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Effect of Teach-Yourself-Mathematics Strategy (TYMS) on Students' Mathematics Achievement

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Abstract
Little has been known about teach-yourself strategy, because many studies have not been carried out on it in most parts of the world, like it has been done with self-regulated learning (SRL) which gave birth to teach-yourself-strategy. It is unfortunate that SRL has not been able to solve the problem of mathematics achievement in Nigeria. This study investigated the effect of Teach-Yourself-Mathematics Strategy (TYMS) on students' mathematics achievement. The participants included 121 (52 males and 69 females) students drawn from two schools in Imo State Nigeria. A structured interview on Gender Perception (GP) and Mathematics Achievement Test (MAT) were used for data collection. The findings revealed a significant increase in the mathematics achievement of low mathematics achieving students who learnt a mathematics topic called sequence and series with the use of teach-yourself-strategy. The mathematics achievement scores of male and female students did not differ significantly showing that teach-yourself-strategy bridged the gender gap that existed in mathematics achievement. The results of this study show that teach-yourself-strategy has the potential of improving students' mathematics achievement and bridging gender gap than every other strategy that has been used previously in teaching mathematics to students.
Keywords: Achievement; Mathematics; Self-Regulatory-Learning; Students; Teach-Yourself.
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Introduction

In the recent past, gender gap in mathematics achievement has generated a lot of controversies. The current issue has attracted the attention of many researchers due to the discrepancies in the results of most research of such studies. Results of previous studies on gender gap in mathematics achievement either revealed that males outperform females in mathematics or the contrary, showing that gender influences mathematics achievement.

Gender is a concept used to distinguish between male and female, especially, in the case of men and women, masculine and feminine (Woolfolk, 2010). Gender is a set of relationships that show what being a man or woman within the society is like (Akin, 2008). Gender is used to describe the characteristics of women and men that are socially constructed, while sex refers to those that are biologically determined. People are born female or male, but learn to be girls and boys who grow into women and men (WHO, 2002). Some cultures expect that males or females cannot excel at certain things because of their gender. Every culture has gender based expectations for males and females. In most African countries and culture, it is assumed that males and females are supposed to act differently; learn some things differently and achieve differently (Gage & Berliner, 1998). In this study, gender is a concept used to distinguish between male and female. The characteristics demonstrated by males and females vary from biological sex, social role, to gender identity and gender perception. Gender Perception (GP) is an individual's view and acceptance that he/she is a male or female. It is an individual's view of their masculinity or femininity. Gender perception has to do with taking up the roles and responsibilities of people with the same biological sex. In this study, gender and gender perception are used interchangeably.

How gender influences mathematics achievement is yet to be known. Onuigbo & Eze (2010) noted that research evidences tend to indicate that in Nigeria, there is a gender imbalance and bias in mathematics in favour of males. Stoet & Geary (2012) also observed that men and women score alike in most areas of mathematics, but a gap favoring men is consistently seen at the high end of mathematics achievement. Similarly, the study of Hannover & Kessels (2011) revealed that males exceeded females in mathematics achievement. Conversely, it is revealed that females outperform males in mathematics. Jeff maintained that males fall behind females in overall achievement.[3)]Contrary to the studies cited above, researchers like Abdu-Raheem (2012); Thurlings et al. (2013) observed no gender gap in the mathematics achievement of students. In the same way, Lindberg et al. (2010) concluded that there were no gender differences in mean achievement of students. Hydeet al. (2008) noted that gender differences in mathematics achievement are insufficient to explain lopsided gender achievement gap, even among high scorers. Ndukwu (2017) posited that the gender gap that existed in mathematics achievement existed due to poor instruction.

Despite the findings of many studies, a consensus is yet to emerge on whether gender actually influences mathematics achievement or not. So the gender-based achievement gap needs to be resolved through an empirical research like this, using Teach-Yourself-Mathematics Strategy (TYMS)

