THE EFFECT OF JIGSAW STRATEGY AND MASTERY LEARNING MODULES ON MATHEMATICS STUDENTS' ATTITUDE AND ACHIEVEMENTS IN NIGERIAN SCHOOLS

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Abstrak

Pencapaian Matematik yang secara berterusan kurang memberangsangkan di sekolah menengah di Nigeria merupakan satu isu yang menjadi perhatian Kerajaan Persekutuan Nigeria. Justeru, kajian berkaitan strategi pengajaran Matematik adalah perlu untuk melaksanakan kajian secara berterusan tentang faktor yang menyumbang kepada pencapaian yang tidak yang efektif perlu dilaksanakan secara berterusan supaya ia dapat menyumbang kepada peningkatan pencapaian Matematik di Nigeria. Guru Matematik di Nigeria telah lama berasa selesa untuk mengajar Matematik. Hal ini telah mempengaruhi sikap terhadap matematik dan pencapaian matematik pelajar Nigeria. Tujuan kajian ini adalah untuk mengenal pasti kesan penggunaan Modul Strategi Pembelajaran Koperatif Jigsaw dan Modul Pembelajaran Masteri ke atas sikap terhadap matematik dan pencapaian Matematik dalam kalangan pelajar sekolah di Nigeria. Kajian ini menggunakan gabungan pendekatan kuantitatif dan kualitatif. Reka bentuk kuasi-eksperimen ujian pra dan ujian pasca telah digunakan untuk mengutip data kuantitatif melalui ujian pencapaian matematik dan ujian sikap terhadap matematik. Data kualitatif telah dikutip melalui temu bual dan pemerhatian berpandukan senarai semak pemerhatian. Populasi sasaran bagi kajian ini ialah 5901 pelajar senior Secondary School One (SS1) di Gombe State, Nigeria. Seramai 120 orang pelajar SS1 telah terlibat dalam kajian ini dan mereka telah dibahagikan kepada dua kumpulan rawatan dan satu kumpulan kawalan. Kumpulan rawatan pertama dan kedua masing-masing diajar menggunakan Modul Strategi Jigsaw (JS) dan Modul Strategi Jigsaw dan Pembelajaran Masteri (JSML). Kumpulan kawalan diajar menggunakan pendekatan konvensional. Data kuantitatif dianalisis menggunakan ANCOVA. Data kualitatif pula dianalisis secara tematik. Dapatan kajian menunjukkan terdapat peningkatan skor Matematik bagi kumpulan JSML dan JS. Pencapaian pelajar kumpulan JSML adalah lebih baik berbanding dengan pencapaian pelajar kumpulan JS dan terdapat perbezaan yang signifikan secara statistik antara kumpulan kawalan dan kumpulan rawatan ($p < .05$) bagi skor ujian pasca sikap dan ujian pasca Matematik. Data kualitatif menunjukkan maklum balas yang positif diberikan oleh guru terhadap modul bagi kumpulan JSML dan JS. Majoriti pelajar menunjukkan sikap positif terhadap Matematik dan hal ini telah menyumbang kepada peningkatan dalam pencapaian Matematik.

Kata kunci: Pembelajaran koperatif, Strategi Jigsaw, Pembelajaran Masteri, Pencapaian Matematik, Sikap Matematik, Sikap terhadap Matematik.

Abstract

The persistent poor Mathematics achievement in Nigeria's secondary schools is an issue that has long been a concern of the Federal Government of Nigeria. Hence, it is necessary to carry out continuous research on effective teaching strategies so that it can contribute to the improvement of Mathematics achievement in Nigeria. Mathematics teachers in Nigeria have long been complacent to teach Mathematics using the conventional approach. This approach has been influencing Nigerian students' attitude towards mathematics and their mathematics achievement. This study aims to determine the effect of Jigsaw Strategy and Mastery Learning Modules on attitude towards mathematics and their mathematics achievements among secondary schools students in Nigerian. This study used mixed methods. A Non-equivalent controlled pre-test post- test quasi-experimental design was used to collect the quantitative data via Mathematics attitude and Mathematic achievement test. The qualitative data was collected via interviews and observation checklist. The target population of this study was 5901 Senior Secondary School One (SS1) Students in Gombe State, Nigeria. A total of 120 SS1 students had participated in this study and they were divided into two treatment groups and one control group. The first and second treatment groups were respectively taught Mathematics using the Jigsaw and Mastery Learning (JSML) approach and the Jigsaw Strategy (JS) approach. The control group was conventionally taught. The quantitative data were analyzed using Analyses of Covariance (ANCOVA) while the qualitative data was thematically analyzed. The findings show that there was improvement in the JSML and JS groups' Mathematics scores. The JSML group students achieved better than their JS group counterparts and a statistically significant difference was observed between the control and treatment groups ($p < .05$) in the Mathematics Topics post-test and the attitude post- test scores. The qualitative data revealed favorable responses from the teachers towards the use of modules for JSML and JS groups. Majority of the students had positive attitude towards Mathematics which contributed towards the increase in Mathematics achievement.

Keywords: Cooperative learning, Jigsaw strategy, Mastery learning, Mathematics achievement, Mathematics attitude

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Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

CHAPTER ONE

INTRODUCTION

1.1 Introduction

Mathematics plays a significant role in class programme globally because it is employed in day - to - day life (Ahmad, Fatimah, Latih, & Hidayah, 2010; Baglama, Yikmis, & Demirok, 2017; Kakkar, 2016; Olosunde & Olaleye, 2010).It is a significant subject critical to understanding different major fields. To buttress this claim Akinsanya, Ajayi, and Salomi (2011) remarked that Mathematics is the queen and servant of all fields of study.

Furthermore, Aguele and Usman (2007) described Mathematics as an application obtainable for building theories in science and different areas of endeavor. This is often seen as a result of human thinking that promotes logical understanding among people. In addition, it provides a good manner of building mental disciplines, impulses, reasoning and mental rigor (Ale & Adetula, 2010). Mathematics is thus much more than the power to calculate, memorize formulae, or solve equations. Rather, it trains and promotes reasoning (Lappan & Schram, 1989).

Due to the importance of Mathematics to the society, the Nigerian government enacted a policy that created the study of the subject as obligatory for all levels of education (Federal Republic of Nigeria, 2004). Consequently, credit pass in Mathematics becomes a necessity demand for admission into tertiary institutions within the country. (Nigerian Universities Commission, 2016). As a mark of

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Appendix A
Letter of Data Collection

AWANG HAD SALLEH
GRADUATE SCHOOL OF ARTS AND SCIENCES
UUM College of Arts and Sciences
Universiti Utara Malaysia
06010 UUM SINTOK
KEDAH DARUL AMAN
MALAYSIA

Tel: 604-928 5299/5260/5254
Faks (Fax): 604-928 5297/5298
Laman Web (Web): http://ahsgs.uum.edu.my

KEDAH AMAN MAKMUR - BERSAMA MEMACU TRANSFORMASI

UUM/CAS/AHSGS/901006

30 May 2016

TO WHOM IT MAY CONCERN

Dear Sir/Madam

DATA COLLECTION FOR PROJECT PAPER/THESIS

This is to certify that **Mr. Yemi Madu Tukur (matric number: 901006)** is a full time postgraduate student in Doctor of Philosophy (Education) at UUM College of Arts and Sciences.

He needs to do his field study and data collection for his project paper/thesis in order to fulfill the partial requirements of his graduate studies.

We sincerely hope that your organization will be able to assist him in the data collection and the distribution of the questionnaires for his research.

Thank you.

"KNOWLEDGE, VIRTUE, SERVICE"

Yours faithfully

WANNORHASHIMA BINTI WAHMIN
Assistant Registrar
for Dean
Awang Had Salleh Graduate School of Arts and Sciences
UUM College of Arts and Sciences

Appendix B

Appointment Letter of Assessors

PUSAT PENGAJIAN PENDIDIKAN DAN BAHASA MODEN
SCHOOL OF EDUCATION AND MODERN LANGUAGES
College of Art and Sciences
Universiti Utara Malaysia
06010 UUM SINTOK
KEDAH DARULAMAN
MALAYSIA

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"MUAFAKAT KEDAH"

UUM/CAS/SEML/PP/P-74/3
5 March 2017

ASSOC PROF. DR. AIZAN YAACOB
School of Educational & Modern Languages
UUM College of Arts & Sciences
Universiti Utara Malaysia
06010UUMSintok
Kedah Darul Aman, Malaysia.

Dr.

Appointment as Appraisal Instrument Rating Expert for Doctoral Studies

With reference to the above,

2 I am Dr. Nurulwahida Azid @ Aziz a doctoral supervisor to Modu Tukur Yemi, Matric No. 901006 who is currently pursuing a Doctor of Philosophy (Curriculum and Instruction) at Universiti Utara Malaysia. I would like to appoint you as an expert to assess the instrument used in his study entitled EFFECTIVENESS OF COOPERATIVE LEARNING (JIGSAW) STRATEGY AND MASTERY LEARNING MODEL ON MATHEMATIC STUDENTS ACHIEVEMENT OF NEGERIAN SECONDARY SCHOOL.

Therefore, I would like you to check and verify the instrument based on your experience and expertise. Herewith I enclose an instrument for your perusal.

Your attention and cooperation is very much appreciated.

Yours sincerely,

DR NURULWAHIDA BINTI HJ AZID@AZIZ
Senior Lecturer
School of Educational & Modern Languages
UUM College of Arts & Sciences
Universiti Utara Malaysia
06010UUMSintok
Kedah Darul Aman, Malaysia.

Appendix C

Letter to Gombe State Ministry of Education

Department of Science Education

Faculty of Education

Federal University Kashere,

Gombe State

23/06/2016

The Commissioner

Ministry of Education

Gombe State

Sir,

APPLICATION FOR REQUEST OF PERMISSION TO USE SOME SCHOOLS AS SAMPLE OF MY RESEARCH

I am a lecturer with the above Institution undergoing a PhD Education programme at Universiti Utara, Malaysia.

