



ITEM RESPONSE THEORY ANALYSIS OF ENGLISH STUDIES BASIC EDUCATION CERTIFICATE EXAMINATION IN TARABA STATE, NIGERIA

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ABSTRACT

This study applied Item Response Theory (IRT) to assess the quality of 2022 English Studies Basic Education Certificate Education (BECE) multiple choice items in Taraba State. The study was guided by 2 research objectives and 2 research questions. The survey research design was adopted for the study. The population of the study comprised of 17,574 students' responses to English Studies BECE test items from 285 public schools in Taraba state. A sample of 1000 marked-answered scripts was drawn through the multistage sampling procedure using cluster, simple random and systematic sampling techniques. Data was generated through unobtrusive measures from students' responses in 2022 English Studies BECE Multiple-Choice Questions (MCQs) which was developed by the Education Resource Centre (ERC) and subsequently administered by the Ministry of Education (MOE) to upper basic (JSSIII) students in the state. The data was analysed using the 3PLM of IRTPRO 4.2 to generate item parameter values of difficulty and discrimination. Findings of the study revealed that 41 out of the 60 items are moderately difficulty. Furthermore, 7 items were found difficult and 5 items were found easy. In addition, it was also found that nearly all the items (47) have acceptable *a*-parameter values. Based on these findings, recommendations were made for the study. It was recommended among others that the Taraba state ERC and MOE should involve test experts to improve the quality of items identified as difficult, easy and those with low *a*-parameter values so as to create a more balanced and representative set of test items.

Keywords: Item Response Theory, English studies, BECE, Taraba state, IRTPRO

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Introduction

Assessment is an indispensable tool that plays a significant role in evaluating the extent to which instructional objectives are achieved at different stages of the teaching and learning process. Tontus (2020) defines assessment as “the process of gathering and discussing information from various sources and activities in order to develop a deep understanding of what students know, understand, and can do with their knowledge as a result of their educational experiences”. In education, formative and summative assessments are used to determine the extent to which instructional goals and objectives are attained at various levels in the school. Today, there is hardly any form of teaching or learning that does not accord assessment.

Teachers commonly employ assessment tools like tests to evaluate the effectiveness of the variety of teaching methods they use or even the extent to which behavioural objectives have been achieved in the classroom. Administrators typically study assessment results to make decisions on learners regarding admission, placement, promotion, guidance, and award/reward performance, among others. Counsellors also use students’ assessment results to identify areas of strength and weakness for each student and provide career and professional guidance. Achievement tests are basically developed and administered either by teachers referred to as Teacher-Made Tests (T-M-T) or largely by standardized examination bodies. These tests are commonly used in formative and summative assessments of learners to determine the attainment of instructional objectives. Results obtained from summative assessments, which mostly used to be through Standardized Achievement Tests (SATs), are used to make decisions regarding certification, placement, curriculum planning, and administration, among others (Abdullahi, 2024).

In compliance with the provision of the National Council on Education (NCE) on basic education in Nigeria, the Basic Education Certificate Examination (BECE) was established (National Policy on Education, 2013). The BECE is developed by the Education Resource Centre (ERC) and administered by the Ministry of Education (MOE) in all states, whereas the National Examination Council (NECO) conducts the BECE for unity schools and other government-owned secondary schools established by the Federal Government of Nigeria (FGN). Among other mandates of this examination, students are issued a basic education certificate and placed in Senior Secondary Schools (SSS).

BECE is a high-stake examination designed using the upper basic education curriculum of all subjects offered at the basic education level. It is also mandated that a combination of both core and elective subjects be prescribed for all candidates. In addition, a minimum of ten (10) and a maximum of thirteen (13) subjects are to be offered by all candidates in this examination. Candidates are required to obtain a minimum of 5 credits in both core and elective subjects in order to stand a chance for admission into either science, art, commercial, or technical classes in Senior Secondary School (SSS).

English, originally the language of England has now assumed an international status whereby it is been spoken and used in almost all countries. It is also the lingua franca of international business and most professions in the world. Joshi (2013) states that today, any professional who has a strong grasp on communication skills in English is considered an asset for any business organization. The English language plays a significant role in Nigeria as a whole. Firstly, it serves as the official language of the country in which executive, legislative, and judicial functions are carried out. It is also a core subject that is taught across all levels of education in the country. Furthermore, the English language is the medium of instruction through which the teaching and learning of other subjects are transmitted.

