantage of the framework and its overall essence to be appreciated and popularized in our local situation.

3. The government, ministries of education and high-profile stakeholders in education should procure the various IRT analytical software and sponsor the training of individuals to learn the analysis using IRT framework. This way, the framework would have been popularized and the interpretation of the results and usage of the framework will thus be demystified.

Conclusion

Conclusively, the psychometric analysis of 2022 civic education qualifying examination of Jigawa state Nigeria indicated the items had desirable difficulty indices since both the positive and negative range, are close to -0.096 and the standard deviation is low 0.779; it equally has a desirable discrimination power since both the low and high range, are close to 0.69 and the standard deviation is low 0.44; and also the option supplied is functional to a high extent, this implies that, the options supplied are plausible to the extent that it carry away the attention of examinees in picking the right answer among options.

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