I am conducting a research title;" The effectiveness of Cooperative learning (STAD) strategy on students achievement and attitude towards learning mathematics in Nigerian Secondary Schools, a case study Gombe state" as per attach letter from the school.

I intend to use the following schools:

1. GSSS 2 Gombe
2. GDSS Orji Quarters Gombe
3. GGSS Doma Gombe
4. GDSS Gandu
5. GDSS Pilot Gombe

As sample schools of my research, I therefore, request for the following:

a. The permission to use the mentioned schools
b. List of mathematics teachers and their highest qualification in Gombe
c. Senior Secondary School Certificate results (NECO & GCE) 2011 - 2015 in Gombe state
d. Junior NECO results for the period s above
e. The population of SS 3 students 2011 - 2015 &
f. The current population of SS 3 of the sampled schools based school.

Appendix D

Teacher's Observation Checklist for Treatment Group One

Please tick(√) the option "Yes" or "No" for each of the Observations item.

A checklist of Unit 1 activities

N	Observation items	Yes	No	Remarks
	Jigsaw Strategy of Cooperative Learning			
1	The jigsaw strategy activity encourages the students to work as a team.			
2	The jigsaw strategy activity involves all the elements of jigsaw method.			
3	Students contributing in the discussion on the subtopics in jigsaw strategy form.			
4	The objective of each of the activity of module one was understood by the students.			
5	The group interaction is positive and supportive.			
6	This activity is arranging in a logical order which involves time to solve the problems.			
7	The activity stimulates student's ability to communicate and share ideas effectively			
8	The jigsaw strategy activities encourage students to concentrate and solve problems of zero power explained in unit three of the jigsaw strategy and mastery learning module.			
	Mastery Learning Strategy			
9	The students who did not demonstrated mastery in the formative test at the designated level 80% correct are given additional instruction (Corrective Instruction).			
10	Students who attained 80% or higher on formative quiz were provided enrichment activities pertaining to the same units.			

Comments from the observer:

.....
.....
.....
.....
.....

Name:
Signature:

Stamp:
Date:

Appendix E

Teacher's Observation Checklist for Treatment Group Two

Please tick (√) the option "Yes" or "No" for each of the Observation item.
A checklist of Unit 1 activities.

N	Observation items	Yes	No	Remarks
1	The jigsaw strategy learning makes activities easy for students to understand problems of Indices explained in jigsaw strategy learning module.			
2	The jigsaw strategy activity encourages the students to discuss the learning material with other students.			
3	Students understand the lesson well using the jigsaw strategy learning.			
4	Students contribute in the discussion on the subtopics in jigsaw strategy form.			
5	The objective of each of the activity of jigsaw strategy learning module was understood by the students.			
6	The group interaction is positive and supportive.			
7	Some of the members in the expert groups dominate the discussion			
8	The activity stimulates student's ability to communicate and share information on the topic effectively			

Comments from the observer:

.....

.....

.....

Appendix F

Assessment Form for Modules

Instruction

Please give your honest response to each statement by ticking (√) the most appropriate to you. The number of"√" marks cannot exceed one in each category. If you disagree with any statement, please leave it blank.

Module Activity	Rating Scale for Assessing Mathematics Module				
	Poor	**Fair**	**Good**	**Very Good**	**Excellent**
1. The learning outcomes of the module is clear and understandable to students	1	2	3	4	5
2. The learning outcomes of the module is clear and understandable to teachers	1	2	3	4	5
3. Introduction of the module capture the interest of the students	1	2	3	4	5
4. The main Aim is in line with the objectives of the module	1	2	3	4	5
5. All learning outcomes are obvious to achieve the desire goal	1	2	3	4	5
6. All the learning activities planned are suitable with the stated learning.	1	2	3	4	5
7. The arrangement of the learning activities is from simple to complex.	1	2	3	4	5
8. The pages arrangement in the module are suitable for students to use.	1	2	3	4	5
9. The pages arrangement in the module are suitable for use by the teacher.	1	2	3	4	5
10. Module contains enough worked examples	1	2	3	4	5

11. The Self-Assessment and Pre-test/Post-test questions in this module measure the learning outcomes	1	2	3	4	5
12. The conclusion of the learning activity stated at the end of each unit is suitable	1	2	3	4	5

Total

Thank you for your kind cooperation.

VERIFICATION FORM FOR EXPERTS, VIEWS AND COMMENTS

After reviewing and evaluating the test item, I hereby certify that:
Students Name: **MADU, TUKUR YEMI**
Matric No: **901006**
Research Topic: **The effect of Jigsaw Strategy and Mastery Learning Modules on Mathematics Students' Attitude and Achievements in Nigerian Schools**

Under the Supervision of:

1. **Dr. Nurulwahida Hj Azid @ Aziz**
   Senior Lecturer
   School of Education and Modern Languages, UUM
   College of Arts & Sciences,
   Universiti Utara Malaysia.

2. **Prof. Madya Dr. Ruzlan Bin Md. Ali**
   School of Education and Modern Languages, UUM
   College of Arts & Sciences,
   Universiti Utara Malaysia.

The student is qualified to carryout pilot study or main study by taking into account the views and Comments (if any) that is mentioned above.
Signature

Date:
Stamp.

Appendix G

Pre-Test/Post-Test

About the test:
This test is designed for SSS 1 students' competence in Indices, Logarithms, Algebra and Simultaneous Equation. This test item consists of 30 multiple choice items.
INSTRUCTIONS: Read the items carefully. You are required to answer all the items. For each items, four (4) options, a, b, c, d are given. You are required to choose **ONE** correct answer for each item. All working must be clearly shown on your answer sheet.

1. $Simplify\ (3a^2\ b)^0$
(a) 1
(b) $3a^5$
(c) $3a$
(d) $10a$

2. $Evaluate\ (2^{-2})^{-2}$
(a) 2^2
(b) 16
(c) 10^2
(d) 10

3. $Evaluate\ (\frac{3}{4})^{-2}$
(a) $\frac{3}{4}$
(b) $\frac{1}{3}$
(c) $\frac{16}{9}$
(d) 0

4. $Evaluate\ (8^{\frac{1}{3}})^2$
(a) 8
(b) $8^{\frac{3}{2}}$
(c) 2^9
(d) 4

5. $Simplify\ (\frac{16}{81})^{-\frac{1}{4}}$
(a) $\frac{3}{2}$
(b) $\frac{2}{3}$
(c) $\frac{1}{4}$
(d) $\frac{1}{5}$

6. *Solve for x in the equation,* $7^x = 1$

(a) $\log_7 x$

(b) 4

(c) 0

(d) 7^x

7. *Solve the exponential equation,* $3^{3-x} = 27^{x-1}$

(a) $\frac{1}{3}$

(b) $\sqrt{27}$

(c) 0

(d) $\frac{3}{2}$

8. *Solve,* $\log_2 32 = x$

(a) 32

(b) 5

(c) 6

(d) 1

9. *Solve,* $\log_{36} x = -\frac{1}{2}$

(a) $\frac{1}{2}$

(b) 36

(c) $\frac{1}{6}$

(d) 6

10. *Simplify,* $\log 20 + \log 3$

(a) 3

(b) $\log 20$

(c) $\log 60$

(d) $\log 10^2$

11. *Evaluate,* $\log_7 98 - \log_7 30 + \log_7 15$

(a) $\log 7.2$

(b) $\log 3 + \log 7$

(c) $\log 2$

(d) 2

12. *If* $\log_7 7 = x$, *calculate the value of* x.,

(a) 7

(b) 49

(c) $7 \log 7$

(d) 1

13. *Given that,* $\log_{10} 2 = 0.3010$, $\log_{10} 3 = 0.4771$and $\log_{10} 7 = 0.8451$. *Evaluate,* $\log_{10} 7.2$

(a) 1.8572

(b) 2.8572

(c) -1.8572

(d) -2.857

14. *Evaluate,* $\log_5(0.04)$

(a) 1
(b) -2
(c) $\frac{2}{3}$
(d) -1
15. *Expand,* $(x + 5)(x + 2)$
(a) $x^2 - 7x + 10$
(b) $x + 5$
(c) $x^2 + 7x + 10$
(d) $x^2 + 7x$
16. *Expand* $(x + 4)^2$
(a) $(x + 4)^8$
(b) $4x^2$
(c) $x^2 + 8x + 16$
(d) $12a + 8a^2$
17. *Factorize* $12a + 8a^2$
(a) 20
(b) $20a^3$
(c) $4a$
(d) $4a(3 + 2a)$
18. Simplify, $-4x^2 + 5x^2 + 6x^4 + 3x^3 + 2x^4 - x^2$
(a) $6x$
(b) $4x^2$
(c) $13x$
(d) $8x^4 + 3x^3$
19. *Evaluate the expression,* $2a^2$ *be when* $a = 3$, $b = -4$ *and* $c = -5$
(a) 360
(b) 120
(c) 130
(d) 140
20. *Simplify* $2[3b + 5(b - 2)]$
(a) $6b + 10$
(b) $10b + 20$
(c) $16b - 20$
(d) $20 + 16b$
21. Factorize $6x^2 + 8x$
(a) $2x(3x + 4)$
(b) $6x$
(c) $3x + 1$
(d) $3x - 1$
22. Solve the simultaneous equations below using substitution

method,

$4x = y + 7$; $3x + 4y + 9 = 0$

(a) x = 1, y = -3

(b) y = 3, x = 2

(c) x = -1, y = 2

(d) x = 3, y = 5

23. Solve the simultaneous equation

$5m + 10n = 10, 2m - n = 1$

(a) $m = \frac{6}{5}, n = \frac{4}{5}$

(b) $m = \frac{4}{5}, n = \frac{3}{5}$

(c) $n = 8, m = 3$

(d) $m = \frac{3}{7}, n = \frac{1}{4}$

24. *Using eliminition method, solve* $3x - 2y = 4;\ 2x + 3y = -6$

(a) $x = \frac{1}{2}, y = 2$

(b) $x = 0, y = -2$

(c) $x = \frac{7}{8}, y = 1$

(d) $x = -2, y = -5$

25. *Solve the simultaneous equation* $3a = 2b + 1;\ 3b = 5a - 3$

(a) $a = 9, b = 4$

(b) $a = 5, b = 3$

(c) a = 2, b = 2

(d) a = 3, b = 4

26. *Solve the following Simultaneous equations*

$x + y = 5$ *and* $x - y = 1$

(a) $x - y$

(b) $5x^2$

(c) $x = 3, y = 2$

(d) $y = 2, x = 4$

27. *Simplify,* $(3x - 5) + (4x - 6) - (3x + 4)$

(a) $4x - 15$

(b) $3x$

(c) $2x - 4$

(d) 0

28. *Evaluate,* $\log_3 24 + \log_3 15 - \log_3 10$

(a) $\log_3 2$

(b) $2 \log_3 6$

(c) $\log_2 36$

(d) 406

29. *Evaluate,* $\log_2 0.25$

(a) 0

(b) log−2

(c) 4log 2
(d) -2
30. *Simplify*; $3a + 5b - 2z + a$
(a) $4a + 5b - 2z$
(b) $3a + 5b - 2$
(c) $6abz$
(d) $8a$

