

Gender Disparity on the Interest of Learners When Exposed to Concepts in Technical Drawing Using Mind Mapping Instructional Techniques

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Abstract

This study determined the effect of Mind mapping instructional techniques (MMIT) on learners' interest in secondary school (SS) Technical Drawing (TD). The interest of learners exposed to instruction in TD using MMIT was compared with learners exposed to instruction in TD using the traditional approach as control. Three research questions and 3 null hypotheses guided the study. A quasi-experimental research design was employed. The Participants were 298 SSII TD students for the 2018/2019 Academic session in Gwagwalada Area Council of Federal Capital Territory, Abuja. The sample was 86 TD students drawn through a multistage sampling technique. TD Interest Inventory (TDII) developed by the researcher and validated by three experts was the instrument used for data collection. The instrument was trial tested and its internal consistency index was determined using the Chronbach alpha procedure. A reliability coefficient index of 0.69 was obtained for the TDII. Data collected were analysed using mean and ANCOVA. Findings revealed that MMIT was more suitable for improving learners' interest in TD than the Conventional or traditional method. Gender was not an established fact or variable that contributed to learners' interest in TD when exposed to MMIT. Lastly, the research outcomes show a significant interaction effect of gender and treatment on interest. The study suggested adequate training of teachers on the use of MMIT in TD for secondary schools.

Key words: Gender, interest, mind mapping instructional technique

1. Introduction

Gender differences in science, technology, and mathematics (STEM) have been extensively researched, with particular attention to the choice of occupation. This problem has persisted, particularly in science and technology (S&T)

education and as a result, learners, particularly girls, do no longer interested in S&T and related occupations when they are in secondary school (SS) (Blickenstaff, 2005; Riegler-Crumb, Moore, & Ramos-Wada, 2011; Whitelegg, 2001). Learners' choice of occupation typically commenced when they are 11 or 12 years (Nurmi, 2005) and grow to

maturity in their SS years as a result of learning and participating in different types of tasks both inside and outside of the classroom, and also develop affection for particular course or occupation being piqued (King & Glackin, 2010). As a result, learners that fully involved in practical tasks developed more affection in S&T and their affection is also being displayed in STEM occupations more constantly than learners that are not involved or get involved a little in the practical tasks or activities (Kang & Keinonen, 2017; Jocz, Zhai, & Tan, 2014; Potvin & Hasni, 2014; Gibson & Chase, 2002). As a result, stakeholders in S&T have encouraged learners' participation in a variety of initiatives in order to boost their interest in S&T, as well as S & T-associated occupations (PROFILES; Bolte, Holbrook, Mamlok-Naaman, & Rauch, 2014).

Gender is the fact of being male or female. Gender is the outcome of a complicated chain of biological, social, and environmental influences (Lippa 2005). In addition, gender is a significant variable which affects speech, mannerisms, behaviour and also defining standards for communication (European Commission, 2013a). Gender stereotypes are opinions about females and males, and the definition of femininity and masculinity. These standards build on and reinforce gender preconceptions. Gender rules are shaped through social organisations like families, schools, workplaces, and tertiary institutions, as well as broader cultural domains like books, literature and films (European Commission 2013a).

Gender differences in interest in classroom control and supervision have been reported in a variety of ways. According to research, there was a considerable impact on the area of specializations' interest (Lippa, 2005). Other studies found no evidence of a significant impact (Potvin & Hasni, 2014; Gibson & Chase, 2002). But,

some efforts have been on the impact of gender on learner interest. The socialization process in child parenting has been linked to the gender groups' influential variations in several pieces of research (European Commission 2013a). Another group of opinions also proposed that gender differences in interest are biological in nature (Lippa, 2005). But, several researchers have found that there is no genetic gender difference between boys and girls (Miller, Nolla, Eagly and Uttal, 2018; Archer and MacRae, 1991). Njoku (2002) went on to say that the assumed gender variation was not innate, but rather a result of gender stereotypes in the teaching and learning contents, that are influenced by male-dominated culture.