Teach-Yourself-Mathematics Strategy is a stratagem which can aid learners to teach themselves subjects like mathematics and learn at their own pace with the guidance of their teachers. Teach-Yourself-Mathematics Strategy is an offshoot of the self-regulatory learning (SRL) strategy propounded by (Bandura, 1988). And this present study anchors on Bandura's self-regulatory theory (Bandura, 1988), to solve the problem of low mathematics achievement. Schraw, Kauffman and Lehman (2006) posited that self-regulated learning theory evolved from Bandura's (1997) social-cognitive learning theory. Self-regulatory theory is a conscious self-management and task engagement that involves the process of guiding one's own thoughts, behaviours, and feelings to reach a goal. Schraw, Kauffman and Lehman (2006) averred that self-regulated learning refers to our ability to understand and control our learning environments. To do so, we must set goals, select strategies that help us achieve those goals, implement those strategies, and monitor our progress towards our goals (Schunk, 1996). Pintrich, (2000) asserted that few students are fully self-regulated and that those students who are have better self-regulatory skills tend to learn more and report higher levels of academic satisfaction than those with less self-regulatory skills. The tenet of self-regulatory learning strategy enables students to learn by doing. The self-regulatory learning strategy gives students the opportunity to monitor and evaluate progress of their work; organize and transform information to improve learning; set goals and plan for activities; review, rehearse and memorize information and above all teach themselves and make learning easier, and this is what TYMS is all about.

Self-regulated learners are cognizant of their academic strengths and weaknesses, and they have a repertoire of strategies they apply to tackle their day-to-day challenges of academic tasks. Hertel and Karlen (2020) found that SRL were more strongly related to students' achievement goals, learning strategies, and metacognitive knowledge. Self-regulated students are effective in school because they set learning goals, apply effective learning strategies, monitor their own goal progress, establish a productive learning environment, and develop self-efficacy beliefs for learning. Self-regulated learning supports the theory that individuals are active agents of their behaviours, which mean that students can manipulate, control, direct, and be responsible for their own learning. Binnur & Sedat (2017) observed that the effect of self-regulated learning on academic achievement in mathematics is large. Low achievers who were trained to be self-regulated learners were able to overcome prior difficulties in mathematics skills (Camahalan, 2006). According to Weimer et al. (2007), self-regulatory learning is the self-directive process by which learners transform their mental abilities into academic skills. According to Montague (1992), one of the characteristics of self-regulation strategies is self-teaching. Such learners believe that they can learn and surmount any task they have before them because they are self-motivated and approach every task practically and Mathematics learning requires a pragmatic approach.

Mathematics learning is undoubtedly best learned by doing using self-regulatory learning strategy. It is imperative to allow and encourage students to do certain things on their own, irrespective of their gender. The research study conducted by Ndukwu and Ndukwu (2017) revealed that gender does not influence students' self-regulation and mathematics achievement. One wonders if the gender gap noticed in mathematics test scores over the years was caused by poor instruction used in teaching mathematics to students or students' gender perception itself. The researchers are interested in finding out if the use of TYMS will improve students' mathematics achievement and close the gender gap that existed, which the conventional method (CM) of teaching mathematics has not been able close till now.

Given the constant evolution in teaching and learning of mathematics for a more conceptual understanding, the poor achievement of students in mathematics is an evidence that shows that mathematics is one of the subjects both teachers and students find difficult in Nigeria.

The present study tends to explore the current state of mathematics instruction in Nigeria, particularly, the research question;"what is the effect of teaching mathematics with the teach-yourself-mathematics strategy". In the present study the researchers focused on students' mathematics achievement, because, high ability in mathematics is seen as an important aspect of school achievement. Mathematics is a prerequisite for attending higher education in Nigeria.

Statement of the Problem

Enyiogugu and Nguru students in Imo State Nigeria were reputed to be very good at mathematics. But of late, the mathematics achievement in the area has fallen drastically in external examinations. There is fear that if this mathematics achievement continues to dwindle, it may compel many students to indulge in examination malpractices, give up their dream courses in the university, or eventually drop out of school and become deviants. Such an ugly trend may adversely affect the scientific and technological development of Nigeria now that the world is technologically driven, and Nigeria needs scientific advancement.

Studies in the developed nations show that teach-yourself-mathematics strategy which is a derivative of

self-regulated learning has the potential of enhancing learning. This assertion is supported by Stoeger & Ziegler (2008) who found in their study that self-regulated learning strategies increased students' academic achievement in mathematics. Similarly, Yildzhi and Saban (2016) found that self-regulated learning activities increase students' achievement in mathematics. Self-regulated learning training improves mathematics achievement, meta-cognitive self-regulation (Bol et al., 2016).

One wonders if a study on self-regulation and self-teaching, with Nigerian students who operate on a different socio-cultural milieu, will improve students' mathematics achievement.