Appendix H

Answers to Pre-test and Post-Test Items

Item	1	2	3	4	5	6	7	8	9	10
Answer	a	b	c	D	a	c	d	b	c	c

11	12	13	14	15	16	17	18	19	20
D	d	b	d	c	c	d	d	a	c

21	22	23	24	25	26	27	28	29	30
A	a	b	b	d	c	a	b	d	a

Appendix I

Interview Protocol for Treatment Group One

Dear Respondent,
I am a postgraduate student currently pursuing a Doctor of Philosophy at Universiti Utara Malaysia, School of Education and Modern Languages. I am conducting a research on **the effect of Jigsaw Strategy and Mastery Learning Module on Mathematics Students' Achievement and Attitude in Nigerian Schools.**
I write to request for your cooperation to provide as much as possible the sincere response to each item. The result of the responses will be strictly used for the purpose of the study, and will remain confidential.

S/N	Questions
1	What is your comment on the learning activities used in the jigsaw strategy and mastery learning on students' understanding of the topic?
2	What are your comment on the learning activities involving jigsaw strategy and mastery learning process that is used in this module?
3	What are the advantages of using this jigsaw strategy and mastery learning module?
4	What are the disadvantages of using this jigsaw strategy and mastery learning module?
5	Would you recommend secondary school teachers to use this jigsaw strategy and mastery learning module? Why? Why not?
6	In your own opinion, can the process of jigsaw strategy and mastery learning applied in this learning session improve students' achievement in the subject area? Yes/No. why?
7	What are your suggestions to improve the strategy of this module?

AppendixJ

Interview Protocol for Treatment Group Two

Dear Respondent,
I am a postgraduate student currently pursuing a Doctor of Philosophy at Universiti Utara Malaysia, School of Education and Modern Languages. I am conducting a research on **the effect of Jigsaw Strategy and Mastery Learning Module on Mathematics Students' Achievement and Attitude in Nigerian Schools.**
I write to request for your cooperation to provide as much as possible the sincere response to each item. The result of the responses will be strictly used for the purpose of the study, and will remain confidential.

	Questions
1	What is your comments on the implementation strategy of learning activities used in the jigsaw strategy on students understanding of the topic?
2	What are your comments on the implementation strategy of learning activities involving jigsaw learning process that is used in this module?
3	What are the characteristies of good or positive in this jigsaw strategy module?
4	What are the characteristies of bad or negative in this jigsaw strategy module
5	Would you recommend secondary school teachers to use this module?
6	In your own opinion, can the process of jigsaw strategy as applied in this learning can improve student's achievement in the subject area? Yes/No. why?
7	What are your suggestions to improve the implementation strategy of jigsaw strategy module?

Evaluation Verification Form for Expert Views / Comments

Your Cooperation is highly appreciated.
After reviewing and evaluating the study questionnaire, I hereby certify that:
Students Name: **MADU, TUKUR YEMI**
Matric No: **901006**
Research Topic:
The effect of Jigsaw Strategy and Mastery Learning Module on Mathematics Students' Attitude and Achievement in Nigerian Schools.

Supervisor:

1. **DR. NURULWAHIDA HJ AZI D@AZIZ**
   SENIOR LECTURER
   SCHOOL OF EDUCATION AND MODERN LANGUAGES, UUM COLLEGE OF ARTS & SCIENCES,
   UNIVERSITI UTARA MALAYSIA.

2. **PROF. MADYA DR. RUZLAN BIN MD. ALI**
   SCHOOL OF EDUCATION AND MODERN LANGUAGES, UUM COLLEGE OF ARTS & SCIENCES,
   UNIVERSITI UTARA MALAYSIA.

The student is qualified to carryout pilot study or main study by taking into account the abovementioned views and Comments (if any) that is mentioned above.

Signature
Name:
Date:
Stamp.

Appendix K

Jigsaw and Mastery Learning Attitude Inventory

Dear Student,

Personal Data

Male()

Female()

Age ----------

Class ----------

School ----------

Year ----------

Instruction:

Please give your honest response to each statement by ticking (√) the most appropriate to you. The number of "√" marks can exceed one in each category. If you disagree with any statement, please leave it blank.

EXAMPLE:

INTRODUCTION

1. I am comfortable asking questions to group members when I do not understand something----------√----------

2. I do not like to learn in groups----------√----------

3. I enjoy learning in group----------

4. I feel more comfortable asking students in my group for help than asking my mathematics teacher----------√----------

5. I have more confidence to try mathematics problems when I work in groups---√–

Total Number of Tick(√) ----------4----------

No	Items	Tick (√) If it is appropriate to you
	Jigsaw Strategy	
1	I am comfortable asking questions to group members when I do not understand something-	
	I do not like to learn in groups----------	.....
2	I enjoy learning in group----------	.....
3	I feel more comfortable asking students in my group for help than asking my mathematics teacher	.....
4	I have more confidence to try mathematics problems when I work in groups----------	.....
		.....
	I learn mathematics better when in groups----	.....
5	I prefer the Jigsaw strategy more than the conventional (Lecture) method of instruction	
6	I understand more quickly when a friend explains to me	.....
		.....

7	The Jigsaw strategy learning atmosphere for mathematics class is quite interesting----------	.....
8	Time pass more quickly during the Jigsaw strategy learning sessions than during the conventional method of instruction.....	....
9	The use of Jigsaw strategy learning was more effective than the conventional method of instruction.....	....
10	Working in groups help me to better understand the mathematics concepts.....	.....
	Mastery Learning	....
11	I prefer the Mastery learning more than the conventional (Lecture) method of instruction	....
12	The Mastery learning atmosphere for mathematics class is quite interesting----------Time pass more quickly during the Mastery learning sessions than during the conventional method of instruction	.....
13	The use of Mastery learning was more effective than the conventional method of instruction	....
14		.....
15		
16		

Total Tick (√) ----------

Thank you for your kind cooperation.

Appendix L

Marking Scheme

SELF-ASSESSMENT (WEEK ONE)

1. $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$

2. Power of a product

3. a^{-n}

4. $b = 0$

5. $\frac{a^m}{a^n}$

6. $15x^0 = 15 \times 1 = 15$

7. $(3x)^0 = 1$

8. $(2a^0) = 2 \times 1 = 2$

9. $10^5 \div 10^5 = 10^{5-5} = 10^0 = 1$

10. $(-5^{1/2})_0 = 1$

11. $(5^{-3}) = 5^{-6} = \frac{1}{56} = \frac{1}{125}$

12. $(xy^2)^{-2} = x^{-2}y^{-4} = \frac{1}{x^2y^4}$

13. $(16)^{-3/4} = \frac{1}{16^{3/4}} = \frac{1}{(\sqrt[4]{16})^3} = \frac{1}{2^3} = \frac{1}{8}$

14. $a^{-2} \times b^{-1} = \frac{1}{a^2b}$

15. $(x^3)(y^{-4}) = x^2 \frac{1}{y^4} = \frac{x^3}{y^4}$

16. $\left(\frac{16}{81}\right)^{3/4} = \left(\sqrt[4]{\frac{16}{81}}\right)^3 = \left(\frac{2}{3}\right)^3 = \frac{2^3}{3^3} = \frac{8}{27}$

17. $(9^{3/2}) = (\sqrt[2]{9})^3 = 3^3 = 27$

18. $(^3/_4)^2 = {}^9/_{16}$

19. $\sqrt[3]{64} = 4$

20. $(25a^2)^{1/2} = \sqrt{(25a^2)} = 5a$

SELF-ASSESSMENT (WEEK TWO)

1. $2^{x+1} = 2^{3x}$
   $= x+1 = 3x$
   $= 2x = 1$
   $= x = \frac{1}{2}$

2. $8^x = 32$
   $2^{3x} = 2^5$
   $3x = 5$
   $x = {}^5/_3$

3. $3^{2x} = \frac{1}{9}$
   $3^{2x} = 3^{-2}$
   $2x = -2$
   $x = -1$

4. $(3^{x+1})(9^{x-2}) = 27$
   $(3^{x+1})(3^{2(x-2)}) = 27$
   $(3^{x+1})(3^{2x-4}) = 3^3$
   $3^{x+1+2x-4} = 3^3$
   $x + 1 + 2x - 4 = 3$
   $3x - 3 = 3$
   $3x = 6$
   $3x = \frac{6}{3}$
   $x = 2$

5. $(\frac{1}{4})^{x+2} = \frac{1}{64}$
   $(2^{-2})^{x+2} = 2^{-6}$
   $2^{-2x-4} = 2^{-6}$
   $2^{-(2x+4)} = 2^{-6}$
   $-2(x + 2) = -6$
   $x + 2 = 3$
   $x = 1$

