DEVELOPMENT AND VALIDATION OF ESSAY TEST ASSESSOR FOR SENIOR SCHOOL CERTIFICATE EXAMINATION IN NIGERIA

By

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A Ph.D. RESEARCH REPORT PRESENTED TO THE DEPARTMENT OF SOCIAL SCIENCES EDUCATION, FACULTY OF EDUCATION, UNIVERSITY OF ILORIN, ILORIN, NIGERIA IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF DOCTOR OF PHILOSOPHY DEGREE (Ph.D.) IN EDUCATIONAL RESEARCH, MEASUREMENT AND EVALUATION

MARCH, 2021

DECLARATION

I hereby declare that this Thesis entitled "Development and Validation of Essay Test Assessor for Senior School Certificate Examination in Nigeria" was written by me and it has been the record of my own work. I also proclaim that neither the whole work nor any part of it has been, is being or is to be submitted for another degree at this or any other University or examining body.

Signature:…………………………..

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March, 2021

CERTIFICATION

This is to certify that this study entitled "Development and Validation of Essay Test Assessor for Senior School Certificate Examination in Nigeria" was carried out by SOWUNMI, Emmanuel Tolulope (11/68OH014), and has been read and approved as meeting part of the

requirements of the Department of Social Sciences Education, Faculty of Education, University of Ilorin, Ilorin, Nigeria for the award of Doctor of Philosophy (Ph.D.) Degree in Educational Research, Measurement and Evaluation.

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DEDICATION

To the King of all Kings, the father of all potentials.

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ABSTRACT

Objective and essay tests are commonly used measurement instruments for assessment of learning outcomes. The advent of computers for scoring tests has improved the speed and accuracy of assessment even for large scale examinations. Scoring of objective tests using computer is accurate but the same is not true of essay tests. Moreover, research on assessment of essay tests using automated grading system is quite scarce in Nigeria. Studies have shown that that scoring of essay tests has depended on training of computers with as many model answers as 100 or more. There is the need to improve on this; therefore, this study has been designed to use one model answer for scoring essay tests. The objectives of the study were to: (a) develop the Essay Test Assessor (ETA); (b) examine the scores from ETA for grading Economics essay test items; (c) examine the scores from human raters; (d) determine the validity of students' scores from ETA and human raters; and (e) determine the efficiency and speed with which the ETA operates in assessing essay test items.

The study adopted the correlational research design of development and validation of Essay Test Assessor. A sample of 1,200 senior secondary II students was drawn from a population of 11,932 offering Economics in public schools in South-west, Nigeria. The multi-stage sampling procedure was used to select three out of six States and 55 public secondary schools out of 1,102 across South-west, Nigeria. All responses were scored by 32 human raters and ETA. The data collected were analysed using descriptive and inferential statistical. Respondents' scores that fell between 1–6, 7–12 and 13–18 were categorised as low, average and high scores respectively base on their general performance.

The findings of the study were that:
  i.   the developed ETA was validated by human raters (experts) with a grand mean of 9.57;
  ii.   analysis of scores resulting from ETA showed that 11.7%, 57.9% and 30.5% of the sampled students were in the low, average and high score categories respectively;
  iii. analysis of scores resulting from human raters showed that 40.97%, 46.8% and 12.23% of sampled students were in the low, average and high score categories respectively;
  iv.   level of agreement obtained between ETA and human raters was 0.79 using Linear Kappa and 0.69 using Spearman's rho; and
  v.   mean time taken by ETA for scoring across all items and persons was 0.00002 seconds compared to that of human raters at 5.59 minutes.

The study concluded that ETA yielded valid scores comparable to human raters for scoring short-response essay items. The ETA has confirmed the possibility of using one model answer for scoring short-response essay test items. It implies that training of grading systems to score using multiple model answer could be eliminated and one model answer is possible and effective. The study recommended that ETA should be trial-tested and ultimately adopted by senior school examination bodies for scoring short-response essay items in Economics.