English studies which happen to be the independent variables in this research is designated as a core subject in this examination. It is a prerequisite for all students to pass the subject before becoming eligible for admission in nearly all courses of study (Abdullahi, 2024). This subject is also mandatory as contained in the National Policy on Education (NPE) for all students from primary to secondary school. The understanding of this subject by students is fundamental to their performance in all other subjects because proficiency in English Studies affects proficiency in all subjects (Jacob, Alexander & Shola 2013).

However, the performance of students and the quality of measuring instruments presented for assessments can be examined through item analysis. Item analysis is a type of statistical analysis that is employed to determine the quality or characteristics of test items (Maruf & Aliyu, 2013). These characteristics are used as a yardstick to determine whether a test is valid or reliable. By looking at how students answered each question, educators can identify weak or confusing questions. Overall, item analysis is about making sure the test is fair, effective, and accurately measures what students know and provides other valuable information about student learning.

According to Abdullahi and Darazo (2020), the three most distinctive features of item analysis are the investigation of test items with respect to the b-parameter (difficulty), a-parameter (discrimination), and c-parameter (guessing) values. These parameters, when computed, provide vital information about the effectiveness of the items in a test as well as the ability of the testtakers' who are administered the test. In addition, another two important qualities of a test are the validity and reliability. Validity tells the extent to which a test measured what it was intended to measure, whereas reliability provides the consistency of what has been measured.

Basically, item analysis is performed on an already administered test or a pilot test, with the goal that any test item, when found lacking in quality, will be corrected and improved upon for further use. The analysis of test items is carried out on the principles of generalizability theory, Classical Test Theory (CTT) and Item Response Theory (IRT). CTT and generalizability theory are theories that are concerned of the performance at the test level, while the IRT deals with the behaviour of the individual items as well as the whole test (James & Hariharan, 2015). Furthermore, the IRT being a modern test theory has become the most popularly used test theory by researchers in recent times.

The IRT was basically developed to address some of the shortcomings of the CTT. One of the major shortcomings of the CTT identified by Hambleton, Swaminathan, and Rogers (1991) is the problem of circular dependency, whereby examinee characteristics and test characteristics are inseparable. Hence, one can only be interpreted in the context of the other. Whereas, IRT is based on the notion that any response to an item is determined by the unobservable traits of the testtakers answering the item. As this trait increases, the probability of a correct response to the item also increases. Sometimes, test developers generate items for various uses that they may hardly revisit after their administration to determine how effectively they performed in measuring the underlying construct of interest. Consequently, this may result in presenting test items that are either too easy or too difficult for the majority of the testtakers, as this will defeat the purpose of the assessment.

The achievement of instructional objectives at the end of basic education is annually assessed with the use of a standardized instrument. BECE is the first Standardized Achievement Test (SAT) and also the most important examination that every Nigerian child takes at the completion of basic education in the country. The performance of students in BECE is used as a yardstick to determine their future educational path. Students' performance in both core and elective subjects is used as a prerequisite for admission and placement in science, art, commercial, and vocational classes for senior secondary education. It is impossible to overstate the significance of English studies for students' personal and professional growth. Because of this, both of these topics are now required in primary and secondary education across the nation. All students must do well in these disciplines on exams like the BECE because it affects their chances of continuing their education.

However, despite the status accorded to English studies, it has been observed that there is no empirical evidence of ensuring the quality of BECE test items through the rigorous process of item analyses by either the ERC or MOE in Taraba State. Whereas item analysis reveals important information about the quality of test items presented to students for assessment purposes. Item analysis helps test developers identify areas of strengths and weaknesses in examinations that require complementation and improvement, which will save time and resources in subsequent use. In view of the need to determine the quality of test items constructed by ERC and administered by the MOE to students, this study employed the 3PLM of IRT to examine the parameter values of Taraba State 2022 English Studies BECE test items.

Research Objectives

The objectives of the study were to estimate:

1. The b-parameter (difficulty) values of Taraba State 2022 English Studies BECE.
2. The a-parameter (discrimination) values of Taraba State 2022 English Studies BECE.