6. (a) $\log_{\frac{1}{2}} 81 = x$

$3^x = 81$

$3^x = 3^4$, $x = 4$

(b) $log_7 x = x$

$7^2 = x$. Therefore, $x = 49$

(c) $log_{1/2} 32 = x$

$(\frac{1}{2})^x = 32$

$(2^{-1})^x = 2^5$

$2^{-x} = 2^5$

$x = -5$

(d) $\log_7 3 = \frac{1}{3}$

$7^{1/3} = 3$

$\sqrt[3]{7} = 3$

(e) $\log_5 \frac{1}{125} = -3$

$\log_5 \frac{1}{125}$

$\log_5 (125)^{-1} = -3$

$5^{-3} = (125)^{-1}$

$(5^3)^{-1}$

$= -3$

7. $8^2 = 64$

$= \log_8 64 = 2$

8. $16^{1/2} = 4$

$= \log_{16} 4 = \frac{1}{2}$

9. $25^{1/2} = 5$

$\text{Log}_{25} 5 = \frac{1}{2}$

10. $\sqrt{9} = x$

$9^{\frac{1}{2}} = x$

$\log_9 x = \frac{1}{2}$

11. (a) $\text{Log}_a 8$

$= \log_a 2^3$

$= 3\log_a 2$

12. $\text{Log} \frac{40}{15} - \log \frac{16}{25} + \log \frac{840}{35}$

$\text{Log} \frac{8}{83} - (\log 16 - \log 25) + \log 24$

Log8 – log 3 – log 16 + log 25 + log 24
Log 2^3 – log3 – log 2^4 + log 5^2 + log (4x6)
3log2-log3 – 4log2 + 2log5 + log4 + log6
3log5–4log2 +2log 5+ log2^2 + log2
2 log5 + 2log2
2log 5 + 2 log 2
Log 5^2+ log 4
Log (25x4)
Log 100
=2

12b. $\log_3 9 = \log_3 3^2 = 2 \log_3 3$ but $\log_3 3 = 1$
$= 2 \times 1 = 2$

(c) $\log_4 10 + \log_4 21 - \log_4 7$
$= \log_4(10 \times 21) - \log_4 7$
$= \log_4 210 - \log_4 7$
$= \log_4(\frac{210}{7})$
$= \log_4 30$

(d) $\log x^2 + \log x^3 - \log x^4$
$= 2 \log x + 3 \log x - 4 \log x$
$= 5 \log x - 4 \log x$
$= \log x$

AppendixM

Daily Lesson Plan Rubric

JIGSAW STRATEGY AND MASTERY LEARNING

Lesson Plan ... .Subject: **MATHEMATICS**

Expectation performance	Poor 1	Fair 2	Good 3	Excellent 4	Rubric Score
Learning outcomes	Learning outcomes are not measurable	Learning outcomes are less clear and somehow measurable	Learning outcomes are clear and measurable	Learning outcomes demonstrate progress in learning	
Introduction	Introduction do not arouse or capture the attention of the students	Less attempt to capture the attention of the students	The lesson introduction explains the procedure in a clear language	The teacher introduce the lesson by explaining the topics using relevant examples.	
Process & Procedure Jigsaw Strategy and Mastery learning	The procedure of jigsaw Strategy and Mastery learning is little explain.	Process and procedure of jigsaw Strategy and Mastery learning fairly explain	The teacher explain the process and procedure of jigsaw Strategy and Mastery learning	The teacher clearly explains the process and procedure and the content of Jigsaw Strategy and Mastery learning	
Assessment Activity	No assessment activities are given to measure the learning outcomes.	There are assessment in the lesson plan but did not measure the learning outcomes	There are clear and precise assessment as explained in the learning outcomes	Assessment activities are clearly defined and can accurately measure the learning outcomes.	
Closing	Teacher does not conclude the learning process.	The teacher ends the learning process with the limited conclusion.	The teacher ends the learning process ends with good cognitive conclusion.	The teacher concluded the lesson with good cognitive and social closure.	
Professional lesson plan writing	Low quality of writing with many grammatical errors	Few grammatical and spelling errors	Lesson plan writing with little spelling errors	Achieve professional writing with minimum grammatical and spelling errors and good format	

Total Score:

EVALUATION VERIFICATION FORM FOR EXPERT VIEWS / COMMENTS

Thank you for your kind cooperation.
After reviewing and evaluating the study questionnaire, I hereby certify that:
Students Name: **MADU, TUKUR YEMI**
Matric No: **901006**
The student is qualified to carryout pilot study or main study by taking into account the abovementioned views and Comments (if any) that is mentioned above.

Signature:
Stamp:

Name:
Date:

Appendix N

Lesson Plan for Jigsaw Strategy

Name of Teacher:
School:
Subject: Mathematics
Sub-Topics Evaluating numerical expressions that have negative exponents
Date: 20/07/2017
Level of students: 16-17year
Total Number of student: 40 students
Learning outcomes:
At the end of the lesson students be able to:
Evaluating numerical expressions that have negative exponents;
2^{-2}, $(2^{-2})^{-2}$, $(2/3)^{-3}$, $(6^{-2}) / (2^{-3})$, $(3^{-5})(3)^{5}$
Prior Knowledge:
The students have idea of positive integers as exponents. Thus;

1. Simplify $3(-4)^2 + 5(-3)^2$
2. Simplify $4(1/2)^3$

Materials:
2. Table for both home and expert groups labelled with different colors.
3. A Jigsaw strategy and Mastery learning module (one per student)
4. A scores record sheet (Individual and group)
5. A fact sheet paper (Individual & Group)

Step	Content	Teaching and Learning Activities		Rmks
		Teacher	**Students**	
Introduction (5 minutes)	Evaluate exponential expression	Exponents are used to indicate repeated multiplications. The expression "b^n to the nth power". We refer to b as the base and n as the exponent.	Whole class Activity A module containing the learning activities (Home groups)	
Step 1 (5 minutes)	Evaluating expression that have negative exponents	If x is any non-zero real number and n is integer. Then, $x^{-n} = 1/x^n$	Group Discussion	
Step 2 (10 minutes)		The solve the following expressions; 1. 2^6 2. 2^5 3. 2^4 4. 2^3 5. 2^2 6. 2^1 7. 2^0 8. 2^{-1} 9. 2^{-2}	Group Discussion (Expert groups)	

		10. 2^{-3} Evaluate $(2^{-2})^{-2}$ Solution	
Step 3 (10 minutes)	Example 2	$(2^{-2})^{-2}$ $(2^{-2})^{-2}$ $=(2)^{-2,-2}$ $=(2)^4$ **$=16$**	Expert Groups Discussion
Step4 (10 minutes)	Example	Simplify $(2/3)^{-3}$ Solution $(2/3)^{-3}$ $=1/(2/3)^3$ $=1/8/27$ $=27/8$	Brainstorming
Step 5 (20minutes)	Example	Evaluate $(3)^{-5}(3)^5$ **Solution:** $=(3)^{-5}(3)^5$ $=(3)^{-5+5}=(3)^0=3$	Expert Groups Discussion
Step 6	Example	Evaluate $6^{-2}/2^{-3}$ Solution $6^{-2}/2^{-3}$ $=1/36/1/8$ $=1/36$ *$8/1$ $=8/36=2/9$ $=(3)^{-5}(3)^5$ $=(3)^{-5+5}$ $=(3)^0=3$	Expert Groups Discussion

Assessment (20 minutes To test formatively that students have mastered the skill	**Problems 1-5, Answer "True" or "False"** 1. $(2/5)^{-2}=(5/2)^2$ 2. $(3)^0(3)^2= 9^2$ 3. $(3^{-2}/3^{-1})^2= 1/9$ 4. $x^{-6}/x^{-3} = x^2$ 5. $(5^{-2})^{-2}= 625$	Individual Activity (Worksheet) AppendixD
Closing (5 minutes)	The teacher concludes the lesson by asking the students to award 10 marks for each correct answer.	

Appendix O

(Jigsaw Strategy and Mastery Learning)

Subject: Mathematics
Sub-Topics Logarithmic Expression
Date: 20/07/2017
Level of students: 16-1 7year
Learning outcomes:
At the end of the lesson students be able to:
Evaluate Logarithmic Expression;

Log $_4$64, log $_{10}$ 0.1, log $_2$ 0.25, Log$_3$ 1/9, Log $_{49}$ 1/7, & Log$_2$8 – log$_3$9 + log$_4$ (1/16)
Prior Knowledge:
The students have idea on solution of indices using all the rule,
Product rule, Quotient rule, Power of power rule, & Zero power
Materials:
1. A Jigsaw strategy and mastery learning module (one per student)
2. A scores record sheet (individual and group)
3. A fact sheet paper (individual & group)

Steps	Content	Teaching and Learning Activities		RKS
		Teacher	**Students**	
Introduction (5 minutes)	Definition:		Whole class Activity (Home groups)	
Step 1 Learning outcomes (5 minutes)	Example 1	Evaluate log $_4$64 **Solution:** Log $_4$64 Let log $_4$64 = y, then switch to exponential form, we have $4^y = 64$, which we can evaluate as $4^y=64$ $4^y = 4^3$ **Y = 3** Therefore, we can write as **Log$_4$64=3**	Group Discussion	

Example 2.2

Evaluate $\log_{10} 0.1$

Solution:

Step 2

Learning outcomes

(5 minutes)

Example 2

Let $\log_{10} 0.1 = y$, then by switching to exponential form, we have $10y = 0.1$, which can be solved as follows;

$10^y = 0.01$

$10^y = 1/10$

$10^y = 10^{-1}$

$Y = -1$

Thus we obtain **$\log_{10} 0.1 = -1$**

Example2.3

Evaluate $\log_2 0.25$

Solution:

Step 3

Learning outcomes

(5 minutes)

Example 3

Let $\log_2 0.25 = x$, then by switching to exponential form, we have $2^x = 0.25$, which can be solved as follows;

$2^x = 0.25$

$2^x = 25/100$

$2^x = ¼$

$2^x = 2^{-2}$

$x = -2$

Therefore, $\log_2 0.25 = -2$

Example2.4

Evaluate $\text{Log}_3 1/9$

Solution:

Step 4

Learning outcomes

(10 minutes)

Example4

Let$\text{Log}_3 1/9 = x$, then by switching to exponential form, we have $3^x = 1/9$, which can be solved as follows;

$3^x = 1/9$

$3^x = 3^{-2}$

$X = -2$

Therefore, **$\text{Log}_3 1/9 = -2$**

Example 2.5

Evaluate $\text{Log}_{49}\ 1/7$

Solution:

LetLog $_{49}$ 1/7 = x, then by switching to exponential form, we have $49^x = 1/7$, which can be solved as follows;

$49^x = 1/7$

$7^{2x} = 7^{-1}$

$2x = -1$

$X = -1/2$

Therefore, **Log $_{49}$ 1/7 = - 1/2**

SELF ASSESSMENT UNIT 2.2

Question 1-5, Answer "True" or False

Assessment

(5 minutes)

The $\log_m n = q$ is equivalent to $m^q = n$

The $\log_7 7 = 0$

The $\log_5 9^2$ is equivalent to $2\log_5 9$

For the expression $\log_3 9$, the base of the logarithm is 9.