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Appendix

MARKING GUIDE (Questions and Answers)

1a.*What is peasant farming?*
Peasant farming refers to a practice where the purpose of farming is for <u>family (subsistence) consumption</u>. The output of the farm is both for subsistence and for sale. The <u>labour is mostly supplied by the farmer and his family</u>. <u>Simple farm implements</u>/equipment are used.
1 mark for each point = *3marks*

b. *What is co-operative farming?*
Co-operative farming refers to the farming activity where farmers of the <u>same agricultural produce</u> form an <u>association and pool resources</u> together in order to enjoy certain <u>incentives from government</u> and produce on a large scale. They also provide <u>marketing facilities</u> for their produce.
½ mark for each point = *2 marks*

c. *Identify five ways the government can assist peasant farmers.*
i. Establishment of rural and agricultural banks to provide credit facilities for the peasant farmers
ii. Provision of subsidies: farming inputs and equipment should be sold to the farmers at subsidized rates.
iii. Control of pests and diseases: The government can supply chemicals and pesticides at a subsidized rate.
iv. The provision of infrastructural facilities in the rural area to stem rural-urban migration so as to retain labour for agricultural purposes.
v. Land reforms which make larger land available to farmers
vi. Provision of storage facilities e.g. silos, cold room, etc so as to minimize post-harvest losses
vii. Employment of extension workers to provide training for the farmers.
viii. Marketing facilities should be made available e.g. improved transportation, establishment of market stalls in rural areas e.t.c
ix. Implementation of adequate pricing policy to stabilize farmers' incomes
x. Establishment of agro-based industries to make use of farm produce.
1 mark for each point = *5 marks*

2a. *Define an industry.*
An industry is a <u>group of firm or</u> businesses that <u>produce similar or</u> identical goods or services.
1 mark for each point = *2 marks*

For example in the petroleum industry we have different firms like Oando, Total, Exon Mobil etc all these firms are under different management but all produces similar products.
1 mark for a correct example

b. *Explain four types of industry in Nigeria with relevant examples*
i. Manufacturing/process industry
ii. Construction industry
iii. Service industry
iv. Mining Industry

v. Transport Industry
vi. Power and energy industry
vii. Petroleum industry
viii. Communication industry
ix. Agricultural industry
½ mark for each correct point = *2 marks*

3a.***Define Supply***
Supply can be defined as the <u>quantity of a given good</u> or service which a producer is <u>willing, able and ready</u> to offer for sale over a period of <u>time</u> at a particular market <u>price</u>.
½ mark for each point = *2 marks*

bi. ***Explain change in supply***
It refers to a <u>bodily shift</u> of the supply curve either to the right or to the left. This is caused by all <u>other factor</u> that bring about changes in supply ***other than price*** of the commodity itself.
A <u>shift to the right indicates an increase</u> in supply while a shift to the left shows a decrease in supply.
½ mark for each point = *1½ marks*
ii. ***Explain change in quantity supplied***
This is known as <u>movement along the same supply curve</u> as a result of <u>changes in price of the commodity itself</u>. A <u>rise in price of a commodity or service will bring about increase</u> in the quantity supplied and vice versa.
½ mark for each point = *1½ marks*

4a. ***What is inflation?***
Inflation is a <u>persistent and continuous increase</u> in the <u>general price level</u> of goods and services.
1 mark for each point = *2 marks*

b. Explain the concepts of
i. demand-pull inflation
Demand-pull inflation occurs when <u>excessive demand for goods</u> and services result in a <u>continuous increase</u> in the prices of goods and services.
½ mark for each point = *1½ marks*

ii. cost-push inflation
Cost-push inflation occurs when an <u>increase in the cost of factors of production</u> results in <u>increase in the prices</u> of goods and services.
½ mark for each point = *1½ marks*

5a. Define land as a factor of production.
Land can be defined as a <u>free gift of nature</u>. It is used in <u>production process</u>, it includes the <u>earth</u>, <u>oceans</u>, <u>sea</u>, <u>forestry</u>, <u>natural resources</u> etc
½ mark for each point = *1½ marks*

b. State three features of land
1. It is a free gift of nature.
2. Land is geographically immobile
3. Land is fixed in supply

