Effect of team teaching strategy on secondary school students' achievement and interest in linear equations

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Abstract

The study examined the effect of Team- Teaching Strategy (TTS) on secondary school students' Achievement and Interest in Linear Equation. It adopted a quasi- experimental, non- randomized control group design. The study was guided by six research questions and six null hypotheses. The population of the study consisted of 4670 mathematics students in Onitsha Education Zone of Anambra State of Nigeria. A sample of 230(68males and 72 females) senior secondary school students was drawn from six co-educational schools drawn from a population of 14 co-educational secondary schools within the specified area. A flip of coin was used to assign three of the schools to experimental group and the other three to control group. Linear Equation Achievement Test (LEAT) of 50 multiple choice items structured by the researcher and Linear Equation Interest Scale (LEIS) of 20 items formed the instrument for data collection. The instruments were duly validated by experts and reliability index of 0.89 was obtained for LEAT using KR-20 while 0.87 was obtained for LEIS using Cronbach alpha reliability. Mean and Standard Deviation were used to answer the research questions while ANCOVA was used to test the null hypothesis at 0.05level of significance. The findings of the study showed a significant difference between students taught using TTS and those taught using Single Teacher Teaching Strategy (SSTT) in favor of TTS. Also there was a significant difference in students' interest in linear equation when taught with the two methods infavor of TTS, among other findings. The study concluded that TTS is a better strategy for improved students' achievement than STTS. It was recommended among others that TTS should be adopted for effective teaching of mathematics in secondary schools. Mathematics teacher- trainees should be trained on the use of TTS and serving teachers should be encouraged to use it in teaching.

Keywords: Team Teaching Strategy, Single Teacher Teaching Strategy, Achievement, Interest, Linear Equation.

INTRODUCTION

Education has been regarded as an indispensable tool for societal development and transformation all over the world. It is on basis of this assertion that the Federal Republic of Nigeria (FRN, 2013) stated in her National policy on Education that Education is an instrument for excellence for effecting National development. In order to achieve the goals of education, the Federal Government from time to time initiates various policies and programs. These policies and programs are achieved through the establishment of schools of different levels of which secondary education is one of them. Secondary education has both senior and junior levels. Senior Secondary education is an education system that takes place after three years of upper basic education and is followed by higher education. In line with the (Federal Republic of Nigeria,2013), Secondary education is designed to meet the national objective of preparing individuals for useful living within the society and higher education afterwards. Among the subjects taught in secondary schools to achieve the above stated objectives, are the combination of Arts and Science Subjects of which mathematics is at the core.

Mathematics is a way of life as it allows learners to organize experience and use them in life. Development in almost all the areas of life is based on effective knowledge of science and mathematics. There cannot be any meaningful development in virtually any area of life without the knowledge of science and mathematics. It is for this reason that the education system of countries like Nigeria that are concerned with their development has put great deal of emphasis on the study of mathematics. Mathematics is also widely regarded as one of the most important school subjects and a central aspect of the school curriculum in every society. (Okafor& Nwabuoku,2022). The researcher in collaboration sees mathematics as an extremely advantageous tool in almost all spheres of human life, be it Science and Technology, Medicine, Engineering, Economy, Industry, and public decision making, to mention but a few.

The importance of mathematics in particular cannot be over emphasized as there cannot be meaningful development without the study of mathematics (Zakariyya & Manko, 2021). This is why most countries put great emphasis on the study of a well planned and effectively implemented mathematics education program especially those that are concerned with their scientific and technological development. Despite the importance of mathematics, students' achievement in the subjectin both internal and external examination has remained consistently poor. This abysmal achievement in mathematics in public secondary schools has been a source of worry to concerned public, stake holders, mathematics educations, and government as it is no doubt threatening the foundation of Nigeria's value and vision as a nation. The West African Examination Council (WAEC) Examiner's report (2020-2023) revealed that students' performance in science subjects and mathematics is becoming low. Such problems have been traced to conventional method of teaching used in instructional delivery. Okafor (2019) asserted that the conventional method employed by teachers has negative effect as students develop hatred for the subject, giving rise to persistent failure.