$\text{Log}_2 8 - \log_3 9 + \log_4 (1/16) = -1$

Corrective instruction

After the completion of the formative test (Quiz) and marking process, those who achieved the mastery level by scoring 80% will be given reward ask to move to the next unit of learning while those students identified to be below 80% in score will be denial reward and ask to go back and revise the unit again by help of other team mates as corrective instruction until they mastered the content.

Another chance will be given to them to attempt the self-assessment test again.

Conclusion (5 minutes)	**Cognitive conclusion** Students with teacher guidance summarizes the learning content. The teacher informs the activities at the next meeting that is about logarithms. **Social conclusion** Teacher reward the students by clapping students who pass the assessment 80% and above. Teacher ended the lesson by saying bye.

Appendix P

Data Collection Pictures

The researcher and the assigned teacher in the JSML group at the begging of the treatment

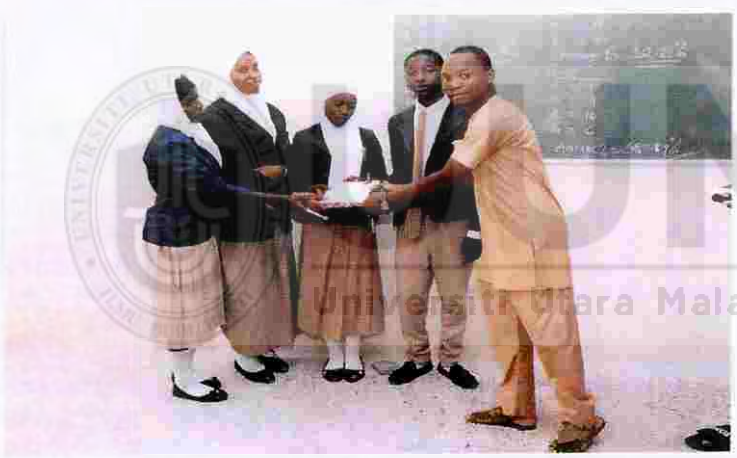
The researcher and the assigned teachers and observers in a group picture after the pre-test session

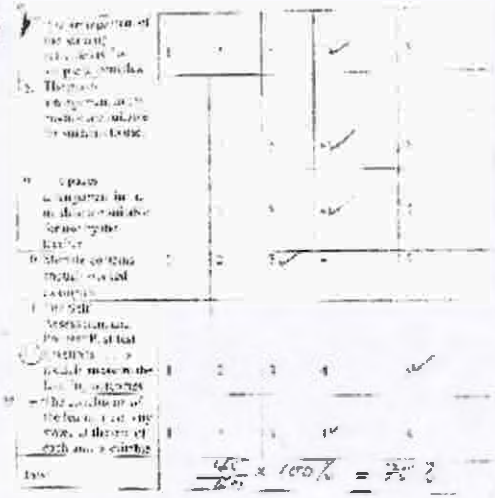
dents in the
xpert groups
and the picture
of male students
with the
reseacher

Post-test Session

The picture of best group students in JSML with the participating teachers and the researcher in the center after the treatment.

Students in the JS groups Activities





VERIFICATION FORM FOR EXPERTS, VIEWS AND COMMENTS

Please see attached sheet behind page 3.

7. The arrangement of the learning activities is from simple to complex.	1	2	3	4 ✓	5
8. The pages arrangement in the module are suitable for students to use.	1	2	3	4 ✓	5
9. The pages arrangement in the module are suitable for use by the teacher.	1	2	3	4 ✓	5
10. Module contains enough worked examples	1	2	3 ✓	4	5
11. The Self-Assessment and Pre-test/Post-test questions in this module measure the learning outcomes	1	2	3	4	5 ✓
12. The conclusion of the learning activity stated at the end of each unit is suitable	1	2	3	4 ✓	5
Total	$\frac{45}{60} \times 100\% = 75\%$				

Thank you for your kind cooperation

VERIFICATION FORM FOR EXPERTS, VIEWS AND COMMENTS

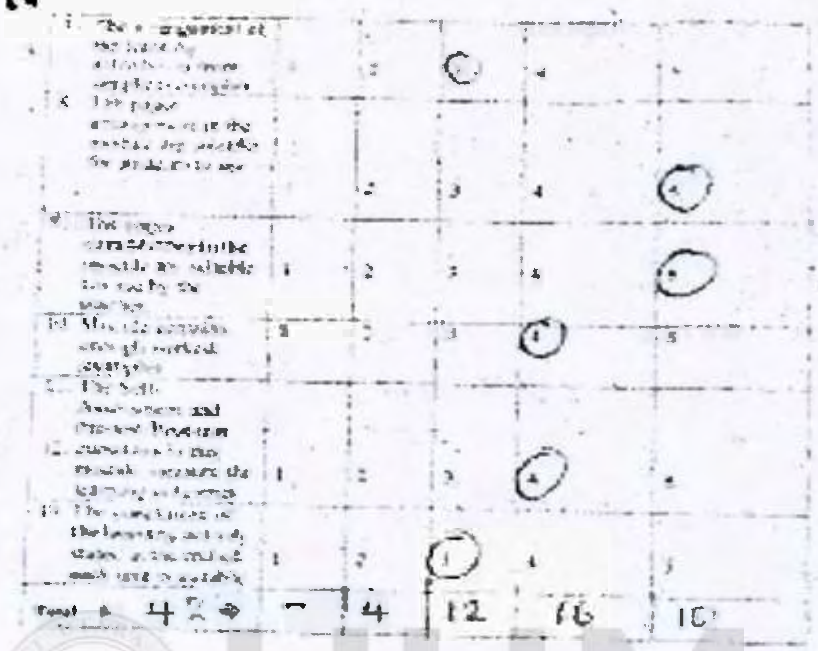
Please see attached sheet behind page 3.

7. The arrangement of the learning activities is from simple to complex.	1	2	3	4✓	5
8. The pages arrangement in the module are suitable for students to use.	1	2	3	4✓	5
9. The pages arrangement in the module are suitable for use by the teacher.	1	2	3	4✓	5
10. Module contains enough worked examples	1	2	3✓	4	5
11. The Self-Assessment and Pre-test/Post-test (12.) questions in this module measure the learning outcomes	1	2	3	4	5✓
12 ~~13.~~ The conclusion of the learning activity stated at the end of each unit is suitable	1	2	3	4✓	5
Total	$\frac{45}{60} \times 100\% = 75\%$				

Thank you for your kind cooperation.

VERIFICATION FORM FOR EXPERTS, VIEWS AND COMMENTS

Please see attached sheet behind page 3.



Every term that is used has to be explained, such that meaning and concept has to be understood

7 The arrangement of the learning activities is from simple to complex	1	2	(3)	4	5
8 The pages arrangement in the module are suitable for students to use	1	2	3	4	(5)
9 The pages arrangement in the module are suitable for use by the teacher	1	2	3	4	(5)
10 Module contains enough worked examples	1	2	3	(4)	5
11 The Self-Assessment and Pre-test Post-test 12 questions in this module measure the learning outcomes	1	2	3	(4)	5
13 The conclusion of the learning activity stated at the end of each unit is suitable	1	2	(3)	4	5
Total → 42 →	-	4	12	16	10

Thank you for your kind cooperation

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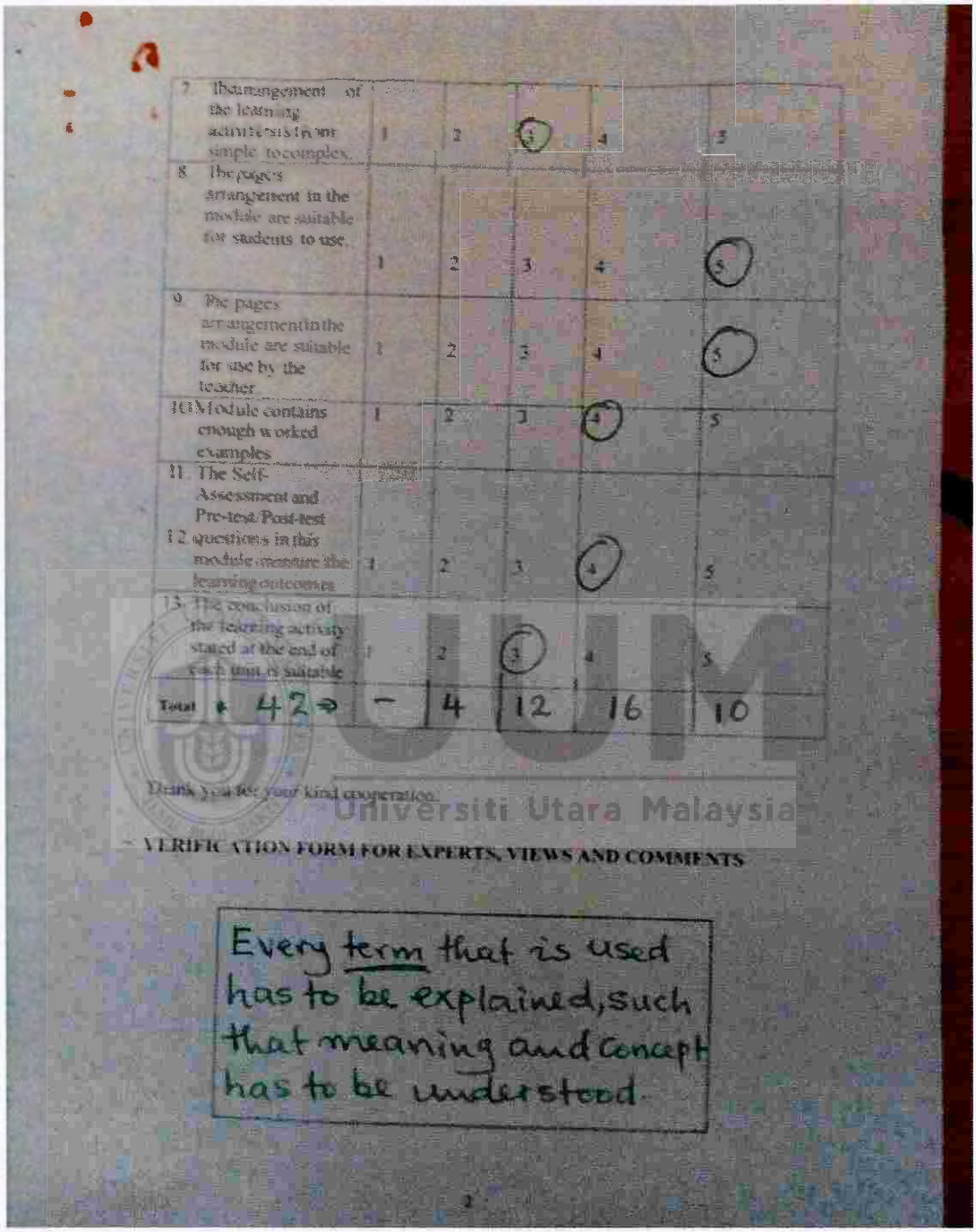


