EFFECT OF GENDER AND ACHIEVEMENT ON AQUISITION OF MATHEMATICAL LITERACY THROUGH METACOGNITIVE GUIDANCE ON SECONDARY SCHOOL STUDENTS IN ABUJA

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ABSTRACT

This study investigated the effect of metacognitive guidance in forum discussion on the acquisition of mathematical literacy among senior secondary school students in Abuja. The design was quasi-experimental pre-test, post-test, non-equivalent groups factorial design. Forty female and forty male SSII students of Abuja School of Accountancy and Computer Studies (ASACS) Abuja were sampled using purposive sampling technique out of a population of 42,653 senior secondary school students in Abuja to participate in the study. Two research questions and equivalent two hypotheses were asked and tested respectively to guide the study. Variables of concern in the study were achievement in mathematical literacy, and influence of gender. Achievement Test in Mathematical Literacy (ATML) was constructed by the researchers and validated by experts. Logical validity index of 0.81 and Cronbach's alpha of 0.794 were obtained for ATML . The instrument was administered to the participants as pre and post tests. Two different lesson plans for the control and experimental groups were used for the study. The experimental group was taken through a four-week teaching of mathematics using metacognitive guidance embedded with forum discussion tailored after IMPROVE method which utilizes a series of four self-addressed metacognitive questions, while the control group was taken through a four-week teaching of mathematics using the conventional method without metacognitive guidance. Thereafter, the two groups were post tested. The data collected were analyzed using frequencies, mean, standard

deviation, t-test and Analysis of Co-variance (ANCOVA). Results from the analysis indicated significant difference in the mean score of students exposed to metacognitive guidance and those not exposed to metacognitive guidance in mathematical literacy. There was no gender influence in students' achievement in mathematical literacy. The study recommended among others, that metacognitive guidance should be introduced in the teaching of mathematics, that mathematical literacy be included in the school curriculum and teachers trained at pre-service and in-service to be able to deliver mathematical literacy through metacognitive guidance. Gender discrimination and apathy should be discouraged, and rather encourage gender sensitivity in the study of mathematics and other related courses.

Keywords: Metacognitive Guidance, Achievement, Mathematical Literacy, Gender.

1.0 Background to the study

Mathematics is basic to the development of science and technology, as it is the tool to keep balance in our life .It is the mother science of the abstract world; an essential creative and powerful discipline recognized globally. As important as man has discovered the relevance of Mathematics, the subject has to be handled well in the schools, from basic to advanced levels in order to bring out the utilitarian goals of mathematics to real life situation (Oluwaniyi, 2006). Mathematical theories are used every day by experts in applied sciences like astrology, meteorology, archaeology , geology, space science, travel and research, automobile, construction industries, flight, ship navigation, mining, petrochemical industries and security, espionage (wiring, code breaking etc.,).

Mathematics is taught using different methods, techniques, strategies and approaches by different teachers in different cultures (Sadiq, 2014). Replete research reports and recommendations for the adoption of various methods, techniques and strategies of teaching and learning mathematics abound. However, teaching mathematical literacy through metacognitive guidance with forum discussion is relatively new in this part of the world. Most indigenous studies in metacognitive guidance (Okoza & Aluede, 2014; Okoza, Aluede & Owens-Soglo, 2013; Onu, Eskay, Igbo, Obiyo & Agbo, 2012; Nbina & Viko, 2010) have little or nothing to say on mathematical literacy. Methods of teaching mathematics at various historical phases are contingent on the objectives mathematics education attempts to achieve. One of the strongest results in recent research is that the most important feature in effective teaching is giving students opportunity to learn, as the place and role of the learner is very important. Constructivists opine a learner- centered approach is preferred to the emphasis on the teacher centered. Teachers

and learners have variously employed different methods but unfortunately, performances in mathematical tasks have not been as expected in our schools especially in the secondary schools (Adetula, 2003; National Mathematical Centre (NMC), 2004; SMASE Nigeria, 2006). Every country needs mathematically literate citizens to deal with a very complex and rapidly changing society; it is necessary that the capacities of students to analyze, reason and communicate ideas effectively as they pose, formulate, solve and interpret mathematical problems in a variety of situations must move beyond the kinds of situations and problems typically encountered in school classrooms (PISA/OECD, 2003). It is to this effect that the researcher examined how to enhance mathematical literacy through metacognitive guidance in forum discussion. Mathematical literacy chooses to emphasize putting mathematical knowledge to functional use in a multitude of different situations in varied, reflective and insight-based ways.