This conventional method of teaching as opined by Okafor has the teacher as information giver with the teaching lacking inspiring methods that involve hands- on, minds-on,laboratory activities etc, that reduce students' mass failure in public examination and do not empower students to become deep thinkers who are capable of making new discoveries and solving complex problems.The conventional method that will be focused in this study is the Single Teacher Teaching Strategy (STTS). Single Teacher Teaching Strategyhas continued to dominate the instructional processes in Nigeria education system. The STTS is a method that focuses on the intellectual aspect of learning while neglecting the experiential learning aspect(Umar&Abdulmutallib, 2022). It is a mode of communication in which

learners are passive and the teacher transmits information (Subject or Content) verbally to the students, sometimes writing it on the whiteboard or using instructional materials. The students listen and take notes of the facts and ideas that are considered important and sometimes asking the teacher questions for clarification. In other words they memorize the facts without the actual knowledge of the process thereby bringing low achievement among mathematics students.

Achievement is accomplished especially by special effort, great courage, teaching strategies and superior ability. Achievement is usually expressed in terms of learning goals that a student successfully completes within a certain specified time (Okafor, 2020; Adebisi & Alake, 2023). In this study, achievement refers to the extent to which mathematics students learn or gain from the lessons they were taught in the concept of linear equation in focus.

Linear equation is one of the most important topics in algebra and mathematics as a whole. Linear equation moves students beyond emphasis on arithmetic operations to the use of symbols to represent numbers and express mathematical relationships. Linear equation is not a branch of mathematics that can be mastered by mere memorization of the basic rules. It requires sound theoretical knowledge and intensive practice in its application. Linear equation is one of the most important topics in algebra and it plays a central role in the development of other mathematical concepts and on solving real life problems. Unfortunately students' achievement as evidenced by WAEC Chief Examiner's Report (2019-2022) showed that students performed poorly in mathematics in Anambra State based on their inability to answer question on change of formula, simple linear equation, Indices and number system etc. This implies that the state of students' achievement and interest in algebra has left much to be desired.

Students'interest has become a challenging problem for the academic community. In the context of this study, interest means having the desire and likeness in the subject matter. Furthermore, students in secondary schools averred that mathematics is more difficult and uninteresting than any other subject in the school curriculum (Ugwu, Fagbenro & Akano, 2019). Interest is generally students' attention, greater concentration, pleasant feelings and increased motivation to learn. The contemporary theories on interest carried two components of interest as individual interest and situational interest (Wong, 2019). Individual interest is more enduring and trait-like, and endures over time. It can be considered a disposition that individuals take with them from one context to the next. For instance, when a student has personal liking for mathematics that spurs him to always do mathematics tasks and discuss mathematics problems such a student would be said to have developed individual interest in mathematics irrespective of circumstances, such student would want to take the interest with him or her to any place he or she goes. On the other hand, situational interest is more momentary and depends on the environment he or she finds him or her. It is also the sort of interest that arouses when a person watches an entertaining video clip or engages in incisive conversation (Okechukwu & Opara, 2021).

In summary, regardless of the objective value of an activity or topic, if students do not recognize its value they may not be motivated to expend effort. Some students develop likeness on a topic depending on the way the knowledge is passed and disposed. Once the students' interest is on a topic or subject it is clear that they will be eager to learn. That necessitated the need for a more innovative method that enhances students' achievements and interest in mathematics. Based on the reviewed literature, the researcher proposes the application of Team Teaching Strategy (TTS) as it goes beyond the traditional practice of STTS, to enforce students' achievement.

Team teaching (TT) as opined by the researcher involves a group of two or more teachers working together to plan conduct and evaluate the learning activities for the same group of learners. It is an opportunity to expose students to more perspective and content knowledge than a single instructor may provide (Team Teaching Guide,2023). Team generally comprise Staff members who may represent different areas of subject expertise but who share the same group of students and a common planning period to prepare for the teaching. For the instructors who often work alone, team teaching provides a supportive environment that overcomes the isolation of working in self-contained or departmentalized classrooms by working together within the same class, teachers can observe and critique each other's teaching and assessing pedagogy, supporting each other to enhance the learning outcomes of students. The intention of team teaching has been to meet the needs of all students' academic achievements and to ensure that all the students reach their potentials (Adebisi & Alake - 2023). The essential benefits of team teaching include sharing knowledge and problems together, reduction of tension and stress from the teacher while teaching and making students to be problem solvers.This study proposed TTS as a likely way to achievestudents' achievements and interest based on some reviewed study irrespective of gender.