4. It varies in quality and value due to location.
5. The reward of land is rent.
6. Land is heterogeneous in nature
7. It can be used for collateral
8. Land is subject to law of diminishing return.
½ mark for each point = *1½ marks*

c. Explain four benefits of land to your country.
1. It provides area for agricultural activities
2. It is used for mining and quarrying
3. It is used for transportation purposes/means.
4. It is used for site and material for production purposes.
5. It provides employment opportunities e.g fishermen, farmers, miners and lumbers
6. It is a source of income to government in terms of tax and rent.
½ mark for each point = *2 marks*

APPENDIX II

UNIVERSITY OF ILORIN, ILORIN
FACULTY OF EDUCATION
DEPARTMENT OF SOCIAL SCIENCE EDUCATION
RESEARCH PROFORMA

Dear Respondent,

Am a PhD student at the department of social science education, University of Ilorin, seeking to elicit relevant information on a research titled *development and validation of essay test assessor for senior secondary school certificate examination in Nigeria.*

This proforma is designed to elicit responses that will be used in fulfilling the research objectives of this study. Kindly, respond to the questions with sincerity and accuracy as much as possible. You are assured that all responses will certainly be treated with utmost confidentiality and purely for the research purpose.

Thank you for your time and invaluable contribution.

SOWUNMI, Tolulope E.
_____

Class: _____
Gender: Male (   )   Female (   )   {*Kindly tick as appropriate*}
Age: _____

QUESTIONS
1a. What is peasant farming?
_____

_____

b. What is co-operative farming?
_____

_____

c. Identify five ways the government can assist peasant farmers.
_____

_____

_____

_____

_____

2a. Define an industry.
_____

b. Mention *four types of industries* in Nigeria.

_____

_____

_____

_____

3a. Define Supply

_____

_____

bi. Explain change in supply.

_____

_____

ii. Explain change in quantity supplied.

_____

_____

4a. What is inflation?

_____

_____

b. Explain the concepts of **i.** *demand-pull inflation.*

_____

_____

ii. *cost-push inflation*

_____

_____

5a. Define land as a factor of production.

_____

_____

b. State three features of land

_____

_____

_____

c. Explain four benefits of land to your country.

_____

_____

_____

_____

LIST OF ACRONYMS

AWA	-	Analytical Writing Assessment
AI	-	Artificial Intelligence
ACARA	-	Australian Curriculum Assessment and Reporting Authority
AEG	-	Automated Essay Grading
AES	-	Automated Essay Scoring
AES	-	Automated Essay System
AGS	-	Automated Grading Systems
AWE	-	Automatic Writing Evaluation
CIE	-	Cambridge International Examinations
CSS	-	Cascading Style Sheets
COW	-	Common Words
CAA	-	Computer Aided Assessment
CAT	-	Computer Assisted Testing
CBA	-	Computer Based Assessment
CbAS	-	Computer-based Assessment Systems
CBT	-	Computer-Based Testing
CAT	-	Computerized Adaptive Testing
CRASE	-	Constructed-Response Automated Scoring Engine
C-rater	-	Content Rater
DTL	-	Decision Tree Learning
ETS I	-	Education Testing Service I
ETS	-	Educational Testing Service
E-Rater	-	Electronic Rater
ES4ES	-	Expert System for Essay Scoring
GCE	-	General Certificate Examination
GCSE	-	General Certificate of Secondary Education
GMAC	-	Graduate Management Admission Council
GMAT	-	Graduate Management Admissions Test
GRE	-	Graduate Record Examination
HTML	-	Hypertext Markup Language
ICT	-	Information and Communication Technologies
IE	-	Information Extraction
IR	-	Information Retrieval
IAT	-	Intelligent Assessment Technologies
IEA	-	Intelligent Essay Assessor
ICC	-	Interclass Correlation Coefficient
JAMB	-	Joint Admissions and Matriculation Board
LSA	-	Latent Semantic Analysis
LWA	-	Lexile Writing Analyzer
LIWC	-	Linguistic Inquiry and Word Count
LCS	-	Longest Common Subsequence
ML	-	Machine Learning
MOOCs	-	Massive Open Online Courses
MsNLP	-	Microsoft Natural Language Processing
MCQ	-	Multiple Choice Questions
MySQL	-	My Structured Query Language
NASOP	-	National Assessment and Surveys Online Program

