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INVESTIGATING THE RELATIONSHIP BETWEEN TEACHER EFFICACY, AND STUDENTS' GEOMETRY SELF-EFFICACY AND PERFORMANCE IN YOBE STATE, NIGERIA

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ABSTRACT

This study investigated the relationship between teacher efficacy, and students' Geometry self-efficacy and performance in Yobe State, Nigeria. The study adopted a correlation survey research design. Sample of 370 students and 12 teachers were drawn from a population of 10,231 senior secondary two (SSII) students and 507 Mathematics teachers in 42 public secondary schools in 2021/2022 academic session using multi-stage sampling technique. Four

INTRODUCTION

Globally, motivation plays the vital role in Mathematics education. Students incline to utilize more effort on their studies when they have interest in and zeal for the subject. One of the conceptions which is claimed to have a crucial role in the motivation and academic achievement of students is self-efficacy (Pajares, 1996). Self-efficacy can be defined as the cognitive assessment of students' capacity to perform a particular task. On the other hand, self-efficacy is whether or not students / individuals believe that they have capacity to carry out a certain task up to the desired targeted out-come (Bong, 2013). Bong notes that the effects of failure on personal self-efficacy depend on the strength of individuals existing self-efficacy beliefs, the timing of failures in the entre achievement experiences and the value of the task for the learner. Most of the recent studies related to self-efficacy are anchored on the social cognitive theory of Bandura (1982), which states that individuals make their choices according to their self-knowledge (a person's perception of oneself). The need to understand self-efficacy (a judgment of one's own competency to perform certain action) with respect to

research questions guided the study and four null hypotheses were formulated and tested at 0.05 level of significance. Four instruments were used for data collection viz.; Teachers' Sense of Efficacy Scale (TSES), Self-Efficacy Beliefs toward Teaching Mathematics Scale (SEBTMTS), Students' Geometry Self-Efficacy Scale (SGSES) and Students' Geometry Performance Test (SGPT). The TSES and SEMBTMTS were adapted, SGSES and SGPT were constructed by the researchers duly validated and the reliability coefficients of TSES, SEMBTMTS, SGSES and SGPT yielded 0.82, 0.93, 0.89 and 0.95 using Cronbach's alpha and Kuder- Richardson (KR-20) formula methods. Research questions were answered using means and standard deviations while Pearson (R) and z-test were used to test the hypotheses The findings revealed among others that no significant relationship between general teaching efficacy or Mathematics teaching efficacy and student-related variables(P<0.05). Based on the findings therein, the study provided possible recommendations.

Keyword: *Teacher Efficacy, Students, Geometry, Self-Efficacy, Performance*

Mathematics has been addressed in the National Curriculum and Evaluation for secondary schools Mathematics which states that one objective for students is to become self-confident in doing Mathematics.

Teachers may effectively aid students to improve high self-efficacy through using influential teaching methods. Previous researcher has found that teaching methods are related to teacher efficacy (Laughran , 1997. Teachers who have confidence in their ability to teach, devote effort to teaching and use different methods in classroom situation (Ghaith &Yaghi, 1997). This effective teaching may have a positive influence on the learning of students, as well as on their desire to work (Nelson, 2007). To Nelson, teacher efficacy predicts students' academic performance and students' achievement beliefs (that is students' self– efficacy) and students' levels of interest in academic subjects, which in other way round predicts motivation. When students learn adequately and experience repeated success, the students may develop the belief that they can achieve better in Mathematics. In addition, students, in turn will show signs of improved learning which will reciprocally increase the self-efficacy of teachers about their own ability to teach Mathematics. Hence, teachers' efficacy beliefs may be related to Mathematics students' achievement and Mathematics self-efficacy (Pajares, 2002).

From the fact that self-efficacy has been viewed as domain-specific, a task and situation-specific (Bandura, 2006). It may vary for different tasks and academic settings. As a result

of this, Bandura recommended studying self-efficacy with respect to specific tasks. Also, since there are different topics in Mathematics curriculum, it would be appropriate to study self-efficacy for a specific Mathematics topic. Therefore, this study has specifically considered Geometry topic of Mathematics. Geometry is one of the significant topics in the senior secondary school Mathematics curriculum (Saglam , 2007), and one of the topics students dislike because they feel the topic is difficult and could not be understood easily (Eraikhuemen , 2013). Geometry is an aspect of Mathematics which deals with the study of geometric objects such as shapes, diagrams and curves which is done through direct observation, description and analysis of spatial distribution of points. It is a special branch of Mathematics and it follows that if Mathematics teachers do not have adequate knowledge of Geometry, the teaching and learning of Mathematics will likely be deficient. Hence, Geometry is an essential part in the study of Mathematics at all levels of schooling. Knowledge of Geometry is crucial in that it help students to be familiar with many geometric shape and properties in their environment. Therefore, the need to improve the Geometry learning of students in secondary schools.