Gender according to Okafor (2019) is a socially ascribed attribute which differentiates feminine from masculine. A number of studied have verified the influence of gender on mathematics achievements and interest of students. Noberth and Okafor (2023) found teaching methodas a factor that hinder access and interest of girls in science and mathematics. Reichmann and Peckham in Okafor (2019) revealed that girls are less confident about future mathematics achievements and show less confident in their ability to learn than boys and less willing to approach new materials, implying that male students achievements was superior to female. Musa, Uloko, Usman and Vale cited in Okafor(2019) likewise reported that male achieve higher than their female counterparts when exposed to some mathematics activities. Although gender related achievements reports above showed disparity, there are still some reports which do not agree with any of them. Ajai and Imoko (2015) and Arnoyo – Barriguete et al (2023) reported that both male and female achievements are at par, after exposing them to some mathematics activities. This is in line with some studies that divulge that gender plays no significant role in achievement in science and technology (Anaduaka & Okafor, 2013; Okafor& Nzomiwu 2021). Salau in Okafor (2019) believes that there are no innate biological and psychological reasonswhile girls should not do well as boys in mathematics, if provided with adequate motivation and good learning environment, and if the right method is adopted.

In respect of the above result on gender parity and disparity in mathematics achievements, there is need for further investigation on gender issue as it relates to mathematics achievements, especially when students are exposed to certain methods like Team Teaching Strategy with emphasis on the teaching and learning of linear equation. This work has proposed to explore the effectiveness of Team Teaching strategy which has been found effective in the accomplishment of educational objectives though in some related science subjects (Team Teaching Guide 2023, Adebisi & Alake, 2023). With the emphasis of Team Teaching on the learner, it is obvious that learning is an active process occurring within and influenced by the learner as much as by the instructor and school. However despiteresearch evidences in favor of the strategy there is yet not enough awareness of its impact on students' achievement and interest in mathematics. This may be what Nigerian mathematics educators need to redeem the prevailing situation of poor achievement of students in the subject. This study therefore is set to verify the effect of Team Teaching strategy on secondary school students' achievements and interest in linear equation.

Statement of problem

Reports have shown that the present state of mathematics achievements in Nigerian secondary schools has been very unsatisfactory. The poor achievement of students in mathematics in secondary schools is a proof that the teaching methods utilized by mathematics teachers are not effective.WAEC Chief Examiner's Annual reports of five consecutive years reviewed have continued to highlight students' weakness in answering questions relating to some concepts in mathematics of which linear equation under Algebra ranks high. From the reviewed literature, the present method used in teaching linear equation aspect of mathematics which are but not limited to conventional method have failed to arouse and sustain students' achievement and interest in the subject. The method does not appear to have enhanced students' achievement in mathematics internal and external examinations. Several researchers have conducted researches with a view of finding better ways of teaching and learning of mathematics for greater students' achievements, though it is yet to yield the expected result. It is for this reason that the researcher sought to ascertain if application of team teaching strategy in teaching and learning of linear equation could enhance students' achievement and interests based on research evidence that supports its efficiency in improving achievement of all categories of students in science subjects.

Purpose of study

The main purpose of this study is to determine the effect of team teaching strategy on secondary school students' achievements and interest in linear equation in Onitsha Education Zone of Anambra State. Specifically, this study sought to determine the:

(1) mean achievements score of students taught linear equations using Team Teaching Strategy (TTS) and those taught using Single Teacher Teaching Strategy (STTS).
(2) mean interest scores of students taught linear equation using TTS and those taught using STTS
(3) mean achievements scores of male and female students taught linear equations using TTS and those taught using STTS.
(4) mean interest scores of male and female students taught linear equation using TTS and those taught using STTS.
(5) interaction effect of teaching methods and gender on mean achievement scores of students in linear equation and
interaction effect of teaching method and gender on mean interest scores of students in linear equation.

Research Questions

The following research questions guided the study:

1. What are the mean achievement scores of students taught linear equations using TTS and those taught using STTS?
2. What are the mean interest scores of students taught linear equations using TTS and those taught using STTS?.
3. What are the mean achievement scores of male and female students taught linear equation using TTS?

4. What are the mean interest scores of male and female students taught linear equation using STTS?
5. What is the interaction effect of teaching methods and gender on mean achievement scores of students in linear equation?
6. What is the interaction effect of teaching methods and gender on mean interest scores of students in linear equation?