7. The arrangement of the learning activities is from simple to complex.	1	2	(3)	4	5
8. The pages arrangement in the module are suitable for students to use.	1	2	3	4	(5)
9. The pages arrangement in the module are suitable for use by the teacher.	1	2	3	4	(5)
10. Module contains enough worked examples	1	2	3	(4)	5
11. The Self-Assessment and Pre-test/Post-test 12 questions in this module measure the learning outcomes.	1	2	3	(4)	5
13. The conclusion of the learning activity stated at the end of each unit is suitable	1	2	(3)	4	5
Total = 42 ⇒	-	4	12	16	10

Thank you for your kind cooperation.

– VERIFICATION FORM FOR EXPERTS, VIEWS AND COMMENTS

Every term that is used has to be explained, such that meaning and concept has to be understood.

REPORT OF THE FACE VALIDATION OFTHE JIGSAW CREATE SUCCESS (JCS) MODULE

1. The JCS is well laid out and structured.

2. Attempt have been made to effect some corrections and adjustments so as to fine-tune the work. The corrections and adjustments can be seen on the affected pages, please.

3. The keys of the 30 items in the JCS Pre-test/ Post-test are fairly randomly distributed. An analysis of the number answers used reveals the following:

Letter	a	b	c	d	Total
Times used	7	6	8	9	30

There is the need to re-visit the keys of the items with respect to the following:

(a) Ensuring an almost even distribution of the keys, meaning let each of the letters be used in equal or almost equal proportion.

(b) Redistribute the keys especially b having 6 and d having 9 so as to reduce the option d such that 1 or 2 goes to b to make b seven times and d eight times or b eight times and d seven times as the case is with options a and c.

Generally, it could be said that the JCS questions are tasking enough and quite relevant to the intended usage. A job well done by Mr. Madu.

UNIT HEAD MATHS. SBRS.
GOMBE STATE
UNIVERSITY NIGERIA
SIGN
DATE 27/05/14

Sulai, Erasmus Ibrahim., M. Sc. (Ed.) Mathematics Education

Principal Tutor in Mathematics

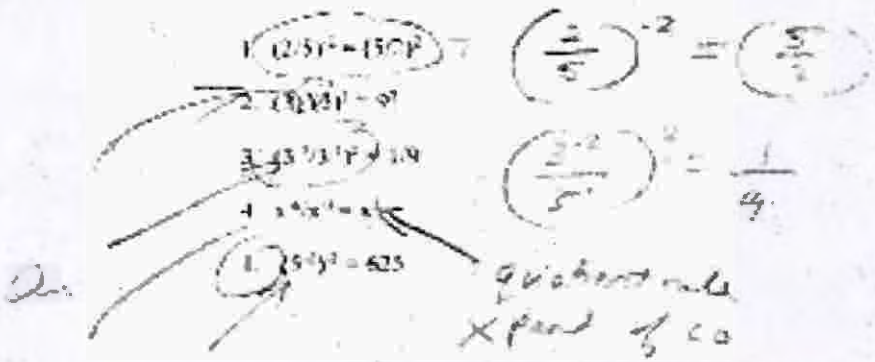
School of Basic & Remedial Studies (SBRS),

Gombe State University, Gombe – Nigeria.

08024075724

SELF ASSESSMENT FOR UNIT 1.1

Problems 1-5, Answer "True" or "False"



ANSWERS TO SELF ASSESSMENT UNIT 1.1

Question	1	2	3	4	5
Answer	True	False	True	False	True

SELF ASSESSMENT FOR UNIT 1.1

Problems 1-5. Answer "True" or "False"

1. $(2/5)^{-2} = (5/2)^2$
2. $(3)^0(3)^2 = 9^2$
3. $(3^{-2}/3^{-1})^2 = 1/9$
4. $x^{-6}/x^{-3} = x^2$
5. $(5^{-2})^2 = 625$

ANSWERS TO SELF ASSESSMENT UNIT 1.1

Question	1	2	3	4	5
Answer	True	False	True	False	True

SELF ASSESSMENT FOR UNIT 1.1

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ANSWERS TO SELF ASSESSMENT UNIT 1.1

Question	1	2	3	4	5
Answer	True	False	True	False	True

masjid?

Sekian, Terima Kasih

TIR AMRITA JUNIOR
Visiting Senior Lecturer
School of Education and Modern Languages
Utara College of Arts and Sciences
Universiti Utara Malaysia

module?

_____

_____

_____

Sekian, Terima Kasih

DR. AMRITA KAUR
Visiting Senior Lecturer
School of Education and Modern Languages
UUM College of Arts and Sciences
Universiti Utara Malaysia

18. What are your suggestions to improve the implementation strategy of this module?

_____

_____

_____

Sekian, Terima Kasih

DR. AMRITA KAUR
Visiting Senior Lecturer
School of Education and Modern Languages
UUM College of Arts and Sciences
Universiti Utara Malaysia

INSTRUCTION: Please circle the appropriate scale to evaluate the statement below:

Title: Module Growth based on Diagram and Mastery learning strategy	Very good (4)	Good (3)	Fairly Good (2)	Not good (1)
1. The objectives of the module is clear and understandable to both students and teachers	4	3	2	1
2. Introduction of the module capture the interest of the students	4	3	2	1
3. The main Aim is in line with the objectives of the module	4	3	2	1
4. All objectives are design to achieve the desire goal	4	3	2	1
5. All the activities planned are suitable with the stated objectives	4	3	2	1
6. The arrangement of the activities is from simple to complex.	4	3	2	1
7. The pages arrangement in the module are suitable to ensure students and teachers for use of module and teaching	4	3	2	1

INSTRUCTION: Please circle the appropriate scale to conform the statement below:

Title: Module Activity based on Jigsaw and Mastery learning strategy	Scale			
	Very good (4)	Good (3)	Fairly Good (2)	Not good (1)
1. The objective of the module is clear and understandable to both students and teachers	4	3	2	1
2. Introduction of the module capture the interest of the students	4	3	2	1
3. The main Aim is in line with the objectives of the module	4	3	2	1
4. All objectives are set out to achieve the desire goal	4	3	2	1
5. All the activities planned are suitable with the stated objectives	4	3	2	1
6. The arrangement of the activities is from simple to complex	4	3	2	1
7. The pages arrangement in the module are suitable to ensure students and teachers for use of students and teachers	4	3	2	1

(I don't see any wordy)

Mean.

INSTRUCTION: Please circle the appropriate scale to confirm the statement below:

Title: Module Activity based on Jigsaw and Mastery learning strategy	Scale			
	Very Good (4)	Good (3)	Fairly Good (2)	Not good (1)
1. The objective of the module is clear and understandable to both students and teachers	4	3	2	1
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3. The main Aim is in line with the objectives of the module	4	3	2	1
4. All objectives are obvious to achieve the desire goal	4	3	2	1
5. All the activities planned are suitable with the stated objectives.	4	3	2	1
6. The arrangement of the activities is from simple to complex.	4	3	2	1
7. The pages arrangement in the module are suitable to ensure students and teachers for use of students and teachers	4	3	2	1

20 March 2017

Comments on the Mathematics Module developed by Madu, Tukur Yemi (901006)

The candidate has demonstrated his knowledge of the Jigsaw pedagogy used in the Mathematics lesson.

1. The learning outcome is not aligned to instruction and to the assessment. The objective is not reflected in the examples. For example, p. 131, the LO on 'or is any non-zero real number ...' is not reflected in Example 1.4 as it measures quotient rule. Similarly too with eg 1.5 that measures product rule. The self-assessment is not aligned to the LO and the examples. For example, p. 135, Item 4 assesses on a zero exponent, which is not part of the LO and not captured in the examples (instruction). Similarly too with Item 2, which tests on quotient rule. There are many more misalignments of this type.
   Suggestion: Pls ensure that the LO is aligned to the examples (instruction) and the items in self- assessment (assessment).
2. Pls state the instructions clearly for the self-assessment, pre/post assessments.
   Suggestion: Pls require that students provide working to address guessing and that learning actually occurred.
3. State the duration for the self- assessment.
   Suggestion: 1.5 minutes for obj items (TIMSS report).
4. A lot of type errors in terms of mathematical symbols (upper case, lower case, italiced alphabets, item number) throughout the module
   Suggestion: Pls use Microsoft object to help you rectify.
5. Provide evidence of content validity by preparing a table of specification for pre/post assessments.
   Suggestion: At least 1 item for one LO

Since the module does not meet the requirement of alignment between the objective, examples and the assessment, at this stage , it is not possible to assess the lesson plans as the examples used to conduct the class conflicts with the LO and the self-assessment items. The candidate will need to rectify these errors which encompass both the content and typo errors before the module is ready to be assessed again.