Purpose of the Study

This study aims at investigating the effect of Teach-Yourself-Mathematics strategy and gender on the mathematics achievement of secondary school students. Specifically, the study sought to determine: (1) the effect of teach-yourself-Mathematics strategy on students' mathematics achievement; (2) the influence of gender perception on students' mathematics achievement; (3) the interaction effect of teach-yourself-Mathematics strategy and gender perception on mean mathematics achievement of students.

Hypotheses

In order to address the stated problems, three null hypotheses were formulated and tested at 0.05 probability level.

Ho_1: There is no significant difference in the mean mathematics achievement scores of students who learnt mathematics with teach-yourself-Mathematics strategy and those exposed to conventional method, as measured by mathematics achievement test.

Ho_2: There is no significant difference in the mean mathematics achievement scores of males and females' students based on gender perception.

Ho_3: There is no interaction effect of teach-yourself-Mathematics strategy (TYMS) and gender perception (GP) on mean mathematics achievement of students.

Research Method

This study adopted a quasi-experimental research design. Specifically, the study made use of pretest-posttest, non-equivalent experimental and control group design, with the experimental group learning mathematics with TYMS, while the control group received CM. A quasi-experiment is a research study in which there is no random assignment of the subjects (Ali, 2006). The design is considered suitable in this study because, intact or existing groups were used for experimental and control groups in order not to disrupt the normal class timetable. Quasi-experimental designs tend to be used in real life conditions and investigations, where existing groups are not divided like we have in this study.

The design and symbols are represented thus:

Groups

	Pretest	Treatment	Posttest
Experimental Group	a_1	y_1	a_2
Control Group	a_1	y_0	a_2

Key;

a_1 = Pretest.
y_1 = Treatment (Self-Regulatory Learning Strategy)
y_0 = Control Group (No Treatment, but Conventional Method (CM).
a_2 = Posttest.

Sample and Sampling Technique

The sample for this study was 121 (52 males and 69 females), identified as low mathematics achieving SSII students. Four intact classes were used for the study. The four classes were drawn from two public coeducational secondary schools in the study area. The two schools were Enyiogugu Secondary School and Nguru Secondary School Ahiato. The two schools were sampled from the 4 public secondary schools in the area of study, and the schools were randomly assigned to experimental and control groups.

Instruments for data Collection

The researchers used two research instruments: A structured interview on Gender Perception Questions (GPQ) and Mathematics Achievement Test (MAT) were used for data collection. GPQ contains 20 open-ended (oral interview questions). GPQ was used to elicit information from students on their gender perception. The idea

behind using the GPQ was to know whether students believe that the gender they identify with has influence on their mathematics achievement. And a paper-and-pencil Mathematics Achievement Test (MAT) which contains 20 standardized items was used to ascertain students' mathematical ability before and after the use of TYMS. The items were 20 objective questions generated from SSII mathematics scheme of work. The items covered sub-topics in arithmetic. Arithmetic is one of the topics most students find difficult to pass well both in internal and external examinations in Nigeria. The instrument has sections A and B. Section A showed personal data; age, gender perception while section "B" showed the 20 objective test items.

Instructional Procedure

Just like Van Steenbruggeet al. (2015), the examination of instruction in this current study was framed by means of instructional episodes, a concept that originated from Stein, Grover, and Henningsen (1996) description of mathematical tasks. Stein et al.'s (1996) definition of a mathematical task relates to a classroom activity that aims to focus students' attention on a specific mathematical idea. This study anchors on Doyle's (1983) notion of academic tasks and what determines the content that students learn, how students learn this content, and by means of which resources they learn it. Stein et al. (1996) do not classify an activity as another mathematical task until the underlying mathematical idea changes.

Before the commencement of the research study, the researchers sought the consent and cooperation of the principals of the schools sampled for the study. The intention was to enable the schools integrate the research programme into the school schedule without disrupting the later. The researchers achieved that by meeting the principals of the schools on the first day of school resumption and explained to them the purpose of the study and the benefits that could be derived from the study, if it was properly conducted. On request, the principals introduced the researchers to their mathematics teachers, who served as their research assistants. The researchers also explained to them the purpose of the research study and then solicited their cooperation. The researchers and their research assistants scheduled time for training. Thereafter, the researchers trained their research assistants. For convenience, the two research assistants received their training separately from each other. The training was concluded before the research assistants were involved in the research study. That was done to ensure that the research assistants knew what to do and how to do it well. The researchers were not directly involved in the data collection, but gave the validated lesson plans, test questions, and the marking schemes to the research assistants for the treatment and control groups.