Hypotheses

The following null hypotheses were tested at 0.05 level of significance

1. There is no significant difference in the mean achievement scores of students taught linear equation using TTS and those taught using STTS.
2. There is no significant difference in the mean interest scores of students taught linear equation using TTS ant those taught using STTS.
3. There is no significant difference in the mean achievement scores of male and female students taught linear equation using TTS.
4. There is no significant difference in the mean interest scores of male and female students taught linear equation using TTS.
5. There is no significant interaction effect of teaching methods and gender on mean achievement scores of students in linear equation.
6. There is no significant interaction effect of teaching methods and gender on mean interest scores of students in linear equation.

Research Method

The research design adopted was quasi- experimental design. The study specifically employed non equivalent control group design. There was no randomization of subjects as intact classes were randomly assigned to experimental and control group by balloting. The experimental and control group were pre-tested using 50 objectives items of LEAT and 20 items of LEIS in the first week before the commencement of the experiment. The experiment in both groups lasted for four weeks with administration of the post test in the fifth week. The study was conducted in Onitsha Education Zone of Anambra State with a population of 4670 SS1 mathematics students in 14 co- educational public secondary schools in the zone in 2023/2024 session (Post Primary Secondary Schools Service Commission Onitsha Zone, 2024). Purpose sampling technique was applied to draw six co-educational secondary schools from a population of 14 co-educational secondary schools within the specified area that has one stream. The six intact classes of SS1 existing in the sampled schools formed the sample size of 230students (68 males and 72 females). The instrument for data collection was made up of 50 multiple choiceitems with four options and any correct response attract two marks, giving a total of 100marks for LEAT and 20 items for LEIS. The instruments were validated by two experts in mathematics education and measurement and evaluation, all in Faculty of Education, Chukwuemeka Odumegwu Ojukwu University, and AnambraState.The pilot testing was conducted in a School located in the study area but not within the sampled zone with 40 students and the reliability co-efficient of the instrument was established at 0.89 using (KR-20) while Cronbach reliability was applied on LEIS and it yielded co- efficient value of 0.87. The intact classes in the experiment group were exposed to the treatment using STTS. The topics covered during the two different treatments were linear equation and change of subject formula. The topics were selected from SS1 mathematics scheme of work and that informed the choice of SS 1 students for this study, 20 items were of lower

order ability and 30 of the items were of higher order cognitive abilities giving a percentage ratio of 40:60 in line with blooms cognitive domain. For both groups different lesson plans prepared by the researcher were applied in the sampled schools with the help of the research assistant who have been initially guided on its application by the researcher. Analysis of data collected was done using mean and standard deviation to answer the research questions while hypotheses were analyzed using analysis of covariance (ANCOVA) at 0.05 level of significance.

Results

TABLE 1: Mean and standard deviation (SD) of pretest and post test achievement scores of students taught linear equation using TTS and those taught with STTS.

Source of Variance	No	Pre-test Mean	SD	Post-test Mean	SD	Mean Gain
TTS	114	30.84	7.88	68.68	3.94	37.84
STTS	116	19.93	2.86	37.83	4.86	17.90

Table 1 shows that the mean achievement score of students taught linear equation using TTS was 68.68 with a mean gain score of 37.84, while that of their counterparts taught with STTS was 37.83 with a gain score of 17.90. This is an indicated that TTS 21 had more effect onstudents' achievement in linear equation than the STTS.

Hypotheses 1
There is no significant difference in the mean achievement scores of students taught linear equation using TTS and those taught using STTS.

TABLE 2: Analysis of Covariance (ANCOVA) of the significant difference in the mean achievement scores of students taught linear equation using TTS and those taught using STTS.

Source	Type III sum of squares	Df	Mean square	Cal .F	P-value
Corrected model	14829.99	2	7414.99	53.76	0.00
Intercept	11315.55	1	11315.55	82.04	0.00
Pre-test	2132.932	1	2132.932	15.47	0.00
Method	4930.073	1	4930.073	35.75	0.00
Error	10344.117	227	137.922		
Total	181777.000	230			
Correction Total	25174.115	229			

R squared = 0.589(Adjusted R squared= 0.578)
S= Significant

The result in Table 2 showed that the mean achievement scores of students taught linear equations using TTS differed significantly. This was indicated by the calculated F-value of 35.75 which is

significant at 0.00 and is less than 0.05 set as level of significance. The null hypothesis of no significant difference in the mean achievement score of students taught linear equation using TTS and those with STTS stands rejected. This implies that there is a significant difference in the mean achievement scores of both groups in favor of the experimental group as TTS increased students' achievement in linear equation than the STTS

TABLE 3: Mean and standard deviation of post achievement test and interest scores of students in linear equation using TTS and those taught using STTS?