1.1.1 Operational Definition of Terms

The following terms/concepts used in the study should be read and understood as defined herein:

1.1.2 Mathematical Knowledge (MK): In a normal classroom setting, learners are exposed to specific themes and topics in the school syllabus drawn from the curriculum. In mathematics for example, topics in algebra, geometry, trigonometry are taught students. The students' understanding of these topics as assessed through formal methods is called Mathematical knowledge. This refers to knowledge of design features involved in mathematical discourse. It includes the understanding of the terms, facts, signs, symbols, procedures and skills in performing certain operations in specific mathematical sub-domains. It also includes the ability of students to analyze, reason and communicate ideas effectively as they pose, formulate, solve and interpret mathematical problems in a variety of situations.

1.1.3 Mathematical Literacy (ML):

Mathematical literacy is the ability and capacity of learners to apply the mathematical knowledge they learnt in the classroom to deal with out of classroom encounters. It mostly requires thinking outside the box. It is a link between classroom theory and practice in tackling real life tasks .Mathematical literacy is the capacity to identify, understand and engage in mathematics as well as to make well founded judgments about the role that mathematics plays in an individual's current and future life as a constructive, concerned and reflective citizen.

1.1.4 **Metacognition**:

Cognition is the mental action or process of acquiring knowledge, skill and appreciation. Metacognition on the other hand is beyond cognition. It is the control and regulation that one has over his/her cognition, learning , thinking process or cognitive functioning .It is, what one knows about one's cognitive performance and how one regulates one's cognitive actions during performance

1.1.5 MetacognitiveGuidance (MG):

To guide is to direct, assist and help chart a particular course. Metacognitive guidance is the help, assistance and direction rendered to learners to facilitate knowledge and control over their cognition. Metacognitive guidance is planned, deliberate, intentional and interwoven between process and product. It is the assistance given to students to improve on their metacognitive activities (Kramarski and Mevarech ,2003).

2.0 Statement of the problem

Too often, the Nigerian society seems to accept the stereotype that mathematics is for the few, not for the many. The reality is that mathematics

is deeply embedded in the modern workplace and in everyday life. It is time to dispel the myth that mathematics is for selected few and demand success in mathematics for all learners. However students must have a solid conceptual foundation in Mathematics in order to apply their knowledge effectively and to continue to learn mathematics. Mathematics is so entwined with today's way of

life that students cannot fully comprehend the information that surrounds them without a basic understanding of mathematical ideas . Teachers and learners have employed various methods in teaching and learning mathematics, but unfortunately, students' performances are not commensurate to the efforts put in. If this scenario is allowed to persist, the students and society on the long run will be adversely affected. Can metacognitive guidance in forum discussion enhance mathematical literacy in some secondary school students in Abuja? Rather than limit the students to the curriculum contents they have learned, is it possible to determine if students can use what they have learned in situations they are likely to encounter in daily life? Is

there any difference in the performance of students in forum discussion and their counterparts not exposed to metacognitive guidance? Seeking answers to these posers constituted the problem that this study was designed to address .The thrust of this study was to identify what will enable students to use their mathematical knowledge to solve real life tasks; how guidance in intentionality will facilitate acquisition of mathematical

literacy through online discussion . It is to determine the characteristics needed to convert students' mathematical "head knowledge" to productive problem solving skills through metacognitive guidance.

3.0 Purpose of study

The purpose of this study was to determine the effect of forum discussion embedded within metacognitive guidance on mathematical literacy of

senior secondary school students in the Federal Capital Territory, Abuja. Specifically, the study strived to achieve the following objectives:

1. Assess the effect of the use of metacognitive guidance in forum discussion in teaching mathematics to senior secondary school students.
2. Examine the influence of gender on the differential learning environment (Experimental and Control groups) for mathematical literacy.

4.0 Research Questions:

The following research questions were raised to guide the study:

1. What is the significant difference in the mean scores of students exposed to metacognitive guidance with forum and those exposed to forum without metacognitive guidance?
2. What is the influence of gender on the differential learning environment for mathematical literacy?

5.0 Statement of the Hypotheses:

To facilitate the collection and analysis of data relevant to the research, the following hypotheses were tested:

1. There is no significant difference in the mean scores of students exposed to metacognitive guidance with forum and those exposed to forum without metacognitive guidance.