The pre-test, treatment and post-test were held during the normal lesson periods in the school timetable. The experimental group lesson plan was used to teach Senior Secondary II students in Enyiogugu Secondary School (which is the treatment group) on each mathematics lesson period, for four weeks. The research assistant in the treatment group used 15 minutes to introduce the instructional topics and explained one question to the students and thereafter gave them other questions to study and solve without the help but guidance of the teacher. The students were given 25 minutes to study and solve the mathematics questions on their own. They were also allowed to ask their teacher questions, when and where they were confused. Each group held their instruction classes for 40 minutes (8:20-9:00 am before the day became hot) each day, three times a week and for four weeks, according to the school timetable. While the control group lesson plan was used to teach students in Nguru Secondary Technical School (which is the control group) on each mathematics lesson period, for four weeks. Light food (meat pie and water) was given to students in both the experimental and control schools before the lesson, the idea was to quench hunger and ensure that the students were physically and emotionally stable during the experiment. The food giving idea was incorporated into the research study due to the fact that most of the students came from homes with low socio-economic status and may have come to school in an empty stomach.

Pre-Test: Pretest was administered before the treatment. That was to ascertain what the students were able to achieve before the treatment.

Post-test: Posttest was administered after the treatment to determine whether the treatment has effect on students' mathematics achievement or not. The pre-test scores were used as covariates to the students' post-test scores. After the pre-test, the researchers reshuffled the items in the MAT for the post test.

Method of Data Analyses

Mean and standard deviation were used in answering the three research questions posed by the researchers, while analysis of covariance (ANCOVA) was used to test all the three null hypotheses at 0.05 level of significance. ANCOVA was a suitable statistical tool capable of taking care of any difference that existed between the experimental and control groups, vis-à-vis pretest-posttest scores. ANCOVA was used to in order to take care of the initial difference in the self-regulated learning ability level of students. In testing the hypotheses and taking a stand, when the associated probability value is greater than the 0.05, the null hypotheses was not retained; but if the associated probability value is less than the 0.05, the null hypotheses were rejected.

Results

Research question 1: What is the difference in the mean mathematics achievement scores of students exposed to TYMS and those exposed to the Conventional Method (CM) of teaching mathematics?

Table 1

TYMS-CM Pretest-Posttest Scores

Variable		Pretest		Posttest		Mean gain
IFB Strategies	N	$\bar{x}$	SD	$\bar{x}$	SD	
IFB	64	21.56	10.12	66.87	23.37	45.31
CFB	57	22.27	9.48	35.21	13.76	12.94

Note: *Pretest and posttest mean score in mathematics achievement of students exposed to both Teach- Yourself Mathematics Strategy (TYMS) and Conventional Method.*

The results are presented in tables according to the research questions and hypotheses that guided the study. The result presented in Table 1 shows the difference in the mean mathematics achievement scores of students exposed to TYMS and those exposed to the CM. The result shows that the pretest mean mathematics achievement scores of students exposed to Teach-Yourself-Mathematics Strategy (experimental group) was 21.56, with a standard deviation of 10.12 and a posttest mean of 66.87 with a standard deviation of 23.37. The difference between the pretest and posttest mean mathematics achievement scores of students exposed to Teach-Yourself-Mathematics Strategy (experimental group) was 45.31. Those exposed to conventional method (control group) had a pretest mean of 22.27, with a standard deviation of 9.48 and a posttest mean score of 35.21 with a standard deviation of 13.76. The difference between the pretest and posttest mean scores of those exposed to the CM (control group) was 12.94. The posttest mean scores of both the TYMS and CM were greater than the pretest mean scores of the two strategies. However, those exposed to Teach-Yourself-Strategy had higher mean gain score of (45.31) than their counterparts who were exposed to the CM who had mean gain score of 12.94. This is an indication that Teach-Yourself-Mathematics Strategy helped to improve the mathematics achievement scores of students exposed to TYMS than those exposed to the CM.

Ho_1: There is no significant difference in the mean mathematics achievement scores of students who learnt mathematics with teach-yourself-Mathematics strategy and those exposed to conventional method, as measured by Mathematics Achievement Test (MAT).