Source of variance	No	Posttest mean	SD	Interest mean	(SD)	Lost in mean
TTS	114	68.68	3.94	66.76	4.63	1.92
STTS	116	37.83	4.86	34.90	5.54	2.93

Table 3 showed that the TTS group has a post test mean score of 68.68 with a post test of SD score of 3.94 while the interest mean score is 66.76 with a SD of 4.63. The STTS group has a post test mean score of 37.83 with a SD of 4.86 with an interest mean score 34.90 with am SD of 5.54. The loss of interest in the mean score of the TTS is 1.92 which is less than that of the STTS that is 2.93. Though there is loss of interest in both groups but it is more in the STTS, this implies that TTS is more effective inenhancing the interest ability of students in linear equation that STTS.

Hypothesis 2:

There is no significant difference in the mean interest scores of students taught linear equation using TTS and those taught using STTS.

TABLE 4: Analysis of covariance (ANCOVA) of the significance difference in the mean interest scores of students taught linear equation using Team-teaching strategy and those taught using single teacher teaching strategy.

Source	Type III sum of squares	DF	Mean square	CAL -F	P-value
Corrected model	12908.778	2	3227.194	18..84	0.000
Intercept	11743.912	1	117743.912	68.54	0.000
Post test	223.090	1	223.090	1.30	0.270
Method	3968.390	1	3968.390	23.16	0.000
Error	20046.116	227	171.334		
Total	318573.000	230			
Corrected Total	32954.893	229			

R squared= 0.392 (Adjusted R squared=0.371)
S= Significant
NS=Not Significant

The result in Table 4 shows that with respect to students' interest, an F – ratio of 23.16 was obtained with associated probability value of 0.000. Since the associated probability value of 0.000 was less than 0.05 set as level of significance, the null hypothesis (Ho$_2$), which stated that there is no

significant difference in the mean interest scores of students taught linear equation using TTS and those taught using STTS was rejected thus, inference drawn is that those taught using TTS have higher mean interest gain. This shows that TTS increased students' interest in linear equation than the STTS.

Research Question 3:

What is the mean achievement scores of male and female students taught linear equation using TTS and those taught using STTS.

TABLE 5: Mean and standard deviation of pre- achievement test and post- achievement test scores of male and female students taught linear equation using TTS.

Gender	No	Pre test	SD	Post test	SD	Mean gain
Male	46	21.00	8.03	62.40	3.62	41.40
Female	68	15.78	5.66	65.87	4.20	50.09
Mean gain diff						8.69

Results in Table 5 showed that male students had a pretest mean achievement score of 21.00 with a standard deviation of 8.03 and a post test mean achievement score of 62.40 with a standard deviation of 3.62. The difference between the pre test and post test mean achievement score for male students was 41.40. The female students taught linear equation had a pre test achievement score of 15.78 with a standard deviation of 5.66 and a post test mean achievement score of 65.87 with a standard deviation of 4.20. The difference between the pretest and the post test mean achievement scores for female students was 50.09. However, for each groups the pre test mean achievement score was greater than the post test mean achievement score with the female students having higher mean gain. This is an indication that TTS is more effective in enhancing the achievement of female students more than that of the males.

Hypothesis 3:

There is no significant difference in the mean achievement score of male and female students taught linear equations using TT strategy.

TABLE 6: Analysis of Covariance (ANCOVA) on the significant effect of TTS on students' achievement in linear equation with respect to gender.

Source	Type III sum of square	DF	Mean square	CAL-F	P-value
Corrected model	34.147	2	17.074	1.11	0.34
Intercept	15150.015	1	15150.15	981.83	0.00
Achievement	32.145	1	32.145	2.08	0.16
Gender	11.470	1	11.470	0.74	0.39
Error	540.063	111	15.430		

Total	149888.000	144
Corrected Total	574.211	133

R Squared = 0.59(Adjusted R squared =0.006)

S=Significant,

NS = Not Significant.

The result in Table 6 shows that with respect to students' achievement, an F –ratio of 0.74 was obtained with associated probability value of 0.39. Since the associated probability value of 0.39 was greater than 0.05 set as level of significance the null hypothesis (Ho_3), which stated that gender has no significant influence on students' mean achievement score in linear equation, was not rejected. Thus inference drawn was that there is no significant difference in the mean achievement score of male and female students taught linear equation using TTS.