2. There is no significant difference in the mean performance of males and females in mathematical literacy.

6.0 Scope of the study

The study is delimited to the investigation of the effects of forum discussion embedded in metacognitive guidance on the acquisition of mathematical literacy. Other approaches to the learning of mathematics were excluded from the investigation because what was in focus in this study is the effect of metacognitive guidance specifically embedded within forum discussion.Senior secondary one and Senior secondary three (SS1 & SS3 respectively) students were excluded from the study because SS3 students were busy preparing for their end of secondary school examinations like the West African Senior Secondary Certificate Examination (WASSCE) and the National Examination Council (NECO), while SS1 students were relatively new in the senior secondary school.Subjects of the study were expected to be able to basically use the internet

so that the researcher will not have to start training subjects before being able to participate in the study, hence the choice of schools with proven internet facilities.

7.0 Methodology

7.1 Introduction:

This section, devoted to the research methodology, is presented under the following subheadings: research design, population, sample and sampling procedure, instrumentation, validation of instruments, reliability of instruments, administration, and procedure for data analysis are discussed.

7.2 Research Design

This study adopted quasi-experimental pre test –post test, non equivalent groups design. Conventionally, there were Experimental and Control groups. The Experimental group was exposed to metacognitive guidance through forum discussion (MG), while the Control group was not exposed to metacognitive guidance. Both groups were allowed forum discussion (FD) on the internet. An achievement test (pre test) was administered and the results used to ensure that the mean performances of both groups are not significantly different, thereby ascertaining that at the beginning of study, the two groups were similar in ability. The experimental group was allowed internet interaction coupled with a four-week metacognitive guidance using a validated instrument and lesson plan tailored after IMPROVE (Mevarech & Kramarski, 1997). In contrast, the Control group was taken through a four-week teaching without metacognitive guidance. At the end, a post-test on mathematical literacy was administered to both groups.

7.3 Population of the Study

Forty two thousand, six hundred and fifty three senior secondary school students from 125 senior secondary schools in the Federal Capital Territory, Abuja ,Nigeria constituted the population of the quasi experimental research. The target population was senior secondary school students with access to functional internet facilities.

7.4 Sample and Sampling Procedure

Purposive sampling of schools that qualified by the delimited scope of the study was relied on. Precisely 40 males and 40 females senior secondary 2 students of Abuja School of Accountancy and Computer Studies (ASACS) Secondary School, Bwari, Abuja were purposely selected for the study. There were 40 subjects for the experimental group with 20 females and 20 males. The control group was also 40 subjects with 20 females and 20 males.

For a study that required subjects to work using the internet, the sample size of 80 subjects satisfies the Central Limit Theorem, that the sample means of the samples will be normally distributed. Senior secondary 2 students were sampled for the study because senior secondary 1 students were relatively new to the senior secondary section, while senior secondary 3 students were not enthusiastic

to participate in the study as their focus was concentrated on their preparations for the Senior School Certificate Examinations (SSCE).**7.5**

7.5 Instrumentation

The instrument employed for data collection in the research is described below along with the tools for the experimental teaching.

7.5.1 Achievement Test in Mathematical Literacy (ATML).

This is an adaptation of the PISA/OECD standardized mathematical literacy questions published by OECD. Ten items were carefully selected from the compendium: "Take The Test". Problems posed require application of mathematical knowledge in solving real life problems/tasks. Each of the ten problems was scored out of a total of ten points. The maximum score obtainable is 100. In mathematical literacy, assessment is given as a percentage and a rating code. The examination papers in Mathematical literacy have approximately 25% of marks from each learning outcome: Learning outcome1- Numbers and Operations in context; Learning outcome2- Functional Relationships; Learning outcome3-Space,Shape and Measurement and Learning outcome4- Data handling .

7.5.2 Tools

Tools for carrying out the study are:

(i) Lesson plans for the experimental group

(ii) Lesson plans for the control group

The lesson plans were prepared to cover the deliberate activities that the experimental and control groups were exposed to.

7.5.3 Validation of Instruments

The researchers presented the ten-item pre-post test instrument to four senior colleagues who are experts in mathematics, statistics and psychometric and from different organizations to rate the instrument with a view to computing index of logical validity. The experts gave logical validity index of 0.81.