Cvencek, Meltzoff and Greenwald (2011) discover that "interests," which develop early, are a solid indicator of scientific and technological occupations, in which males and females who ended up as scientists or technologists are exceptionally comparable in their interests and occupational values. It shows up that either such interests are dispersed between the genders or a few other components intercede to prevent females from such occupations. Interest can be characterized as an action one appreciates and commits his/her time in considering or doing. Interest can be referred to as a feeling within the cause of needing to study more about someone. Chauhan (1987) portrayed interest as a driver that propels the person to activity. Tragically there are solid signs of sex inclinations that plague the S&T educational module utilized in Nigeria SSs (Njoku, 2002). These predispositions are in terms of the selection of diagrams or images as examples in S&T exercises, the dialect of expressions utilized in S&T books, and instructors' selection of exercises utilized in S&T instruction. Females' interest is seldom considered in S&T books (Njoku, 2002). Subsequently, the researcher

posits that females' interest in learning S&T is impeded. Sexual orientation predispositions against females in educational programs are not enhanced by S&T instructors' interaction approaches in terms of choice of classroom exercises, examples, questions, helping students, execution desires, compensation and discipline. S&T instructors tend to be one-sided due to pictures that depict boys only in the learning of S&T. These solid inclinations cause the avoidance of females from S&T instruction and result in the existing contrasts in interest by sex (Njoku, 2007).

Njoku (2007) proposed some explanations for females' low interest in S&T disciplines in SS when compared to males. Non-concentration of girls in the classroom owing to complex responsibilities at home, the masculine nature of S&T in SSs and gender discrimination in S&T curricula and instructions, and child upbringing practices that hinder females' preparedness for instruction in S&T are just a few of these reasons. The stereotype of S&T as masculine is ubiquitous. Numerous periods of disregard for female interest in education helped to create a masculine image of S&T. Consequently, it has resulted in gender discrimination in S&T teaching and learning. Ogundola (2017) used a peer tutoring strategy to assess learners' performance in technical drawing (TD) and discovered that there was a substantial difference in the performance of boys and girls in TD, with the girls outperforming the boys.

In the same vein, Oviawe & Adeola (2017) employed concept mapping to assess the mean achievement and interest scores of learners in TD and discovered that there was a substantial difference in mean accomplishment and interest scores of boys and girls, with boys outperforming girls. In contrast, Ezeudu (1995) and Njoku (1997) found no significant difference between boys' and girls' mean achievement and interest scores

in TD. These researchers adopted distinctive techniques in instructing students and found noteworthy differential gender influence in their subjects. Subsequently, the research discoveries have appeared conflicting proof of performance and interest of learners in TD affected by sex. This contrasts in the group's accomplishment and interest in TD has shown that teaching methods and procedures impact in an unexpected way on learners' performance and interest by sex. In this manner, it is beneficial to assess the impact of mind mapping instructional technique (MMIT) on learners' interest in adopting gender as the independent variable.

Buzan and Buzan (1993) expressed that MMIT could be a useful and categorisation realistic organizer of thoughts which employs the cortical abilities to open the brain possibilities. They expressed that a mind map could be an effective realistic organizer of thoughts, which gives an all-inclusive key to opening the potential of the person's brain. Fennema and Sherma (1977) contented that the spatial and verbal capacities were individually distinguished as being associated with the growth in the right and left hemispheres of the brain. Boys are said to utilize the left hemisphere more than girls for spatial thinking, consequently, the male rules in S&T courses. In the same vein, girls utilize the left hemisphere of the brain more than boys and do better than boys in verbal activities. Mind mapping employs the cortical skills within the right and left hemispheres of the brain extraordinarily to create thoughts and group them in this way joining the natural capacities of both sexes for personal applications

Due to its importance, TD should be taught in a way that learners would have a better understanding and interest in it. In this regard, if TD is properly taught with appropriate strategy or technique, it could stimulate learners' interest

and give the country the desired growth, that is needed, for the attainment of individual and country objectives. Interest characterizes the attributes that stimulate concern that sustains learners during learning (Osisioma, 2005). Okwo and Tartiyus (2004) opined that learners' interest in a course is hindered by the teachers' centred and crude methods of teaching. These methods such as lecture and discussion methods diminish TD to an arrangement of stories composed on the board that have small meaning or are meaningless to the learners. In this regard, scholars advocate the application of an innovative approach as a way of making learners develop an interest in TD. Hence, the need to teach TD in a stimulating way that will allow for the attainment of the desired result. Interest is a vital construct in learning since when someone becomes fascinated by a task or action the person may be profoundly participated and propelled to learn. A study conducted by Ogundola (2017) on causes of low achievement in senior School certificate examination in TD examination reveals that most of the learners or candidates offering TD possess small or no interest in the subject. The researcher further added that for decades now, teachers, parents, the government and the general public have been perplexed and disturbed immensely by the lack of students' interest in TD. Consequently, this research investigated how MMIT will be used to stimulate the interest of boys and girls in TD.