Research Questions 4

What is the mean interest scores of male and female students' taught linear equation using TTS?

TABLE 7 : Mean and standard deviation of post achievement test and interest test scores of male and female students in linear equations

Variable Gender	Number	Post test mean	SD	Interest mean	SD	Mean loss
Male	68	65.87	4.20	64.90	6.30	0.97
Female	46	62.40	3.62	60.10	3.82	2.30
Loss in mean diff						1.33

Results in Table 7 showed that male students had a post test mean achievement score of 65.87 with a standard deviation of 4.20 and interests mean score of 64.90 with a standard deviation of 6.30. The difference between the post test achievement score and interest score of male students was 0.97. The female students taught linear equation had a post test mean achievement score of 62.40 with a standard deviation of 3.62 and interest mean score of 60.10 with a standard deviation of 3.82. The difference between the post test achievement score and interest score of female students was2.30. However, for each of the groups, the interest mean were lower than the post testmeans with the male students having lower loss of interest, of 0.97 as against the female students that had 2.30 loss of interest.

Hypothesis 4:

There is no significant difference in the mean interest scores of male and female students taught linear equation using TTS.

TABLE 8: Analysis of Covariance (ANCOVA) on the significant effect of TTS on student's interest in linear equation with respect to gender.

Source	Type III sum of squares	Df	Mean squares	CAL-F	P-value
Corrected	114.360	2	57.180	1.90	0.16

model					
Intercept	397.248	1	397.248	13.20	0.00
Post test	24.398	1	24.398	0.81	0.37
Gender	95.256	1	95.256	3.17	0.08
Error	1053.219	111	30.092		
Total	161198.000	114			
Corrected Total	1167.579	113			

R squared =0.098(Adjusted R squared) =0.046
S =Significant, NS - Not Significant

The result in Table 8 shows that gender has no significant influence on students' mean interest in linear equation. An F –ratio of 3.17 with associated probability value of 0.08. Since the p- value is greater than the level of significance, the null hypothesis was therefore accepted. Thus there is no significant effect of TTS on male and female students' interest in linear equation.

Research Question 5

What is the interaction effect of teaching methods and gender on mean achievement scores of students in linear equation?

Table 9: Mean and standard deviations of students' overall pre-achievement test and post-achievement test scores in linear equations by teaching methods and gender.

Variable Methods	Gender	N	Pretest	SD	Post test	SD	Mean Gain
TTS	Male	46	21.00	8.03	62.40	3.62	41.40
	female	68	15.78	5.66	65.87	4.20	50.09
STTS	Male	44	15.25	2.34	47.25	11.68	32.00
	Female	72	11.07	5.32	59.13	18.45	48.06
Diff in mean							16.06

Results in Table 9 showed that the male students under the TTS have a pre-test mean of 21.00 with a standard deviation of 8.03 and a post test mean of 62.40 with a standard deviation of 3.62. The difference between the pre-test mean and post test mean was 41.40. The female students under the TTS have a pretest mean of 15.78 with a standard deviation of 5.66 and a post-test mean of 65.87 with a standard deviation of 4.20. The difference between the pretest mean and post-test mean was 50.09. Result in Table 9 also shows that the male students taught linear equation using Single Teacher Teaching Approach has pre-test mean of 15.25 with a standard deviation of 2.34 and a post test mean of 47.25 with a standard deviation of 11.68. The difference between the pre-test mean and post-test mean was 32.00. The female students taught using Single Teacher Teaching Approach has a pre-test mean of 11.07 with a standard deviation of 5,32 and a post-test mean of 59.13 with a standard deviation of 18.45. The difference between the pre-test mean and post test mean was 48.06. However,

for each of the groups, the post-test means were greater than the pre-test means through the male and female students in TTS outperformed their counterparts in STTS.

Hypothesis 5;

There is no significant interaction effect of teaching methods and gender on students' mean achievement score in linear equation.

Table 10; Analysis of Covariance (ANCOVA) on the interaction effect of teaching methods and gender on students' mean achievement score in linear equation.

Source of Variance	Type III sum of squares	Df	Mean square	Cal.F.	P-value
Corrected Model	12117.984	4	3029.496		
Intercept	3136.612	1	3136.612		
Pre-test	154.990	1	154.990		
Treatment Model	8348.862	1	8348.862		
Gender	590.108	1	590.108		
Treatment/ Gender	193.233	1	193.233	3.61	0.06
Error	4009.566	227	53.461		
Total	261882.000	230			
Corrected Total	16127550	229			

Table 10 shows that at 0.05 level of significance 1 df numerator and 229 df denominator, the calculated F is 3.61 with a p-value of 0.06 which is greater than 0,05. Therefore, the null hypothesis is not rejected. So, there is no significant interaction effect of teaching methods and gender on students' mean achievement score in linear equation.