Student self-efficacy plays a critical role as a result of its influence on motivation and their achievement in academic settings (Zimmerman, 2000). Self-efficacy is also associated with students' choices, thought patterns and emotions, and the level of effort they put into the learning task. Self-efficacy also influences students' educational and career decisions, ability to set attainable goals to complete a task (Martinez &Kopala, 1999). Highly efficacious students exert more effort and tend to persevere or made effective career decisions, perceived extensive career options, and persisted in pursuing their educational goals, while students with low self-efficacy put in less effort or give up easily or were less decisive and perceived more career option limitations (Robbins & Judge, 2007). Students with low Mathematics self-efficacy cannot maintain study routines, do not have organizational skills, and have difficulty in following the covered material in class (Usher, 2009), while students with high self-efficacy participate more willingly in lessons. The enhanced performance resulting from these strategies may lead to increased academic achievement (Bandura, 1997). A study conducted by Zereyak (2012) on the relationship between self-efficacy and Mathematics achievement found positive relationships, implying that self-efficacy is an important variable on students' Mathematics performance and effects their achievement positively. However, Goulao (2014) researched on the relationship between self-efficacy and academic achievement in Adults' Learners Portugal and a significant relationship exists between self-efficacy and academic achievement.

Teacher efficacy refers to a personal characteristic enabling a teacher to effectively deal with the performance of their students (Kounin & Gump, 1974). Teachers with high self-

efficacy have perceptions about their teaching strategies, expect success from themselves and their students, .are innovative in their pedagogical practices, report being more satisfied with their job, manage their classroom with purpose and control, and invite students to participate in democratic decision making (Landys & Conte, 2010) . Pajares (2002) establishes a link between teacher efficacy and effective learning and asserts teachers with high self-efficacy beliefs create mastery experiences, vicarious learning, social persuasion, and physiological and emotional states, analyze the teaching task (instruction, students engagement, and classroom management) and assess personal teaching competency to perform a task. Through these processes, teachers evaluate their teacher efficacy level. The consequences of teacher efficacy, such as goal setting, persistence and effort, contribute to teaching performance which becomes a new source of efficacy for the teacher.

In addition, teachers with low efficacy tend to perceive student problems as being more stable and resistant to change than high efficacy teachers. Low efficacy teachers are more likely than high efficacy teachers to use negative consequences and severe punishments (Gordon, 2001).Gordon further maintains that low efficacy teachers usually prefer to use a lecture-driven, teacher-dominant method of teaching while high efficacy teachers prefer to use more student-centred methods of teaching. Since teacher efficacy is associated with teaching methods, it is equally associated with student motivation and achievement. Ashton and colleagues (1983) carried out a research with high school teachers to explore the relationship and the findings of the research revealed that levels of teaching efficacy were significantly positively associated with students' achievement in Mathematics. Also, Rose and Medway (1981) found that teachers with high levels of teaching efficacy had higher achieving students.

In the same vein, Sarac (2017) conducted a research on the relationship between teacher efficacy and students' Trigonometry self-efficacy and achievement and revealed significant relationship was found between general teaching efficacy or Mathematics teaching efficacy and students' related variables. In addition, Alvefaei (2015) examined the relationship between teacher efficacy and students' achievement in Mathematics and Science and found significant relationship between teacher efficacy and students' achievement in Mathematics and Science. From the previous studies so far, there is no specific study on the relationship between teacher efficacy and students' Geometry self-efficacy and performance in Yobe state of Nigeria. Hence, the need for this study.

Purpose of the Study

The purpose of the study was to investigate the relationship between teacher efficacy, and students' Geometry self-efficacy and performance in Yobe State of Nigeria. Specifically, the study sought to:

1. Determine the relationship between general teaching efficacy, and students' Geometry self-efficacy and student Geometry performance.
2. Determine the relationship between Mathematics teaching efficacy, and students' Geometry self-efficacy and student Geometry performance.
3. To find out if there is any difference between the Geometry self-efficacy of students of high and low Geometry teaching efficacy teachers.
4. To find out if there is any difference between the Geometry performance mean score of students of high Geometry teaching efficacy teachers and the mean score of students of low Geometry efficacy teachers.

Research Questions

The following research questions were posed and answered in the study:

1. Is there any relationship between general teaching efficacy, and students' Geometry self-efficacy and student Geometry performance?
2. Is there any relationship between Mathematics teaching efficacy, and students' Geometry self-efficacy and student Geometry performance?
3. Is there any difference between the Geometry self-efficacy of students of high and low Geometry teaching efficacy teachers?
4. Is there any difference between the Geometry performance mean score of students of high Geometry teaching efficacy teachers and the mean score of students of low Geometry teaching efficacy teachers?