2. Statement of the Problem

There are a lot of worries about which procedure or approach to delivering instructions in our schools and colleges that can change the poor learners' interest patterns in TD. A few proposals were made in the past with respect to the distinguishing proof of S&T instructional delivery strategies and approaches that encourage learners to study more and attain better

outcomes in their thinking about TD. Studies have shown that instructors utilize obsolete and inappropriate instructional delivery approaches and techniques in delivering TD instruction in schools which with other variables are responsible for poor learners' interest in TD. The circumstance, in this manner, calls for the application of other instructional delivery approaches and strategies which have been discovered to be viable in a few other fields of studies and nations. One of these instructional strategies is the application of MMIT. MMIT can create the required atmosphere for the proper delivery of TD in a way that learners' interest will be enhanced and increased.

Numerous pieces of research were carried out on gender and interest in TD. It has been famous that boys appear to develop more interest in TD than girls. Other research revealed that girls developed more interest than boys in TD. No gender contrasts in learners' interest in TD were also discovered. These conflicting results in learners' interest in TD necessitated the call for confirming the influence of MMIT and gender on the learners' interest in this study.

3. Objectives

The study determined:

1. The difference in mean interest score of learners taught TD with MMIT and Conventional (lecture) method.
2. The difference in mean interest score of boys and girls in TD when taught with MMIT.
3. The interaction effect of gender and treatment on the interest of learners in TD

4.0 Research Questions

The study was guided by the following research questions

1. What is the difference in the mean interest score of learners in TD when taught with MMIT and the conventional (lecture) method?

2. What is the difference in the mean interest score of boys and girls in TD when taught with MMIT?

4.1 Hypotheses

The following null hypotheses were tested at $P \leq 0.05$ Alpha level.

HO1: There is no significant difference in the mean interest score of learners in TD when taught using MMIT and the conventional method.

HO2: Gender does not significantly influence the interest of learners in TD when taught utilizing MMIT

HO3: There is no significant interaction effect of gender and MMIT on the interest of learners in TD.

5. Methodology

This study was a quasi-experimental non-equivalent pre-test-post-test non-randomized control group design. Intact classes were employed for the study. The selection of this design was due to the fact that it allows control of extraneous factors and the researcher will not also arbitrarily allot the participants to treatment conditions so that the school timetable will not be obstructed. The design is symbolically represented below.

$$E_G = O_1 X O_2$$

$$C_G = O_1 - O_2$$

Where E_G denote experiment (MMIT) group

C_G denote control (Lecture method) group

O_1 denote pre-test observation

X denotes the treatments using MMIT

$-$ denotes the use of the lecture method

O_2 denote post-test observation

All the 298 senior secondary two (SSII) TD students of 2018/2019 set in 14 senior secondary schools (SSSs) in Gwagwalada Area Council (GAC) of Federal Capital Territory (FCT) Abuja made up the population. Four schools with a population of 86 (58 males and 28 females) were randomly selected. Two schools were assigned to the experimental group (MMIT) and the remaining two schools to the control group (Lecture Method)

The instrument utilized for gathering data was a 30-items 4-point scale TD interest inventory (TDII) developed by the researcher. The responses are Strongly Agree (4), Agree (3), Disagree (2) Strongly Disagree (1). The participants were required to show their level of approval or disapproval of some items in SS TD. The TDII was validated by one expert in Measurement and Evaluation and two in TD Education at the Federal University of Technology Minna, Niger State. The basic evaluation and suggestions of the specialists were utilized for correcting the items. The TDII was tested with 20 SS2 TD learners of Government Secondary School Kuje in FCT. The reliability index of the TDII was calculated with the Cronbach alpha formula and a reliability coefficient index of 0.78 was obtained.

Two sets of lesson plans were prepared by the researcher- one was on MMIT and applied in the Experimental group and the second set was on the Conventional approach (Lecture Method) and applied to the control group. The lesson plans were also validated by the experts. The experts were asked to assess the level of converging of the lesson plans with regard to objectives.

