

Analysis of Past West Africa Examination Council / Senior Secondary Certificate Examination Physics Essay Test Items Parameters: Application of IRT Polytomous Model

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Abstract

The study aimed at determining the quality of the WAEC SSCE Physics essay test items for 2015, 2016 and 2017, if they are acceptable when the item response theory (IRT) Polytomous model is applied. A descriptive survey research design was adopted and sampled 1000 senior secondary school students from the 27,615 students who registered for the 2018 senior school certificate physics examination in Delta State, Nigeria. Findings revealed that most of the May/June WAEC SSCE Physics essay test items for year 2015, 2016 and 2017 are not acceptable when the item response theory (IRT) Polytomous model is applied among as presented in this study. It was therefore recommended that test developers should always ensure proper test items validation before use.

Keywords: Parameters, IRT, Polytomous Model, Test Items, WAEC, Physics, Essay Test.

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1. Introduction

West African Examination Council (WAEC) saddled with the responsibility of conducting examination related issues, in particular the senior secondary school examination (SSCE) in her curriculum/syllabus identified physics as one of the core science subjects which is the study of matter, energy and their interactions. Technological development encompasses the application of the principles of physics and it describes how the natural world works through applied Mathematical formulas. The Senior School Certificate Examination papers are made up of two parts, objectives and essay test items. While the objective test items constitute twenty-five percent (25%), the essay test items constitute seventy-five percent (75%) of the total marks earned by the examinees. There is an outcry in the West African Examination Council report on poor performance especially in the science related subjects. In view of this, researchers have been making effort to proffer solution to the problem. Some of the studies focused on the teachers as a factor, others are on students study habit, learning environment and so on. Few or no studies have been carried out on the nature and quality of the test items administered on the students. Where such studies are carried out they dwelled on the objective test items which constitute 25% of the examination. Two major theories have been developed and available for psychometricians in determining the quality and characteristics (items parameters) of test items that are administered to examinees. They are classical test theory (CTT) and item response theory (IRT). While CTT has dominated and remained a leading framework for analyzing and developing standardized test items, it lacks the ability for analyzing essay test items. To this end, a modern theory, known as the Item Response Theory (IRT) was developed to correct the limitations of the CTT. Item Response Theory has two categories of model – dichotomous and polytomous model. While the dichotomous models deals with objective test items, the polytomous model is used for essay test items. The Polytomous model was adopted for this study as the study is aimed at dealing with essay test items.

Item Response Theory (IRT) has become a contemporary issue in psychological and educational assessment in recent times. IRT as described "New psychometric term" is popular in psychological testing, test manuals and journals and very soon psychologists who do not know about item response theory will be a minority and very much at a disadvantage in their research (Hambleton, 2004; Navas, 2001) reported that in Spain today there are several books as general testing practices in relation to IRT. Han & Hambleton (2007) stated that item response theory is a popular and valuable framework for modelling educational and psychological tests data, due to its attractive properties such as the invariance of item and examinee parameter values being reported on a common scale. The theory is built on three basic assumptions, first is that the items are measuring a single latent variable ranging from - to + i.e. unidimensional trait. This assumption refers to the fact that is assumed to be a unidimensional random variable and not a multidimensional random vector. The trait is measurable on a scale i.e. the mere existence of a test assumes this, typically set to a standard scale with a mean of 0.0 and a standard deviation of 1.0. The second assumption is "local independence" which means that items are not related except for the fact that they measure the same trait which is equivalent to the assumption of unidimensionality. Thirdly, that the item response function gives the probability that a person with a given ability level will answer correctly

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Table of Contents West Africa Examination Literature In English Paper 3 Question

1. Understanding the eBook West Africa Examination Literature In English Paper 3 Question
 - The Rise of Digital Reading West Africa Examination Literature In English Paper 3 Question
 - Advantages of eBooks Over Traditional Books
2. Identifying West Africa Examination Literature In English Paper 3 Question
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an West Africa Examination Literature In English Paper 3 Question
 - User-Friendly Interface
4. Exploring eBook Recommendations from West Africa Examination Literature In English Paper 3 Question
 - Personalized Recommendations
 - West Africa Examination Literature In English Paper 3 Question User Reviews and Ratings
 - West Africa Examination Literature In English Paper 3 Question and Bestseller Lists
5. Accessing West Africa Examination Literature In English Paper 3 Question Free and Paid eBooks

- West Africa Examination Literature In English Paper 3 Question Public Domain eBooks
- West Africa Examination Literature In English Paper 3 Question eBook Subscription Services
- West Africa Examination Literature In English Paper 3 Question Budget-Friendly Options
- 6. Navigating West Africa Examination Literature In English Paper 3 Question eBook Formats
 - ePub, PDF, MOBI, and More
 - West Africa Examination Literature In English Paper 3 Question Compatibility with Devices
 - West Africa Examination Literature In English Paper 3 Question Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of West Africa Examination Literature In English Paper 3 Question
 - Highlighting and Note-Taking West Africa Examination Literature In English Paper 3 Question
 - Interactive Elements West Africa Examination Literature In English Paper 3 Question
- 8. Staying Engaged with West Africa Examination Literature In English Paper 3 Question
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers West Africa Examination Literature In English Paper 3 Question
- 9. Balancing eBooks and Physical Books West Africa Examination Literature In English Paper 3 Question
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection West Africa Examination Literature In English Paper 3 Question
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine West Africa Examination Literature In English Paper 3 Question
 - Setting Reading Goals West Africa Examination Literature In English Paper 3 Question
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of West Africa Examination Literature In English Paper 3 Question
 - Fact-Checking eBook Content of West Africa Examination Literature In English Paper 3 Question
 - Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development

- Exploring Educational eBooks

14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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