Research Questions

The study sought answers to the following research questions:

1. What are the b-parameter (difficulty) values of Taraba State 2022 English Studies BECE test items?
2. What are the a-parameter (discrimination) values of Taraba State 2022 English Studies BECE test items?

Method

The survey research design was adopted for this study. This is because the survey design is efficient at reaching a broad range of participants, increasing the likelihood of capturing a representative sample that reflects the population of interest. According to Creswell (2009), "a survey design provides a quantitative or numeric description of trends, attitudes, or opinions of a population by studying a sample of that population". The multi

stage sampling procedure using cluster, simple random and systematic sampling techniques were used to draw a sample of 1000 from a population of 17574 students’ responses in 2022 Taraba state English Studies BECE. The 2022 English Studies BECE Multiple-Choice Questions (MCQs) was developed by the Education Resource Centre (ERC) and subsequently administered by the Ministry of Education (MOE) to upper basic (JSSIII) students in the state. The data was generated through unobtrusive measures and analysed using the 3PLM of IRTPRO 4.2 to generate b-parameter (difficulty) and a-parameter (discrimination) values, respectively.

RESULTS

Summary of Data

Table 1: Sample of Candidates Responses to Taraba State 2022 English Studies BECE (Candidates=1000; Items =60)

Items	Keys	Candidates														
		001	002	003	004	005	006	007	008	009	010	011	012	013	014	015
i1	D	D	D	D	Multiple	D	C	A	D	B	D	D	A	D	D	D
i2	B	B	B	B	B	A	B	D	B	B	C	B	D	B	B	B
i3	A	A	A	A	A	B	A	A	C	A	A	C	A	D	A	A
i4	A	A	A	A	B	C	D	A	B	A	B	A	B	A	C	A
i5	A	B	A	D	A	C	A	B	A	A	D	A	Blank	B	A	C
i6	B	B	B	B	B	A	C	B	D	C	B	B	A	B	B	B
i7	C	A	C	C	D	C	A	C	B	B	C	C	C	D	B	C
i8	A	A	D	A	A	B	A	A	Blank	C	C	A	A	B	A	D
i9	B	B	B	A	B	D	B	B	B	A	C	A	B	B	B	D
i10	A	D	A	A	A	A	A	B	D	D	C	A	D	B	A	A
i11	A	A	B	A	A	C	A	A	A	A	D	A	A	A	D	B
i12	A	A	A	A	Blank	A	B	A	B	A	B	D	Multiple	A	A	A
i13	D	D	D	D	D	D	D	D	B	D	B	B	D	B	C	D
i14	B	D	B	B	B	C	B	B	D	C	A	C	B	B	B	B
i15	A	A	A	C	A	A	D	A	B	A	C	B	A	D	A	A

Table 1 presents a letter-grade sample of candidates’ responses to Taraba State 2022 English Studies BECE. The list of test items and corresponding key appear in the row, while the list of candidates lies in the column on the spreadsheet.

Table 2: Summary of Binary Scores of Taraba State 2022 English Studies BECE (Candidates=1000; Items =60)

Candidates	Items															Total
	i1	i2	i3	i4	i5	i6	i7	i8	i9	i10	i11	i12	i13	i14	i15	
Candidate 1	1	1	1	1	0	1	0	1	1	0	1	1	1	0	1	11
Candidate 2	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	13
Candidate 3	1	1	1	1	0	1	1	1	0	1	1	1	1	1	0	12
Candidate 4	0	1	1	0	1	1	0	1	1	1	1	0	1	1	1	11
Candidate 5	1	0	0	0	0	0	1	0	0	1	0	1	1	0	1	6
Candidate 6	0	1	1	0	1	0	0	1	1	1	1	0	1	1	0	9
Candidate 7	0	0	1	1	0	1	1	1	1	0	1	1	1	1	1	11
Candidate 8	1	1	0	0	1	0	0	0	1	0	1	0	0	0	0	5
Candidate 9	0	1	1	1	1	0	0	0	0	0	1	1	1	0	1	8
Candidate 10	1	0	1	0	0	1	1	0	0	0	0	0	0	0	0	4
Candidate 11	1	1	0	1	1	1	1	1	0	1	1	0	0	0	0	9
Candidate 12	0	0	1	0	0	0	1	1	1	0	1	0	1	1	1	8
Candidate 13	1	1	0	1	0	1	0	0	1	0	1	1	0	1	0	8
Candidate 14	1	1	1	0	1	1	0	1	1	1	0	1	0	1	1	11
Candidate 15	1	1	1	1	0	1	1	0	0	1	0	1	1	1	1	11