7.5.4 Reliability of Instruments

To compute a measure of internal consistency of the instrument used for the research, it was administered to 57 pilot subjects selected randomly from Senior Secondary 2 students of Government Secondary School, Kuduru, Bwari Area Council, Abuja. These students did not take part in the research. The scores were harvested and subjected to Statistical Package for Social Sciences (SPSS) version 21.0 with a view to obtaining Cronbach's alpha($\propto$).

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.794	0.754	10

Cronbach's alpha of 0.794 was obtained.

8.0 Administration:

ATML was administered to the subjects. Participants had two hours to respond to the instrument .They were afforded minimum requirements for test administration to ensure validity. Adequate instructions/information were accorded participants to avoid ambiguity. Relevant test materials were provided.

9.0 Procedure for Data Analysis

Relevant statistical techniques were employed in analyzing data that were gathered from the administered instruments. Research questions were answered with descriptive statistics, mainly means and standard deviations.

(i) T-test statistic was used in testing whether there is a significant difference or not in the mean achievements of the experimental and
control groups in the pre test and post test. Achievement gain was obtained by subtracting the mean pre test score from the post test scores of experimental and control groups.

(ii) ANCOVA was used to test whether or not differences existed in the following:
   (a) Metacognitive guidance + Forum and Forum alone
   (b) Performances according to gender

ANCOVA, a method of analysis that enables the researcher to equate the pre-experimental status of the groups in terms of relevant known variables was applied to the experimental and control groups at the 0.05 level of significance.

10.0 Presentation of Data and Analysis

10.1 Introduction : In this section, data collected in the study are presented and analyzed. Equivalent research questions and hypotheses are restated and relevant data are presented in tables. Procedures used for the hypotheses are given, stating the significance levels ($\propto$), degrees of freedom (df) and the statistical techniques employed. Decisions are made concerning the hypotheses ;statements are also made as to whether or not the decisions are in line with related reviews.

10.2 Presentation of Data Two research questions and equivalent two hypotheses are answered and tested respectively.

10.2.1 Research Question 1

What is the significant difference in the mean scores of students exposed to metacognitive guidance with forum and those exposed to forum without metacognitive guidance?

Data in Table 1 show the mean gain of the experimental group over the control group in pre test to be 0.22, while the mean gain of the experimental group over the control group in post test is 8.45. The use of metacognitive guidance had effect on performance.

Table 1 : Mean scores in mathematical literacy based on exposure or not to metacognitive guidance

	Experimental (N=40)		Control (N=40)	
	Mean	**S.D**	**Mean**	**S.D**
Pretest	36.45	1.568	36.23	4.488
Posttest	45.10	4.088	36.65	2.340

10.2.2 Hypothesis 1

There is no significant difference in the mean scores of students exposed to metacognitive guidance with forum and those exposed to forum without metacognitive guidance. Table 2 is on analysis of covariance of experimental and control groups before and after treatment. Mean scores of subjects are presented.

Table 2: Analysis of Covariance (ANCOVA) on students exposed to metacognitive guidance with forum and those exposed to forum without metacognitive guidance.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	9.000	36	.250	.750	.721
Intercept	63.322	1	63.322	189.965	.001
Posttest	2.492	11	.227	.680	.012*****
Pretest	1.936	12	.161	.484	.842******
Posttest * Pretest	2.409	6	.401	1.204	.026*****
Error	1.000	3	.333		
Total	100.000	40			
Corrected Total	10.000	39			

*** Significant at 0.05 level of significance ** Not significant at 0.05 level of significance**

Data in Table 2 show that there is no significant difference in the mean scores of students exposed to metacognitive guidance with forum and those exposed to forum without metacognitive guidance in pre test (F=0.484, Sig.=0.842) . The post test (F=0.680, Sig=0.12) is significant. That means the null hypothesis is rejected. This indicates that students exposed to metacognitive guidance with forum performed better in mathematical literacy than others in the control who were not exposed to metacognitive guidance.

10.2.3 Research Question 2

What is the influence of gender on the experimental and control groups for mathematical literacy?

Mean scores in mathematical literacy was compared between the female and male subjects of the study.

Results in Table 3 show that achievement in mathematical literacy does not depend on gender. The mean scores of the groups indicate this position. The mean score of female

control is 36.70 while that of male is given as 36.38. The mean score of female experimental is 40.00 while that of male is given as 40.35

Table 3 : Mean scores in mathematical literacy by gender.