DR. S.KANAGESWARI A/P SUPPIAH SHANMUGAM
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UUMCO - Ige of Arts and Sciences

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SEAMEO, Universiti Utara Malaysia
UUM Sintok

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Supervisor

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   UNIVERSITI UTARA MALAYSIA

The student is qualified to carryout pilot study or main study by taking into account the abovementioned views and Comments (if any) that is mentioned above

Signature

Name ASSOC PROF DR RUZLAN MD ALI

Date 4/9/2014

Stamp

Supervisor

1. DR. NURULWAHIDA BT AZID @ AZIZ
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Name ASSOC PROF DR AIZAN YAACOB

Date: 4/4/2017

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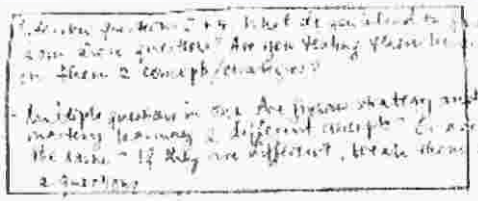
Signature

Name: ASSOC PROF DR AIZAN YAACOB

Date: 4/4/2017

Stamp:

EVALUATION OF EDUCATION GURU FOR EXPERT
APPOINTMENT



Your Cooperation is highly appreciated!

After reviewing and evaluating the study questionnaire, I hereby certify that

Student Name: MADU, TUKUR YEMI

Matric No: 901006

Research Topic:

THE EFFECTIVENESS OF COOPERATIVE LEARNING (JIGSAW) STRATEGY AND MASTERY LEARNING MODEL ON STUDENTS MATHEMATICS ACHIEVEMENT IN NIGERIAN SECONDARY SCHOOLS

EVALUATION VERIFICATION FORM FOR EXPERT

VIEWS / COMMENTS

Interview questions 3 + 4. What do you intend to find out from these questions? Are you testing them knowledge on these 2 concepts/strategies?

- Multiple questions in One. Are jigsaw strategy and mastery learning 2 different concepts? Or are they the same? If they are different, break them into 2 questions.

Your Cooperation is highly appreciated

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1	What is your comments on the implementation strategy of learning activities used in the jigsaw strategy and mastery learning on students understanding of the topic?
2	What are your comments on the implementation strategy of learning activities involving mastery learning process that is used in this model?
3	What are the characteristics of good or positive in this jigsaw strategy and mastery learning model?
4	What are the characteristics of bad or negative in this jigsaw strategy and mastery learning model
5	Would you recommend secondary school teachers to use this model?
6	In your own opinion, can the process of jigsaw strategy and mastery learning as applied in this learning can improve student's achievement in the subject area? Yes/No, why?
7	What are your suggestions to improve the implementation strategy of this model?

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Interview Protocol for Treatment Group 1 Teacher

	Questions
1	What is your comments on the implementation strategy of learning activities used in the jigsaw strategy and mastery learning on students understanding of the topic?
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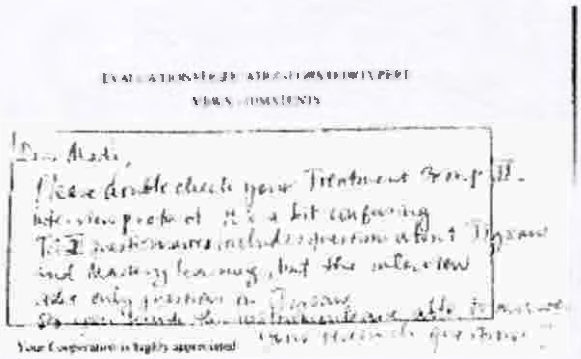

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Matric No: 901006

Research Topic:

THE EFFECTIVENESS OF COOPERATIVE LEARNING JIGSAW I STRATEGY AND MASTERY LEARNING MODEL ON STUDENTS MATHEMATICS ACHIEVEMENT IN NIGERIAN SECONDARY SCHOOLS

EVALUATION VERIFICATION FORM FOR EXPERT

VIEWS/ COMMENTS

Dear Madu,
Please double check your Treatment Group II interview protocol. It's a bit confusing. TG II questionnaires include question about Jigsaw and Mastery learning, but the interview asks only question on Jigsaw. Do you think the instruments are able to answer your research questions?

Your Cooperation is highly appreciated

After reviewing and evaluating the study questionnaire, I hereby certify that

Students Name: **MADU, TUKUR YEMI**

Matric No: **901006**

Research Topic

THE EFFECTIVENESS OF COOPERATIVE LEARNING (JIGSAW) STRATEGY AND MASTERY LEARNING MODEL ON STUDENTS MATHEMATICS ACHIEVEMENT IN NIGERIAN SECONDARY SCHOOLS

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Supervisor:

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The student is qualified to carryout pilot study or main study by taking into accoun
the above-mentioned views and Comments (if any) that is mentioned above.

Signature:

Name:

Date: 28 March 2014

Stamp: DR. NURULWAHIDA ABDULLAH
Pensyarah Kanan
Jabatan Pendidikan dan Bahasa Moden

Supervisor:

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2. **PROF. MADYA DR. RUZLAN BIN MD. ALI**
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   UNIVERSITI UTARA MALAYSIA.

The student is qualified to carryout pilot study or main study by taking into accou the abovementioned views and Comments (if any) that is mentioned above.

Signature

Name:

Date: 28 March 2017

Stamp. DR. SARIMAH SHAIK ABDULLAH
Pensyarah Kanan
Jabatan Pengajian Pendidikan

Supervisor:

1. **DR. NURULWAHIDA HJ AZID @ AZIZ**

   SENIOR LECTURER

   SCHOOL OF EDUCATION AND MODERN LANGUAGES, UUM COLLEGE OF ARTS & SCIENCES,

   UNIVERSITI UTARA MALAYSIA.

2. **PROF. MADYA DR. RUZLAN BIN MD. ALI**
   SCHOOL OF EDUCATION AND MODERN LANGUAGES, UUM COLLEGE OF ARTS & SCIENCES,

   UNIVERSITI UTARA MALAYSIA.

The student is qualified to carryout pilot study or main study by taking into account the abovementioned views and Comments (if any) that is mentioned above.

Signature

Name:

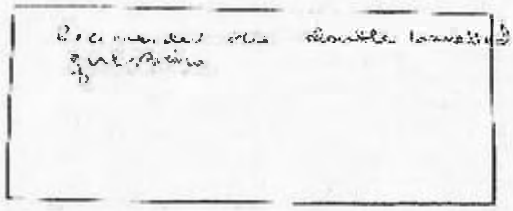
Date: 28 March 2017

Stamp.

DR. SARIMAH SHAIK ABDULLAH
Pensyarah Kanan
Jabatan Pengajian Pendidikan
Pusat Pengajian Pendidikan dan Bahasa Moden
UUM College of Arts and Sciences
Universiti Utara Malaysia

VALIDATION VERIFICATION FORM FOR EXPERT

STUDY INSTRUMENTS



Your Cooperation is highly appreciated

As I am seeking out to use the study questionnaire, I hereby certify that:

Supervisor's Name: MADU, TIMOTHY AWAH

Matric No: 901066

Research Topic:

THE EFFECTIVENESS OF COOPERATIVE LEARNING (JIGSAW) STRATEGY AND MASTERY LEARNING MODEL ON STUDENTS MATHEMATICS ACHIEVEMENT IN NIGERIAN SECONDARY SCHOOLS.

EVALUATION VERIFICATION FORM FOR EXPERT

VIEWS / COMMENTS

Recomended the double barelled questions

Your Cooperation is highly appreciated.

After reviewing and evaluating the study questionnaire, I hereby certify that:

Students Name: MADU, TUKUR YEMI

Matric No: 901006

Research Topic:

THE EFFECTIVENESS OF COOPERATIVE LEARNING (JIGSAW) STRATEGY AND MASTERY LEARNING MODEL ON STUDENTS MATHEMATICS ACHIEVEMENT IN NIGERIAN SECONDARY SCHOOLS.

EVALUATION VERIFICATION FORM FOR EXPERT

VIEWS / COMMENTS

Recommended the double barelled questions

Your Cooperation is highly appreciated.

After reviewing and evaluating the study questionnaire, I hereby certify that:

Students Name: MADU, TUKUR YEMI

Matric No: 901006

Research Topic:

THE EFFECTIVENESS OF COOPERATIVE LEARNING (JIGSAW) STRATEGY AND MASTERY LEARNING MODEL ON STUDENTS MATHEMATICS ACHIEVEMENT IN NIGERIAN SECONDARY SCHOOLS.

EVALUATION VERIFICATION FORM FOR EXPERT

VIEWS / COMMENTS

Recommended the double barrelled questions

Your Cooperation is highly appreciated.

After reviewing and evaluating the study questionnaire, I hereby certify that:

Students Name: **MADU, TUKUR YEMI**

Matric No: **901006**

Research Topic:

THE EFFECTIVENESS OF COOPERATIVE LEARNING (JIGSAW) STRATEGY AND MASTERY LEARNING MODEL ON STUDENTS MATHEMATICS ACHIEVEMENT IN NIGERIAN SECONDARY SCHOOLS.

Interview Protocol for Treatment Group 1 Teacher

	Questions
1	What is your comments on the implementation strategy of learning activities used in the jigsaw strategy and mastery learning on students understanding of the topic?
2	What are your comments on the implementation strategy of learning activities involving mastery learning process that is used in this model?
3	What are the characteristics of good or positive in this jigsaw strategy and mastery learning model?
4	What are the characteristics of bad or negative in this jigsaw strategy and mastery learning model?
5	Would you recommend secondary school teachers to use this model?
6	In your own opinion, can the process of jigsaw strategy and mastery learning as applied in this learning will improve student's achievement in the subject area? Yes/No why?
7	What are your suggestions to improve the implementation strategy of this model?