At the commencement of the experiment, the TDII was administered to the two groups by their

regular TD teachers as a pre-test in their intact classes. At the conclusion of the administration, the instrument was collected from the learners by the instructors. This administration was used to establish the entry level for the two groups. Regular teaching commenced after the administration of the pretest by their regular instructors for 5 weeks. After 5 weeks of instructing, a post-test was administered to the participants by the TD instructors. One hour was permitted for the test. The test was marked by the instructors; scores were collated and given to the researcher. The purpose of the post-test was to ascertain whether there was any knowledge gain that emerged from the application of MMIT (treatment). Extraneous factors such as initial group difference, teachers' variable, Hawthorne effect and others were controlled to minimize experimentation error. Mean was employed in answering the research questions whereas the null hypotheses were tested at 0.05alpha level utilizing ANCOVA.

6. Results

The results of the study are presented in accordance with the research questions and hypotheses.

Research Question 1

What is the difference in the mean interest score of learners in TD when taught with MMIT and the conventional method?

Table 1: Mean of Pre-test and Post-test Scores of Experimental and Control Groups in TDII

Group	N	Pre-test	Post-test	Mean Gain
		\bar{X}	\bar{X}	
Experimental	46	105.86	139.16	33.30
Control	40	102.23	123.40	21.17

Table 1 indicated that the treatment group's mean score was 105.86 in the pre-test, 139.16 in the post-test and a mean gain of 33.30. The mean score of the control group was 102.23 on the pre-

test, 123.40 on the post-test and a mean gain of 21.17. This result, therefore, revealed that the experimental group's mean gain is higher than the mean gain of learners in the control group. Subsequently, MMIT is successful and indeed more successful than the lecture method in arousing learners' interest in TD.

Research Question 2

What is the difference in the mean interest score of boys and girls in TD when taught with MMIT?

Table 2: Mean of Pre-test and Post-test of Male and Female Students Taught TD in the interest inventory

Gender	Mind mapping technique				Conventional (lecture) Method			
	N	Pre-test	Post-test	Mean Gain \bar{X}	N	Pre-test	Post-test	Mean Gain \bar{X}
Boys	58	104.97	140.12	35.15	4	101.93	124.68	22.75
Girls	28	105.27	136.86	31.59	8	102.67	122.98	20.31

Table 2 indicated that the mean score of boys taught TD with MMIT was 104.97 in the pre-test, 140.12 in the post-test and pre-test, and a post-test mean gain of 35.35. The mean score of girls taught TD with MMIT was 105.27 in the pre-test, 136.86 in the post-test and pre-test, and a post-test mean gain of 31.59. Boys in the conventional group had a mean score of 101.93 in the pre-test, 124.68 in the post-test and a pre-test, and a post-test mean gain of 22.75. In the interim, girls in the conventional method had a mean score of 102.67 in the pre-test, 122.98 in the post-test and pre-test, and a post-test mean gain of 20.31. With these outcomes, boys taught TD had higher mean gain scores than girls in TDII. In the same way, there's an effect attributed to the gender on the interest of boys and girls in TD.

Table 3: Summary of ANCOVA for Test of Significance between the Mean Scores of

Experimental and Control groups, Gender and Interaction Effect of Treatment applied to learners and their gender with regard to their mean scores in TDII.

Source	Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	867.634a	4	184.263	15.284	.000
Intercept	112.731	1	112.731	8.839	.005
Pretest	104.76	1	104.76	1.642	.358
Group	612.421	1	612.421	39.760*	.000
Gender	.693	1	.693	.067	.803
Group*Gender	2.005	1	2.005	.184	.571
Error	1134.246	100	11.8790		
Total	2562453.000	105			
Corrected Total	1963.463	104			

*Significant at sig of $F < .05$

The information displayed in table 3 revealed F-cal for mean scores of the experimental and control group in TDII, gender and the interaction of treatment and gender on learners' interest in TD. The F-cal for the group is 39.760 with a significance of F at .000 which is lower than .05. Consequently, the null hypothesis is in this manner rejected at .05 alpha level. The F-calculated for gender stood at .067 with a significance of F at .803 which is more than 0.5. The null hypothesis is subsequently accepted at 0.05alpha level. The outcome, therefore, revealed no significant difference between the influence of gender (male and female) on learners' interest in TD. The interaction influence of MMIT and gender has an F-cal of .184 with a significance of .571 which is greater than .05. The outcome, therefore, implies that there's no significant interaction influence of MMIT (treatment) administered on learners in TD and their gender with regard to their interest in TD.