Research Question 6

What is the interaction effect of teaching methods and gender on mean interest scores of students in linear equation?

Table 11: Mean and standard deviation of students' overall post-achievement test and interest test scores in linear equation by teaching methods and gender.

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Source of Variance	Gender	N	Post-test mean	SD	Interest	SD	Mean less (-)
TTS	Male	46	62.40	362	60.10	3.82	2.30
	Female	68	65.87	4.20	64.90	6.30	0.97
Diff. in mean							1.33
STTS	Male	44	47.44	10.72	40.60	8.34	6.84
	female	72	46.30	9.06	39.07	7.32	7.23
Diff. in mean							-0.39

Results in Table 11showed that the male students in TTS had a post-test mean of 62.40 with a standard deviation of 3,62 and interest mean of 60.10 with a standard deviation of 3.82. The difference between the post-test and the interest mean score was 2.30. The female students under TTS had a post-test mean of 65.87with a standard deviation of 4.20 and mean interest score of 64.90 with a standard deviation of 6.30.

The difference between the posttest mean and interest mean for the female group was 0.97. Results in Table 11 also shows that the male students taught linear equation using STTS had a posttest mean of 47.44 with a standard deviation of 10.72 and interest mean of 40.60 with a standard deviation of 8.34. The difference between the posttest and interest mean was 6.84. The female students under STTS had a posttest mean of 46.30 with a standard deviation of 9.06 and interest mean score of 39.07 with the standard deviation of 7.32. The difference between the posttest mean and interest mean was 7.23. However, for each of the groups, the interest means were less than the posttest means. This indicates that both group lost interest in the concept taught which is more evident with STTS group with a mean loss of -0.39 as against 1.33 for TTS.

Hypothesis 6

There is no significant interaction effect of teaching methods and gender on students' mean interest score in linear equation.

Table 12: Analysis of Covariance (ANCOVA) on interaction effect of teaching methods and gender on students' mean interest in linear equation.

Source of variance	TypeIII sum of squares	Df	Mean square	Cal.f.	P-value
Correction model	9731.893	4	2432.973		
Intercept	1178.145	1	1178.145		
Posttest	188.031	1	88.031		
Treatment model	2594.868	1	3594.868		
Gender	5.196	1	5.196		
Treatment Gender	25.882	1	25.882	0.75	0.39
Error	2579.794	227	34.397		
Total	225007.000	230			
Correction Total	12311	229			

Results in Table 12 shows that at 0.05 level of significance with 1 df numerator and 229 df denominator, the calculated F value is 0.75 with a p-value of 0.39. Since 0.39 is greater than 0.05 it implies that the null hypothesis is accepted, so teaching methods and gender have no significant interaction effect on students' mean interest in linear equation.

Discussion of findings

Findings of the study indicates that Team Teaching Strategy(TTS) has more effect on students' achievement in linear equation than the Single Teacher Teaching Strategy (STTS). With the test of hypothesis one, as shown in Table 2, it was found that the observed difference in the mean achievement scores of both groups was significant. This implies that TTS significantly enhanced students' achievement in the units of linear equations studied than the STTS.

This result is in line with the findings of Okechukwu and Opara (2021), that there is a significant difference between the experimental group taught using TTS and those taught using conventional method. It was therefore noticed that TTS apart from its superiority over the STTS proved to be an effective teaching method on its own, as students have opportunity to learn from different teachers; therefore gaining confidence in solving mathematics task, hence the increase in achievement. This goes to support Bacharachet et al (2015) that team teaching is a strategy that can be applied into students' teaching process to make sure that teaching goes on effectively and that students ' learning is positively enhanced.