Table 2:

Source Type III	Square Sums	Df	Mean Square	F	Sig.
Corrected Model	38320.486[a]	4	9580.122	29.295	.000
Intercept	62257.996	1	62257.996	190.376	.000
PreAchi	985.449	1	985.449	3.013	.085
Strategy	34277.491	1	34277.491	104.816	.000
Gender	03.248	1	703.248	2.150	.145
Strategy * Gender	197.752	1	197.752	.605	.438
Error	45783.652	15	327.026		
Total	452125.000	11			
Corrected Total	84104.138	10			

Note. *Analysis of Covariance (ANCOVA) of mean mathematics achievement scores of students exposed to Teach-Yourself-Mathematics Strategy (TYMS) and (CM) as measured by Mathematics Achievement Test (MAT).*

The result in Table 2 shows an F-ratio of 104.816 with associated probability value of 0.000 which was obtained with regard to treatment as main effect on the mean mathematics achievement scores of students who received Teach-Yourself-Mathematics Strategy and those exposed to CM. Since the associated probability (0.000) was less than 0.05 set as the benchmark for taking a decision, the null hypothesis (H01) was rejected. The inference drawn is that there was a significant difference in the mean mathematics achievement scores of students who received Teach-Yourself-Mathematics Strategy and those exposed to CM, as measured by MAT.

Research question 2: What is the influence of gender perception on mathematics achievement of students who learnt mathematics through Teach-Yourself- Mathematics Strategy and those who learnt mathematics with the conventional method of teaching mathematics?

Table 3.
Gender-posttest scores

		Pretest		Posttest		Mean gain
Gender	N	$\bar{x}$	SD	$\bar{x}$	SD	
Male	52	25.73	11.64	70.02	24.77	44.29
Female	69	24.18	12.67	69.85	25.79	45.67

Note. *Mean and Standard deviation of pretest and posttest difference in the mean scores of low achieving male and female students.*

Result in Table 3 shows the difference in the mean mathematics achievement scores of male and female students. The result shows that the male students had a pretest mean score of 25.73 with a standard deviation of 11.64 and a posttest mean score of 70.02 with a standard deviation of 24.77. The difference between the pretest and posttest mean achievement scores of males was 44.29. On the other hand, the female students had a pretest mean achievement of 24.18 with a standard deviation of 12.67 and a posttest mean scores of 69.85 with a standard deviation of 25.79. The difference between the pretest and posttest mean scores for the female group was 45.67. For both male and female groups, the posttest mean scores were greater than the pretest mean score with male students having a slightly higher mean gain than their female counterparts. In essence, the mean achievement scores of low mathematics achieving female students seem to be slightly higher than their male counterparts.

H02: There is no significant difference in the mean mathematics achievement scores of male and female students as measured by Mathematics Achievement Test (MAT). That shows that gender perception did not influence the mathematics achievement of students exposed to TYMS. The result in Table 2 also shows an F-ratio of 2.150 with associated probability value of 0.145 was obtained with regard to treatment as main effect on the mean mathematics achievement scores of male and female students. Since the associated probability (0.145) was greater than 0.05 set as the benchmark for taking a decision, the null hypothesis (H02) was not rejected. Thus, inference drawn was that there is no significant difference in the mean mathematics achievement scores of male and female students as measured by MAT. This implies that the mean mathematics achievement scores of male and female students do not differ significantly. And the responses from the interview show that gender perception did not influence students' mathematics achievement. As 93.38% of the students said that their gender has nothing to do with their academics' pursuit.

Research question 3: What is the interaction effect of Teach-Yourself-Mathematics Strategy and gender perception on mean mathematics achievement of students.

The results in Table 4 show the interaction effect of TYMS and GP on mean mathematics achievement of students. Result showed that the male students exposed to Teach-Yourself-Mathematics Strategy had a pretest mean of 24.87 with a standard deviation of 9.98 and a posttest mean of 72.17 with a standard deviation of 22.27. The difference between the pretest and posttest mean was 47.30. The female students exposed to the same strategy had a pretest mean of 24.42 with a standard deviation of 10.78 and a posttest mean of 66.33 with a standard deviation of 23.81. The difference between the pretest and posttest mean for the female group was 41.91. For male and female groups exposed to TYMS, the posttest means were greater than the pretest mean with male having a higher mean gain than their female counterparts. This shows that Teach-Yourself-Mathematics Strategy improved the mathematics achievement of male and female students almost equally. Table 4 also shows that the male students exposed to CM had a pretest mean of 22.43 with a standard deviation of 12.12 and a posttest mean of 37.13with a standard deviation of 13.11. The difference between the pretest and posttest mean was 14.70. The female students exposed to this same CM had a pretest mean of 19.67 with a standard deviation of 10.99 and a posttest mean of 36.89 with a standard deviation of 15.01. The difference between the pretest and posttest mean for the female group was 17.22. For male and female groups exposed to CM, the posttest means were greater than the pretest means with female having a slightly higher mean gain than their male counterparts. This is indicative that the CM seems to have improved the mathematics achievement of female students slightly than their male counterparts. Teach-Yourself-Mathematics Strategy improved the mathematics achievement of all the students, and there is no wide margin between the mathematics achievement of males and their female counterparts.