	Experimental (N=40)		Control (N=40)	
	Mean	**S.D**	**Mean**	**S.D**
Female	40.00	4.341	36.70	3.502
Male	40.35	4.682	36.38	3.208

10.2.4 Hypothesis 2

There is no significant difference in the mean performance of males and females in mathematical literacy.

Table 4: Analysis of Covariance (ANCOVA) on performance of males and females in mathematical literacy.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	4634.800[a]	72	64.372	56.326	.000
Intercept	44339.405	1	44339.405	38796.979	.000
Gender	2.204	1	2.204	1.929	.207
Posttest	3084.141	28	110.148	96.379	.000*
Pretest	1022.335	23	44.449	49.405	.000*
Gender * Posttest	1.333	1	1.333	1.167	.316**
Error	8.000	7	1.143		
Total	77606.000	80			
Corrected Total	4642.800	79			

*** Significant at 0.05 level of significance ** Not significant at 0.05 level of significance**

Results in Table 4 indicate the mean performance of males and females in mathematical literacy. This is shown by the F-value of 1.929 which is significant at 0.207 levels and therefore not significant at 0.05 levels. The null hypothesis of no significant difference in the mean performance of males and females in mathematical literacy is accepted. This suggests that the effect of treatment on the students' performance did not depend on their gender.

Data in Table 5 was generated by computing the t-test statistic comparing the sexes before treatment.

Table 5: T-test analysis on gender of pretest of control and experimental groups.

	Paired Differences					t	Df	S
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Female – Male	.325	4.763	.753	-1.198	1.848	.432	39	

*** Not significant at 0.05 levels of significance**

Results in Table5 indicate the t-test analysis on gender of pretest control and experimental groups. This is shown by calculated t=0.432 which is not significant at 0.668 levels. There is no significant difference in the mean scores of males and females in mathematical literacy of the experimental and control groups before treatment.

Data in Table 6 was generated by computing the t-test statistic comparing the sexes after treatment.

Table 6: T-test analysis on gender of post-test of control and experimental groups

	Paired Differences					t	Df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Female – Male	.650	5.137	.812	-.993	2.293	.800	39	.428*

*** Not significant at 0.05 levels of significant**

Results in Table 6 indicate the t-test analysis on gender of post test control and experimental groups. This is shown by calculated t=0.800 which is not significant at 0.428 levels. There is no significant difference in the mean scores of males and females in mathematical literacy of the experimental and control groups after treatment.

11.0 Discussion, Conclusion and Recommendation

11.1 **Introduction**:

This section is devoted to summary, conclusion and recommendations. The sub-divisions cover a restatement of the problem, description of procedures, summary of major findings, discussion, conclusion, limitations, recommendations and suggestions for further research.

11.1.1 Restatement of the Problem

Researchers have advocated the employment of strategies, techniques and approaches to enhance better performances of secondary school students in mathematics. Most of these have not focused on the effect of metacognitive guidance with forum discussion on the acquisition of mathematical literacy. Can metacognitive guidance in forum discussion enhance mathematical literacy in some secondary school students in Abuja? Rather than limit the students to the curriculum contents they have learned, is it possible to determine if students can use what they have learned in the classroom in situations they are likely to encounter in daily life? What will enable the students to use their mathematical knowledge to solve real life tasks? Seeking answers to these posers constituted the problem that this study was designed to address. The study tried to identify what will enable students use their mathematics knowledge to solve real life tasks through metacognitive guidance.

11.1.2 Description of Procedures

Research design – Quasi-experimental non-equivalent groups design was used. Population of the study – 42,653 senior secondary school students from 125 senior secondary schools of the Federal Capital Territory, Abuja constituted the population of the study.Purposive sampling technique was employed to sample 80 senior secondary school students (40 females and 40 males) for the quasi-experimental study. The subjects were drawn from ASCAS, Abuja Two instruments: Achievement Test in Mathematical Literacy (ATML) and

Students' Mathematics Interest Inventory (SMII) were administered to the subjects. The two instruments were validated by four and three experts respectively with logical validity indices of 0.81 and 0.87. The reliability of the instruments was ascertained by administering the instruments to 57 pilot subjects who did not participate in the study. Cronbach's-alpha of 0.794 was obtained.