The result of analysis on the effect of TTS on students' interest in linear equation reveals that TTS is more effective in enhancing the interest ability of students in linear equation than STTS. When this observed difference was tested for significance as shown in Table 4. The findings further showed that TTS has a significant effect on students' interest in linear equation when compared to those taught with STTS. These findings are not far from the assertion of Banfe Yaga (2021) that TTS is more effective in enhancing students' achievement and interest ability of students in Basic Science. Okechukwu and Opara also revealed that there is significant difference in interest scores of students exposed to Basic Science and Technology using TTS. The significant improvement in interest ability of students in TTS as revealed in this study could be linked to the fact that the TTS recognizes the unique nature of linear equation and the learners' individuality. This encourages active participation, creative thinking and students' problem solving ability, thereby, leading to improved students' interest ability. This is in conformity with the submission of Muza (2021) who stated that students who are involved in team-teaching classrooms become more engaged by learning in small groups, getting better individual attention, having their questions answered quicker and collecting their papers, grades and assignments faster.

This study also revealed that gender has no significant influence on students' achievement in linear equation as shown in Table 6, though female students have slightly higher mean gain than their male counterparts. The findings is in consonance with that of Anaduaka and Okafor (2013), Ajia and Imoko (2015) in which they reported that students' achievement towards mathematics was significantly independent of sex. However, it would appear to contradict the findings of Okechukwu and Opara (2021), Darma (2018) which disclosed that the female students in TTS group achieved significantly higher than their male counterparts in English language comprehension. Though, the result of this study has shown that giving equal opportunity and unlimited access to education, both gender will not have disparity in mathematics achievement.

Evidence of this study on the influence of gender on students' interest in linear equation shows that TTS enhances the interest ability of male students more than that of the females. When this observed difference was tested for significance as shown in Table 8, the result further revealed that there was no significant effect of TTS on male and female students' interest in linear equation. Hence the TTS had an even effect on the interest ability of students with respect to gender, thereby attributing to chance any difference that may be found. This implies that gender was not statistically important for students' interest in linear equation especially when exposed to students' centered and action oriented strategy like TTS.

This supports the earlier findings of Ajai and Imoko (2015) and Onah and Anamezie (2022) who respectively opined that gender has no significant contribution because male and female students exposed to the same cooperative instructional strategy have nearly the same scores in assigned test as obtained in Team Teaching Strategy.

The interaction effect of method and gender on mean achievement score of students in linear equation was not significant as shown in Table 9, as both male and female students achieved equally on application of TTS. The male and female students taught linear equation with TTS performed better that their counterparts taught with STTS. This is an indication that TTS minimizes gender differences in achievement. This findings corroborates with the findings of Dania (2023) and Okafor and Nzomiwu (2021) who found no significant interaction between teaching methods and gender on students' achievement. Therefore, one would rightly say that TTS is not gender bias.

The interaction effect of method and gender on students' interest in linear equation was also not significant. This means that TTS is not gender specific as it offers common opportunities to male and female learners. This finding is in harmony with the findings of Passeto et al (2021) who found significant interaction between teaching methods and gender on students' interest in linear equation. This study is also in alliance with the assertion that gender difference my exist but a good teaching method should be capable of neutralizing the difference (Okafor in Okafor (2019). Likewise, changing how we teach is hard, but when we achieve that, knowledgeable, confident students will be the result. The cost of change is high but the results as regards students' achievement is a well deserved future that all Educators should strive to achieve.

Conclusion

The following conclusions were drawn from the findings:
1. There was a significant difference in the mean achievement scores of students taught linear equation using STTS with those taught using TTS having higher mean achievement gain.
2. There was a significant difference in the mean interest scores of students taught linear equation using TTS and those taught using STTS with those taught using TTS having higher mean interest gain.
3. Gender has no significant influence on students' mean achievement score in linear equation.
4. Gender has no significant influence on students' mean interest score in linear equation.
5. There was no significant interaction effect of teaching methods and gender on mean achievement score of students in linear equation.
6. There was no significant interaction effect of teaching methods and gender on mean retention score of students in linear equation.

Recommendations

Based on the findings of the study, the following recommendations were made:

1. Mathematics teachers should change to TTS in their instructional delivery to enable students participate actively in classroom teaching and learning process. The teacher should also create effective classroom management in such a way that students can work individually, and in groups for improved learning and academic achievement.
2. Curriculum planners should incorporate TTS into the education curriculum of teacher training institutions to equip teacher trainees with competencies to appropriately apply it in teaching mathematics and other school subjects when employed. They should also reflect it in the scheme of work and other curriculum materials in secondary school mathematics.
3. The time allotted to linear equation classes in the present secondary school timetable discourages the employment of the TTS. Therefore adequate time should be allotted to mathematics teachers in the timetable for full and effective application of TTS, since its application is a bit time consuming unlike STTS.

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