Table 2 presents a summary of the binary scores of candidates’ responses to the Taraba State 2022 English Studies BECE. The list of candidates and responses to each item appear in the row, while the list of test items and totals lies in the column on the spreadsheet. As depicted on the table, a score of 1 indicates candidates correct response to an item, whereas a score of 0 indicates an incorrect response.

Table 3: Frequency Distribution of Binary Scores of Taraba State 2022 English Studies BECE (Candidates=1000; Items =60)

Items	Binary Scores		Items	Binary Scores		Items	Binary Scores	
	1	0		1	0		1	0
Item 1	600	400	Item 21	168	832	Item 41	341	659
Item 2	790	210	Item 22	531	469	Item 42	599	401
Item 3	830	170	Item 23	668	332	Item 43	272	728
Item 4	837	163	Item 24	742	258	Item 44	758	242
Item 5	906	94	Item 25	667	333	Item 45	473	527
Item 6	572	428	Item 26	650	350	Item 46	419	581
Item 7	539	461	Item 27	653	347	Item 47	196	804
Item 8	639	361	Item 28	763	237	Item 48	203	797
Item 9	287	713	Item 29	553	447	Item 49	508	492
Item 10	95	905	Item 30	358	642	Item 50	548	452
Item 11	845	155	Item 31	389	611	Item 51	346	654
Item 12	594	406	Item 32	636	364	Item 52	477	523
Item 13	624	376	Item 33	628	372	Item 53	604	396
Item 14	658	342	Item 34	715	285	Item 54	165	835
Item 15	700	300	Item 35	589	411	Item 55	474	526
Item 16	677	323	Item 36	580	420	Item 56	382	618
Item 17	661	339	Item 37	526	474	Item 57	433	567
Item 18	420	580	Item 38	750	250	Item 58	624	376
Item 19	578	422	Item 39	859	141	Item 59	622	378
Item 20	399	601	Item 40	280	720	Item 60	328	672

Table 3 presents a frequency distribution of binary scores of candidates' responses in the Taraba State 2022 English Studies BECE. A total of 1000 responses were received by each of the 60 MCQs in the instrument, whereas some responses to the items were found blank and others multiple.

Labels for Interpreting Parameter Values

Table 4: Label for Interpreting Item Difficulty Values (Bichi & Talib, 2018)

Interpretation	Range of values
Very easy	-3.00 ≤ -2.00
Easy	-2.00 ≤ -1.00
Moderately difficult	-1.00 ≤ 1.00
Difficult	1.00 ≤ 2.00
Very difficult	b > 2.00

Table 4 provides a range of b-parameter threshold values upon which items are interpreted as easy, moderate, and difficult in the instrument.

Table 5: Label for Interpreting Item Discrimination Values (Baker, 2001)

Interpretation	Range of values
None	0
Very low	0.01 - 0.34
Low	0.35 - 0.64
Moderate	0.65 - 1.34
High	1.35 - 1.69
Very high	> 1.70
Perfect	+ infinity

Table 5 provides a range of a-parameter values upon which items are described as low, moderate, and high in the instrument.

Answers to Research Questions

RQ 1: What is the *b-parameter* (difficulty) values of items in Taraba state 2022 English Studies BECE?