NAEP	-	National Assessment of Educational Progress
NECO	-	National Examination Council
NLP	-	Natural Language Processing
NJIT	-	New Jersey Institute of Technology
NOUN	-	Nigerian Open University of Nigeria
NATO	-	North Atlantic Treaty Organization
OCR	-	Oxford, Cambridge and RSA Examinations
PHP	-	Personal Home Page
UTME	-	Post Unified Tertiary and Matriculation Examination
PEG	-	Project Essay Grade
SAT-W	-	SAT writing (SAT-W)
SEAR	-	Schema, Extract, Analyze and Report (SEAR)
SD	-	Semantic Distance (SD)
SSCE	-	Senior School Certificate Examination (SSCE)
SVD	-	Singular Value Decomposition (SVD)
SD	-	Software Development (SD)
SDM	-	System Development Methods (SDM)
TF-IDF	-	Term Frequency–Inverse Document Frequency (TF–IDF)
TOEFL	-	Test of English as a Foreign Language (TOEFL)
TOEIC	-	Test of English for International Communication (TOEIC)
THEA	-	Texas Higher Education Assessment
UTME	-	Unified Tertiary Matriculation Examination
UCLES	-	University of Cambridge Local Examinations Syndicate
WbA	-	Web-based Assessment
WAEC	-	West African Examination Council
WASSCE	-	West African Senior School Certificate Examination
WAT	-	Writing Analysis Tool

UNIVERSITY OF ILORIN, ILORIN, NIGERIA
DEPARTMENT OF SOCIAL SCIENCES EDUCATION
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3rd July, 2018.

Our Ref:_____ Your Ref:_____ Date:_____

TO WHOM IT MAY CONCERN
REQUEST FOR RESEARCH ASSISTANCE

SOWUNMI, Emmanuel Tolulope (Matric.No: 11/68OH014) is a Postgraduate Student of the Department of Social Sciences Education, University of Ilorin. He is currently undergoing a Research Project on:

"Development and Validation of Essay Test Assessor for Senior Secondary Certificate Examination in Nigeria".

Kindly render him all possible assistance in this regard.

Thanks for your anticipated understanding and cooperation.

Head
Dept. of Social Sciences Education
University of Ilorin

Dr. (Mrs.) B. O. Olawuyi
Head of Department

Professors in the Department: PROF. C. O. DARAMOLA, PROF. O. E. ABDULLAHI,
PROF. (MRS) F. A. O. OLASEHINDE-WILLIAMS, PROF. (MRS.) A. A. JEKAYINFA

UNIVERSITY OF ILORIN, ILORIN, NIGERIA
UNIVERSITY ETHICAL REVIEW COMMITTEE

Vice Chancellor:Prof. S.A. Abdulkareem
B.Che, M.ChE, (Detroit); Ph.D. (Louisville),
MNAICh, MNSE, MACS, R.Eng. (COREN).
Registrar:Dr, (Mrs) F.M. Olowoleni
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Our Ref:

Date:

UIL/UERC/11/68OH014

14ᵗʰ February, 2019

Protocol Identification Code: UERC/EDU/280
UERC Approval Number: UERC/ASN/2019/1563

DEVELOPMENT AND VALIDATION OF ESSAY TEST ASSESSOR FOR SENIOR SECONDARY
CERTIFICATE EXAMINATION IN NIGERIA

Name of applicant/Principal Investigator: SOWUNMI, Emmanuel Tolulope
Address of Applicant: Department Social Sciences
Faculty of Education,,
University of Ilorin, Ilorin.
Type of Review: Full Committee Review...
Date of Approval: 14/02/2019

Notice of Full Committee Approval

I am pleased to inform you that the research described in the submitted proposal has been reviewed by the University Ethical Review Committee (UERC) and given full Committee approval.

This approval dates from 14/02/2019 to 13/02/2022, and there should be no participant accrual or any activity related to this research to be conducted outside these dates.

You are requested to inform the committee at the commencement of the research to enable it appoints its representative who will ensure compliance with the approved protocol. If there is any delay in starting the research, please inform the UERC so that the dates of approval can be adjusted accordingly.