6. Discussion of Results

This research finding indicated that the mean interest score of learners instructed with MMIT was more than the mean interest score of learners taught with the conventional approach

(Lecture method). Subsequently, the application of MMIT improved the interest of learners. An indication that the instructional delivery processes have altogether influenced the interest of the learners. This noteworthy distinction may be ascribed to the use of MMIT in the experimental group. This result shows that MMIT is more viable in arousing learners' interest in TD than the lecture method. The by and large higher mean interest score indicated by the experimental group against the control group was due to numerous numbers of tasks and enthusiasm provided by the use of Mind mapping developing from learners' brains which may be comparable to that of their instructors. Moreover, the pictorial aide mode of introduction by the application of MMIT exercises arouses interest within the treatment group.

At last, the researcher suggested that MMIT could be a gender encompasses lesson delivery approach which includes hands-on-minds exercises, the key ingredient of their interest. These results concurred with Oyiawe and Adeola (2017) who asserted that mapping can enhance learners' interests in TD when properly applied. This finding also agreed with Okwo (2002), Okwo

and Tartiyus (2004), Osisioma (2005) and Njoku, (2007) that mapping is a viable instructional technique for enhancing students' interest. One van appropriately mentions that MMIT has the capacity of stimulating and supporting learner interests in TD.

The research uncovered that the learners' mean interest score was affected significantly by gender. Usually, a sign that gender had an impact on the interest of learners when MMIT is adopted. The study also indicated a significant difference between the influence of gender (boys and girls) on learners' interest in TD which affirmed that the distinction or contrast between the interest scores of boys and girls in the TDII significant favoured the boys. The self-evident suggestion of this result is that there was an influence probably caused by gender on learners' interest in learning TD. This finding agreed with Nworgu (1990) and Obodo (1990) where the authors opined that learners' interest towards S&T was significantly influenced by gender. Be that as it may, the findings contradicted Anaekwe (1997) and Ifeakor (2005) that indicated no significant impact of gender on learners' interest in S&T.

Furthermore, Anaekwe (1997) and Ifeakor (2005) agreed that girls appeared to show equal interest in S&T with the boys. During human development and growth, a few pieces of research on gender's effect on learners' interest in S&T were of the view that males have more opportunities than females to develop their skills in S&T through more exposure to S&T exercises. Similarly, boys are usually advised and supported to offer S&T-associated fields like technical and industrial arts whereas young ladies usually advise and support in the areas of domestic and financial-related courses.

The finding of this research has indicated that if girls are offered equal opportunities like boys, their interest in S&T will also be aroused and grow in S&T subjects like TD. The advantage is that the

application of MMIT gender involvement strategy has dispensed with a masculine image of S&T contrasts in learners' interest in support of the females in this research.

The interaction effects of treatment and gender on interest were insignificant. This finding is in agreement with Nworgu (1990) who discovered that the interaction influence of gender and the application of instructional aids in S&T classrooms was insignificant. In the same vein, the result negated Ifeakor (2003) where the author detailed that the interaction influence of assignment strategy and gender on interest was significant. Anaekwe (1997) too found that the influence of learners' interaction mode and gender on interest was significant.

7. Conclusion

This study has shown that the MMIT is more viable than the lecture method in stimulating learners' interest in TD. The influence of gender on interest was significant. Boys appeared to indicate more interest better than girls in S&T. The interaction influence of gender and MMIT on interest was not significant. This a sign that the viability of MMIT on learners' interest in TD does not rely on gender. Thus, independent of the nature of gender, learners will develop more interest in TD when MMIT is adopted as a medium of instructional delivery in TD. Hence, the findings revealed that MMIT is a viable teaching method for TD.

8. Recommendations

1. Since the application of MMIT has been demonstrated to be viable in encouraging more noteworthy interest in TD. TD instructors in schools, colleges and tertiary institutions, authorities and curriculum developers can use it to encourage learners' enrolment and also encourage meaningful teaching and learning in TD.

2. TD instructors that are in training ought to be prepared on the application of MMIT for effective usage after graduation.

3. Government and school administrators could support TD instructors in seminars and workshops constantly to enable them to be up-to-date in the use of MMIT and other strategies that will enhance their teaching in the classroom.

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