Table 6: *b-parameter* (difficulty) values of items in Taraba state 2022 English Studies BECE based on Three Parameter Logistic Model (3PLM)

Item	B	SEEb	Item	B	SEEb	Item	B	SEEb
1	-0.01	0.98	21	***	***	41	0.63	0.05
2	-1.47*	0.33	22	0.05	0.13	42	1.04**	0.17
3	-5.81*	2.36	23	-0.36	0.13	43	1.00	0.03
4	***	***	24	-0.75	0.17	44	-1.21*	0.37
5	-1.81*	0.22	25	-0.39	0.09	45	0.34	0.08
6	0.12	0.46	26	-0.37	0.23	46	0.38	0.04
7	0.10	0.10	27	-0.26	0.14	47	4.16**	1.19
8	0.91	0.05	28	-0.71	0.13	48	0.91	0.03
9	***	***	29	0.56	0.04	49	0.75	0.04
10	***	***	30	1.28**	0.15	50	-0.05	0.11
11	-0.95	0.14	31	0.88	0.13	51	1.01**	0.17
12	-0.18	0.24	32	-0.27	0.12	52	***	***
13	0.34	0.09	33	-0.16	0.20	53	0.19	0.46
14	0.37	0.09	34	***	***	54	3.52**	1.12
15	-0.88	0.39	35	0.10	0.39	55	0.49	0.20
16	-0.27	0.07	36	0.68	0.06	56	0.95	0.10
17	-0.58	0.18	37	0.12	0.25	57	0.33	0.08
18	0.81	0.04	38	-0.70	0.16	58	-0.09	0.07
19	0.97	0.06	39	-1.32*	0.16	59	0.95	0.05
20	***	***	40	1.54**	0.16	60	1.86**	0.36

*** deleted item ** difficult item * easy item

Table 6 presents forty-one (41) English studies tests items with threshold values that falls within -1.00 to 1.00 as moderately difficult items. In addition, seven (7) item items with threshold values above 1.00 are labelled as difficult items, whereas, five (5) items with values below -1.00 are presented as easy items. Items flagged moderately difficult are: 1, 6, 7, 8, 11, 12, 13, 14, 15, 16, 17, 18, 19, 22, 23, 24, 25, 26, 27, 28, 29, 31, 32, 33, 35, 36, 37, 38, 41, 43, 45, 46, 48, 49, 50, 53, 55, 56, 57, 58, and 59. Items flagged difficult are: 30, 40, 42, 47, 51, 54 and 60. Items flagged easy: 2, 3, 5, 39 and 44.

RQ 2: What is the a-parameter (discrimination) values of tests items in the 2022 English Studies BECE in Taraba state?

Table 7: a-parameter (discrimination) values of items in Taraba state 2022 English Studies BECE based on Three Parameter Logistic Model (3PLM)

Item	A	SEEA	Item	A	SEEA	Item	A	SEEA
1	0.24*	0.08	21	***	***	41	2.28	0.25
2	0.80	0.12	22	1.26	0.16	42	1.47	0.40
3	0.23*	0.09	23	2.03	0.28	43	10.68	2.26
4	***	***	24	1.55	0.19	44	0.75	0.11
5	1.56	0.21	25	2.46	0.30	45	1.95	0.24
6	0.54**	0.12	26	1.10	0.16	46	3.52	0.37
7	2.05	0.27	27	1.75	0.26	47	0.47**	0.21
8	17.76	1.58	28	2.45	0.33	48	22.83	7.29
9	***	***	29	18.35	1.69	49	7.17	1.43
10	***	***	30	1.19	0.31	50	1.46	0.17
11	3.46	0.66	31	1.31	0.32	51	0.77	0.12
12	0.85	0.13	32	1.83	0.24	52	***	***
13	2.97	0.66	33	1.35	0.21	53	0.60**	0.14
14	4.72	1.43	34	***	***	54	0.93	0.55
15	0.70	0.11	35	0.80	0.19	55	0.91	0.16
16	3.48	0.80	36	15.24	7.18	56	20.58	41.00
17	1.12	0.14	37	0.81	0.14	57	1.58	0.18
18	20.29	4.97	38	2.03	0.27	58	2.63	0.30
19	6.28	0.97	39	1.95	0.24	59	8.26	2.47
20	***	***	40	1.42	0.54	60	0.54**	0.13

*** deleted item ** low * very low

Table 7 shows the discrimination values of test items in 2022 English Studies BECE. As shown in the table, six (6) out of the sixty (60) tests items have low discrimination values between (below 0.64), these items are; 1, 3, 6, 47, 53 and 60; fourteen (14) items have moderate discrimination (0.65 – 1.34), these items are; 2, 12, 15, 17, 22, 26, 30, 31, 35, 37, 44, 51, 54 and 55; thirty-three (33) items showed high discrimination (1.35 and above), these items are; 5, 7, 8, 11, 13, 14, 16, 18, 19, 23, 24, 27, 28, 29, 32, 33, 36, 38, 40, 41, 42, 43, 45, 46, 48, 49, 50, 56, 57, 58, and 59.