Ho3: There is no interaction effect of Teach-Yourself-Mathematics Strategy and gender perception on mean mathematics achievement of students.

Table 4
TYMS-CM Achievement Differences Based on Gender

			Pretest		Posttest		
Variable	Gender	N	$\bar{x}$	SD D	$\bar{x}$	SD	Mean Gain
TYS	Male	6	4.87	.98	2.17	2.27	47.30
	Female	6	4.42	0.78	6.33	3.81	41.91
	Male	6	2.43	2.12	7.13	3.11	14.70
CM	Female	3	9.67	0.99	6.89	5.01	17.22

The result in Table 2 also shows an F-ratio of 0.605 with associated probability value of 0.438 was obtained with respect to the interaction effect of Teach-Yourself-Mathematics Strategy and gender perception on mean mathematics achievement of students. Since the associated probability (0.438) was greater than 0.05 set as the benchmark for taking a decision, the null hypothesis (H03) was not rejected, and so it was concluded that there is no interaction effect of Teach-Yourself-Mathematics Strategy and gender perception on mean mathematics achievement of students. That is to say that gender perception has no influence on students' mathematics achievement but, Teach-Yourself-Mathematics Strategy does.

The result in Table 2 also shows an F-ratio of 2.150 with associated probability value of 0.145 was obtained with regards to the interaction effect of Teach-Yourself-Mathematics Strategy and gender on the mean mathematics achievement of students. Since the associated probability (0.605) was greater than 0.05 set as the benchmark for taking a decision, the null hypothesis (H_{03}) was not rejected, and so the inference drawn was that there is no interaction effect of TYMS and gender perception on the mean mathematics achievement of students.

Summary of Findings

(1) TYMS significantly improved the mathematics achievement scores of students who learnt a mathematics topic called sequence and series with the use of teach-yourself-strategy than those who learnt sequence and series with the CM of teaching mathematics.
(2) There was a significant difference in the mean mathematics achievement scores of low mathematics achieving students who learnt mathematics with TYMS and those exposed to CM of teaching mathematics, as measured by MAT.
(3) The mean mathematics achievement scores of male and female students do not differ significantly. However, the mean achievement scores of male students seem to be slightly higher than their female counterparts.
(4) There is no interaction effect of TYMS and GP on mean mathematics achievement of low achieving students. This implies that GP did not influence mean mathematics achievement scores of students significantly

Discussion

The present study reveals that there is no significant interaction effect of TYMS and GP on the mathematics achievement of students. This is in harmony with the study of Nwafor et al. (2015) which revealed that there is no interaction effect of self-regulated learning approach and gender on students' means achievement scores in Basic Sciences. Kahreh et al. (2018) found that self-regulated learning strategies reduce math anxiety of students. And, like the present study, the work of Medina (2011) revealed that self-regulated learning improved students' mathematics achievement significantly. Nwafor et al. (2015) also revealed that self-regulated enhanced students' achievement in mathematics and other basic sciences. Several studies have found significant gender differences in school achievement favoring girls over boys (Duckworth & Seligman, 2006). Some of such studies on performance in mathematics, highlighted a traditional gender gap in favour of boys (Aunola et al.,). Similarly, Jones &Young (1995) found that boys had more favourable attitudes towards mathematics and science than girls. In contrast, Jeff (2015) revealed that females outperform males in mathematics. In the same way, (2010) revealed that girls performed significantly better than boys. Hyde et al. (1990) pointed out that there is little or no significant gender differences in general cognitive abilities.

The fact that GP did not influence mean mathematics achievement scores of students significantly shows that both male and females benefited equally from the instruction. This also suggests that TYMS is capable of bridging gender gap that has long existed in mathematics achievement. The result of the study also showed that students can learn mathematics on their own, without direct teaching but with teachers' guidance.

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