The UERC requires you to comply with all institutional guidelines and regulations and ensure that all adverse events are reported promptly to the UERC. No charges are allowed in the research without prior approval by the UERC. Please note that the UERC reserves the right to conduct monitoring/oversight visit to your research site without prior notification.

Thank You,

Ismaila Isah
For: University Ethical Review Committee
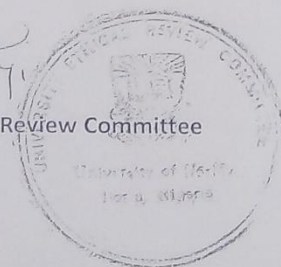
"....If it's not ethical, it's not scientific, if it's not scientific it's not ethical"

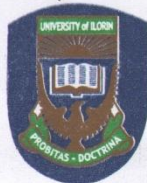# UNIVERSITY OF ILORIN, ILORIN, NIGERIA
POSTGRADUATE SCHOOL

Zahra Ishowo-Jaji House

Vice-Chancellor:
Prof. S. A. Abdulkareem
B.ChE (Detroit); Ph.D. (Louisville);
MNAICh; MNSE; MACS; R.Eng (COREN)

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UIL/PGS/42   4th September, 2019

SOWUMI, Emmanuel Tope
Matric. No.: 11/68OH014
Department of Social Sciences Education
Faculty of Education
University of Ilorin
Ilorin.

Dear **Sowumi,**

APPROVAL OF DOCTORAL RESEARCH PROTOCOL

I am pleased to inform you that, the Board of Postgraduate School at its 282nd Meeting held on Wednesday, 21st August, 2019 considered and approved your Doctoral Research Protocol titled:

Development and Validation of Essay Test Assessor for Senior Secondary Certificate Examination in Nigeria

You are therefore, to proceed with your Ph.D. programme accordingly, please.

Congratulations.

Yours sincerely,

M.A. Alfanla
Secretary, Postgraduate School

MA/JB

Name: SOWUNMI, Emmanuel Tolulope   **Matric No.: 11/68OH014**
          Degree in view: Ph.D.
Programme: Educational Research, Measurement and Evaluation

Proposed Research Title: Development and Validation of Essay Test Assessor for Senior Secondary Certificate Examination in Nigeria

Student start in November 2015	15/11/15	15/12/15	15/01/16	15/02/16	15/03/16	15/04/16	15/05/16	15/06/16	15/07/16	15/08/16	15/09/16	15/10/16	15/11/16	15/12/16	15/01/17	15/02/17	15/03/17	15/04/17	15/05/17	15/06/17	15/07/17	15/08/17	15/09/17	15/10/17	15/11/17	15/12/17	15/01/18	15/02/18
Task	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Literature Review	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
Compiling literature review & course work						█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█							
Proposal writing and presentation																			█	█	█	█	█	█	█	█	█	█
Data collection, sorting, coding & analysis																												
Report Writing, Acknowledgement, Appendices																												
Post Field Presentation / Title Reg.																												
Final Defense/ Final Thesis Submission																												

Timeline Continues …

Student start in November 2015	15/04/19	15/05/19	15/06/19	15/07/19	15/08/19	15/09/19
Task	4 3	4 4	4 5	4 6	4 7	4 8
Literature Review						
Compiling literature review & course work						
Proposal writing and presentation						
Data collection, sorting, coding & analysis						
Report Writing, Acknowledgement, Appendices						
Post Field Presentation / Title Reg.						
Final Defense/ Final Thesis Submission						

APPENDIX VII
BUDGET:

The following is a breakdown of the estimated expenditure for the proposed study

DESCRIPTION	INCOME (₦)	EXPENDITURE (₦)
Personal Savings	1,600,000	
Tuition Fees		450,000
Departmental Charges (Proposal/Final Defense)		50,000
Stationary, books, journal and internet		130,000
Laptop		165,000
Honorarium for Research Assistants		180,000
Field work Accommodation and Transportation		200,000
Training and development of the software (ETA)		195,000
Printer and Toner		90,000
Printing Materials, Analysis, Binding and Others		80,000
Miscellaneous Expenses		60,000
TOTAL	1,600,000	1,600,000