Interview Protocol for Treatment Group I Teacher

	Questions
1	What are your comments on the implementation strategy of learning activities used in the jigsaw strategy and mastery learning on students understanding of the topic?
2	What are your comments on the implementation strategy of learning activities involving mastery learning process that is used in this model?
3	What are the characteristics of good or positive in this jigsaw strategy and mastery learning model?
4	What are the characteristics of bad or negative in this jigsaw strategy and mastery learning model ?
5	Would you recommend secondary school teachers to use this model?
6	In your own opinion, can the process of jigsaw strategy and mastery learning as applied in this learning can improve student's achievement in the subject area? Yes/No why?
7	What are your suggestions to improve the implementation strategy of this model?

Interview Protocol for Treatment Group I Teacher

	Questions
1	What is your comments on the implementation strategy of learning activities used in the jigsaw strategy and mastery learning on students understanding of the topic?
2	What are your comments on the implementation strategy of learning activities involving mastery learning process that is used in this model?
3	What are the characteristics of good or positive in this jigsaw strategy and mastery learning model?
4	What are the characteristics of bad or negative in this jigsaw strategy and mastery learning model?
5	Would you recommend secondary school teachers to use this model?
6	In your own opinion, can the process of jigsaw strategy and mastery learning as applied in this learning can improve student's achievement in the subject area? Yes/No. why?
7	What are your suggestions to improve the implementation strategy of this model?

Supervisor:

1. [illegible] WAHIDA HAZIYAH HAZIZ
   SENIOR LECTURER
   SCHOOL OF EDUCATION AND MODERN LANGUAGES, UUM
   COLLEGE OF ARTS & SOCIETY
   UNIVERSITI UTARA MALAYSIA

2. PROF MADYA DR HJ ZAINIBIN MD ALI
   SCHOOL OF EDUCATION AND MODERN LANGUAGES, UUM
   COLLEGE OF ARTS & SOCIETY
   UNIVERSITI UTARA MALAYSIA

The student is qualified [illegible] the above study by taking into account

the [illegible] and [illegible] that is worth [illegible].

Signature:

Name: DR ASHRAF SAHIDAH

Date: 9 March 2017

Stamp: DR ASHRAF SAHIDAH
[illegible]

Supervisor:

1. DR. NURULWAHIDA HJ AZID @ AZIZ

   SENIOR LECTURER

   SCHOOL OF EDUCATION AND MODERN LANGUAGES, UUM COLLEGE OF ARTS & SCIENCES,

   UNIVERSITI UTARA MALAYSIA.

2. PROF. MADYA DR. RUZLAN BIN MD. ALI
   SCHOOL OF EDUCATION AND MODERN LANGUAGES, UUM COLLEGE OF ARTS & SCIENCES,

   UNIVERSITI UTARA MALAYSIA.

The student is qualified to carryout pilot study or main study by taking into account the abovementioned views and Comments (if any) that is mentioned above.

Signature:

Name: DR AHMAD SAHIDAH

Date: 8 March 2017

Stamp: DR. AHMAD SAHIDAH
Senior Lecturer (Visiting)
School of Education and Modern Languages
UUM College of Arts and Sciences
Universiti Utara Malaysia

Supervisor:

1. DR. NURULWAHIDA HJ AZID @ AZIZ

   SENIOR LECTURER

   SCHOOL OF EDUCATION AND MODERN LANGUAGES, UUM COLLEGE OF ARTS & SCIENCES,

   UNIVERSITI UTARA MALAYSIA.

2. PROF. MADYA DR. RUZLAN BIN MD. ALI
   SCHOOL OF EDUCATION AND MODERN LANGUAGES, UUM COLLEGE OF ARTS & SCIENCES,

   UNIVERSITI UTARA MALAYSIA.

The student is qualified to carryout pilot study or main study by taking into account the abovementioned views and Comments (if any) that is mentioned above.

Signature

Name: DR AHMAD SAHIDAH

Date: 8 March 2017

Stamp: DR. AHMAD SAHIDAH
Senior Lecturer (Visiting)
School of Education and Modern Languages
UUM College of Arts and Sciences
Universiti Utara Malaysia

Recommended

Your Cooperation is highly appreciated.

After reviewing and evaluating the study questionnaire. I hereby certify that

Student's Name: MAKU, JOSEPH

Matric No: 901086

Research Topic:

THE EFFECTIVENESS OF COOPERATIVE LEARNING (JIGSAW) STRATEGY AND MASTERY LEARNING MODEL ON STUDENTS MATHEMATICS ACHIEVEMENT IN NIGERIAN SECONDARY SCHOOLS.

EVALUATION VERIFICATION FORM FOR EXPERT

VIEWS / COMMENTS

Recommended

Your Cooperation is highly appreciated

After reviewing and evaluating the study questionnaire, I hereby certify that

Students Name: **MADU, TUKUR YEMI**

Matric No: **901006**

Research Topic

THE EFFECTIVENESS OF COOPERATIVE LEARNING (JIGSAW) STRATEGY AND MASTERY LEARNING MODEL ON STUDENTS MATHEMATICS ACHIEVEMENT IN NIGERIAN SECONDARY SCHOOLS.

EVALUATION VERIFICATION FORM FOR EXPERT

VIEWS / COMMENTS

Recommended

Your Cooperation is highly appreciated

After reviewing and evaluating the study questionnaire, I hereby certify that:

Students Name: MADU, TUKUR YEMI

Matric No: 901006

Research Topic:

THE EFFECTIVENESS OF COOPERATIVE LEARNING (JIGSAW) STRATEGY AND MASTERY LEARNING MODEL ON STUDENTS MATHEMATICS ACHIEVEMENT IN NIGERIAN SECONDARY SCHOOLS.

Supervisor:

1. DR. NORLIZWARIDA RUAZIDA AZIZ
   SENIOR LECTURER
   SCHOOL OF EDUCATION AND MODERN LANGUAGES, UUM COLLEGE OF ARTS & SCIENCES
   UNIVERSITI UTARA MALAYSIA.

2. PROF. MADYA DR RUZLAN BIN MD. ALI
   SCHOOL OF EDUCATION AND MODERN LANGUAGES, UUM COLLEGE OF ARTS & SCIENCES
   UNIVERSITI UTARA MALAYSIA.

The student is qualified to conduct pilot study or main study by taking into account the above mentioned views and Comments (if any) that [illegible].

Signature

Name:

Date:

Stamp:

Supervisor:

1. DR. NURULWAHIDA HJ AZID@AZIZ

   SENIOR LECTURER

   SCHOOL OF EDUCATION AND MODERN LANGUAGES, UUM COLLEGE OF ARTS & SCIENCES,

   UNIVERSITI UTARA MALAYSIA.

2. PROF. MADYA DR. RUZLAN BIN MD. ALI
   SCHOOL OF EDUCATION AND MODERN LANGUAGES, UUM COLLEGE OF ARTS & SCIENCES,

   UNIVERSITI UTARA MALAYSIA.

The student is qualified to carryout pilot study or main study by taking into account the abovementioned views and Comments (if any) that is mentionedabove.

Signature 

Name: Rozlina Khalid

Date: 8/3/2017.

Stamp.

ROZALINA BT. KHALID
Penyelia

EVALUATION VERIFICATION FORM FOR EXPERT

VIEWS / COMMENTS

Please amend accordingly

Your Cooperation is highly appreciated.

After reviewing and evaluating the study questionnaire, I hereby certify that:

Students Name: **MADU, TUKUR YEMI**

Matric No: **901006**

Research Topic:

THE EFFECTIVENESS OF COOPERATIVE LEARNING (JIGSAW) STRATEGY AND MASTERY LEARNING MODEL ON STUDENTS MATHEMATICS ACHIEVEMENT IN NIGERIAN SECONDARY SCHOOLS.

2

	Questions
1	What is your comment on the implementation strategy of learning activities used in the jigsaw strategy and mastery learning on student understanding of the topic?
2	What are your comments on the implementation strategy of learning activities involving mastery learning process that is used in this model?
3	What are the characteristics of pair-cooperative in this jigsaw strategy and mastery learning model?
4	What are the characteristics of bad-or-negative in this jigsaw strategy and mastery learning model
5	Would you recommend secondary school teachers to use this model?
6	In your own opinion, can the process of jigsaw strategy and mastery learning applied in this learning can improve student's achievement in the subject area? Yes/No. why?

	Questions
1	What is your comment on the implementation strategy of learning activities used in the jigsaw strategy and mastery learning on students' understanding of the topic?
2	What are your comments on the implementation strategy of learning activities involving mastery learning process that is used in this model?
3	What are the characteristics of good or positive in this jigsaw strategy and mastery learning model?
4	What are the characteristics of bad or negative in this jigsaw strategy and mastery learning model?
5	Would you recommend secondary school teachers to use this model?
6	In your own opinion, can the process of jigsaw strategy and mastery learning be applied in this learning will improve students' achievement in the subject area? Yes/No, why?

Interview Protocol for Treatment Group I Teacher

	Questions
1	What is your comment on the ~~implementation strategy of~~ learning activities used in the jigsaw strategy and mastery learning on students' understanding of the topic?
2	What ~~are~~ is your comment on the ~~implementation strategy of learning~~ activities involving mastery learning process ~~that is~~ used in this model?
3	What are the ~~characteristics of good or positive~~ advantages of using in this jigsaw strategy and mastery learning model?
4	What are the ~~characteristics of bad or negative~~ disadvantages of using in this jigsaw strategy and mastery learning model?
5	Would you recommend secondary school teachers to use this model?
6	In your own opinion, can the process of jigsaw strategy and mastery learning ~~as~~ applied in this learning session will improve students' achievement in the subject area? Yes/No. why?
7	What are your suggestions to improve the implementation strategy of this model?