Two different lesson plans were prepared, one for the experimental group and the other for the control group. The experimental group was exposed to metacognitive guidance with forum discussion for four weeks based on IMPROVE, the self-metacognitive questioning method suggested by Kramarski and Mevarech (2003), while the control group was taught mathematics also for four weeks using the lesson plan prepared for it with the conventional method and without metacognitive guidance. At the end of the four weeks, both the experimental and control groups were post-tested. Statistical techniques employed in the analysis of data were mean, standard deviation, t-test and Analysis of Covariance (ANCOVA).

Variables considered in the study were achievement in mathematical literacy tasks, and students' gender.

12.0 Summary of Findings

Findings from the study are as follows:

(1) Students exposed to metacognitive guidance outperformed those not exposed to metacognitive guidance in mathematical literacy.

(2) There was no significant difference in the mean performance of males and females in mathematical literacy. Gender has no influence in mathematical literacy.

13.0 Discussion

This study showed that metacognitive guidance with forum discussion can enhance mathematical literacy. This conforms with the study of Mevavech & Kramerski (2012). Metacognition can be taught. The Constructivists believe that knowledge is constructed and the learner is an active creator. In metacognitive guidance, the learner is guided to construct knowledge. Metacognitive behaviour in mathematical tasks will foster originality and intentionality in learners, thereby curbing or reducing the propensity of learners to cheat or be involved in examination malpractices. Metacognition, or the ability to control one's cognitive processes are refered to as metacomponents by Sternberg (1984). These are processes that control other cognitive components as well as receive feedback from these components. In this study, the experimental group was exposed metacognitive guidance with forum, while the control group was exposed to forum but not to metacognitive guidance. The study showed that the subjects exposed to metacognitive guidance outperformed those not exposed to metacognitive guidance in mathematical literacy. This is in conformity with research results of Kramarski & Mizrachi (2004), Mevarech & Kramarski (2004), Eden, Mevarech & Kurtz (2008), Kramarski (2012).

The results of this research indicated that gender does not influence the performance of subjects in mathematical literacy. This result is consistent with earlier reports of Olosunde (2013), Adaramola & Obomann (2013), and Salman & Ameen (2014). It is often said that "what a man can do, a woman can do , even better". Discrimination on the basis of gender in academic pursuits and accomplishments is counter-productive and should be discouraged. Females have ventured into

areas traditionally held to be males' domain. Curriculum developers, book writers and teachers should understand and encourage both sexes to undertake courses available and should not encourage the wrong impression that males are better than females in some courses e.g. mathematics and that females are better than males in language studies. There should be gender sensitivity. Studies reporting lopsided beliefs in support of superiority or inferiority of one sex to the other are isolated and cannot be generalised. For example Kenny-Benson et al., (2006) opined that girls are more likely than boys to hold mastery over performance goals and to refrain from disruptive classroom behaviour which predicted girls' greater effortful learning overtime. They reported that the sex difference in learning strategies accounted for girls' edge over boys in terms of grades. They opined that girls do not do better on achievement tests possibly because self-efficacy, for which there was also no sex difference, was the central predictor of performance on achievement tests

14.0 Conclusion

Answers to the questions raised and decisions taken concerning the hypotheses are presented here.

Metacognitive guidance has positive effect on performance in teaching mathematics to senior secondary school students. There is a significant difference in the mean scores of students exposed to metacognitive guidance with forum discussion and those exposed to forum discussion without metacognitive guidance. Gender has no influence on the differential learning environment for mathematical literacy. There is no significant difference in the mean performance of males and females in mathematical literacy.

15.0 Limitations

This study required subjects to use the internet for online discussion. Only one school was used for the study since it would have been too tasking to use many schools as the researchers personally handled the two groups (experimental and control) involved in the study. Although, the results of the study have contributed to research and knowledge, if more schools were used, generalisation would have been wider.

16.0 Recommendations

Based on the findings of this study, the following recommendations are made:

1. Metacognitive guidance should be introduced in the teaching of mathematics in the secondary schools.
2. If metacognitive guidance as an approach to teaching mathematics should be introduced in the secondary schools, the teachers through whom this should be accomplished must be trained in metacognition, as one cannot give what she/he does not have.
3. Mathematical literacy should be introduced into the secondary school curriculum.
4. Gender sensitivity should be encouraged rather than gender discrimination and disparity among students in the study of Mathematics. Equal opportunities and encouragement should be given to the sexes in their academic pursuits, especially in mathematics and mathematically related courses.

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