Discussion

The findings of the study on b-parameter (difficulty) of Taraba State 2022 English Studies BECE items have revealed that forty-one (41) items representing 68% have moderate difficulty values. These are items that fall within the range of -1.00 to 1.00, as used in the study. Furthermore, the English Studies revealed seven (7) difficult items and five (5) easy items. This shows that the majority of the test items in the English Studies BECE are of moderate difficulty values.

This finding is in agreement with Mawak, Efomo and Mustapha (2024); Oyiborhoro, Odili, and Osadebe (2023); Hamza and Aminu (2023); Ohiri (2023); Jimoh and Adediwura (2022); and Batubo and Orluwene (2022), who in different studies all found most of the test items to be of moderate difficulty on the principles of the IRT. Moreover, this finding was further supported by Uduafemhe, Uwelo, John and Karfe (2021); Oguguo and Lotobi (2019); Okocha (2019); Ajeigbe (2018); and Joe-Kinanee and Opara (2017), who in separate studies found more than half of the test items to have moderate difficulty values. The consistency of these findings across multiple studies strengthens the credibility of the conclusion.

However, this finding contradicts Essien, et al. (2024); Abdullahi (2018); Mustapha (2018); Abubakar (2018); Kusamawati and Hadi (2018); Joe-Kinanee and Orhuwene (2017); Ani (2014); and Adedoyin and Makobi (2013), who all found in separate studies more easy and difficult test items. In practical terms, the implication of this finding is that the English Studies BECE instrument in Taraba State is well-balanced, offering a fair representation of difficulty levels. This balance is seen as beneficial for average learners, as they would likely find the majority of the test items to be of moderate difficulty, allowing for a more accurate assessment of their knowledge and skills in the subject.

The findings of the study on a-parameter (discrimination) of Taraba State 2022 English Studies BECE revealed that forty-seven (47) items representing 89% showed an acceptable range of discrimination values. Furthermore, the English studies BECE displayed six (6) items representing 11% with low discrimination values. This means that nearly all the items in the instrument discriminate well between the high and low achievers in the examinations.

This finding agrees with Mawak, Efomo and Mustapha (2024); Hamza and Aminu (2023); Oyiborhoro, Odili and Osadebe (2023); Ohiri (2023); Batubo and Orluwene (2022); and Maxwell, Danladi, Sunday and Roseline (2021), who in separate studies reported that the items discriminate well in the examination. This finding also tallies with results from Oguguo and Lotobi (2019); Okocha (2019); Abdullahi (2018); Kusamawati and Hadi (2018); Joe-Kinanee and Opara (2017); and Ani (2014), who separately discovered most of the items with an acceptable range of discrimination values.

However, this finding disagrees with results in Essien et al. (2024); Jimoh and Adediwura (2022); Mustapha (2018); Ajeigbe (2018); Kusamawati and Hadi (2018); and Joe-Kinanee and Orhuwene (2017), who all found low discrimination among the majority of the test items computed for different examinations. The overall implication of this finding is that the items with good or moderate difficulty values, coupled with high discrimination values, contribute to the overall quality of the examination. Test items that effectively discriminate between high and low achievers provide a more accurate assessment of students' proficiency levels.

Conclusion

Based on the findings from the study, it was concluded that majority of test items in the Taraba State 2022 English Studies BECE test items are found to be moderately difficult and within the acceptable range of IRT b-parameter values. In addition, the examination was able to discriminate well between high and low achievers as majority of the items in the instrument displayed acceptable a-parameter values.

Recommendations

Based on the findings of the study, the following recommendations were made:

1. Taraba State ERC should improve the difficulty levels of the identified difficult and easy items to create a more balanced and representative set of test items. This adjustment should aim to provide a fair assessment of students' proficiency across a range of difficulty levels.
2. Taraba State ERC should conduct a thorough review of items with low discrimination values in both 2022 English Studies and Mathematics BECE. Involve subject matter experts, educators, and assessment specialists to identify potential shortcomings in the content, wording, or structure of these items.

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