Statement of the Hypotheses

The following null hypotheses (H_o) were formulated and tested at 0.05 level of significance:

Ho_1: There is no significant relationship between general teaching efficacy, and student Geometry self-efficacy and student Geometry performance

Ho_2: There is no significant relationship between Mathematics teaching efficacy, and student Geometry self- efficacy and student Geometry performance

Ho_3: There is no significant difference between the Geometry self-efficacy of students of high and low Geometry teaching efficacy teachers

Ho_4: There is no significant difference between the Geometry performance mean scores of students of highGeometry teaching efficacy teachers and the mean scores of students of low Geometry efficacy teachers

Methodology

Correlation survey research design was adopted in this study, which focused on teacher efficacy with the following two related variables: General teaching efficacy and Mathematics teaching efficacy and student self-efficacy with two related variables:

Geometry self-efficacy and Geometry performance. The population of the study comprised 42 public senior secondary two (SS2) Mathematics students in Yobe State for 2021/2022 academic Session and senior secondary two (SS2) Mathematics teachers. There were 10,231 Mathematics students (5,130 males and 5,103 females) and 507 Mathematics teachers (291 males and 216 female teachers). The sample for the study consisted of 370 students and 12 teachers in 5 co-educational public senior secondary schools in Damaturu educational zone of Yobe State, Nigeria. Multi-stage sampling technique was used to draw the sample. Four instruments used for data collection for this study were Teachers' Sense of Efficacy Scale (TSES), Self-Efficacy Beliefs toward Teaching Mathematics Scale (SEBTMTS), Student Geometry Self-Efficacy Scale (SGSES) and Student Geometry Performance Test (SGPT). Adding to these instruments, were interviews carried out with teachers to obtain more information relating to their experiences in teaching Geometry to classify them for their Geometry teaching efficacy. The TSES was developed by Tschannen and Woolfolk (2001) and was adapted by the researchers for the fact no instrument is validated forever. TSES consisted of a nine-point Likert scale and used to obtain information relating to the teaching efficacy of teachers.

The SEBTMTS was developed by Dede (2008) according to Science Teaching Efficacy Belief Instrument (STEBI) of Riggs and Enochs (1990), and was equally adapted by the researchers since no instrument is validated forever. This SEBTMTS was used to collect data/information relating to the Mathematics teaching efficacy of teachers.

The SGSES scale was constructed by the researchers following the model of Betz and Hackett (1981) who developed Mathematics Self-Efficacy Scale (MSES) for college Mathematics topics, algebra, economics, statistics and calculus. The SGSES consisted of 20 items and each item had a rating scale with 5 levels to indicate the confidence level of students in solving the problems/tasks. Students were requested to choose the appropriate number, which indicates level of their confidence, rather than finding the answer. The structure of the scale was kept back the same as MSES to maintain the construct validity. Since the aim of the present study was to measure self-efficacy in Geometry, the Geometry problems were adopted from general Mathematics textbooks for senior secondary schools according to the objectives in the scheme of work. The SGSES was used to measure the efficacy level of students in Geometry.

The SGPT was a 15- multiple choice item constructed by the researchers following the similar technique as the SGSES to choose Geometry questions (items) according to the objectives in the scheme of work. Note that SGSES items were asking students relating to perception of their capability to solve the question, but students really solved SGPT items. As a result of this, the items were not identical or same but addressing same Geometry

knowledge and skills. Hence the SGPT was used to measure students' Geometry performance.

The four instruments were correctly subjected to face and content validity by experts in the field of Mathematics education, measurement and evaluation. From their comments and suggestions, some of the items were modified to suit the study. Face and Content validity for TSES, SEMBTMTS, SGSES and SGPT were established using Cronbach's alpha and Kuder- Richardson (KR-20) Formula methods of establishing the reliability coefficients, the TSES, SEMBTMTS, SGSES and SGPT yielded 0.82, 0.93, 0.89 and 0.95 respectively. Both instruments were administered with the help of research assistants (Mathematics teachers) in the sampled schools. Descriptive statistics of means and standard deviations were used to answer research questions while Spearman Rho correlation coefficient of non-parametric version of Pearson (R) was used to test the null hypotheses one and two and z-test for hypotheses three and four at 0.05 level of significance.

Results

Data used to answer research questions one and two are presented in Tables 1, 2and 3.

Table 1: Means, Standard Deviations (SD), minimum and maximum scores of Respondents on TSES, SEBMTS, SGSES and SGPT

	N	Mean	SD	Min	Max	Full Scores
TSES	12	162.8	13.74	138	188	212
SEBTMTS	12	43.2	7.016	30	54	60
SGSES	365	37.5	12.81	12	60	80
SGPT	**370**	**3.19**	**1.710**	**0**	**10**	**11**

Table 1 shows the means, standard deviations, minimum and maximum scores computed from the instruments, The highest scores obtained from the TSES, SEBMTS, SGSES, and SGPT were 212, 60, 80, and 11 in that order.. The mean score for students' Geometry performance test stood at 3.19 which is very low. Though students were taught all the topics addressed in the test by their teachers.

Table 2: Correlation's Analysis between Teacher Efficacy Variables (TSES and SEBTMTS) and Student Self-Efficacy

			TSES	SEBTMTS	
Students' Geometry		Low	- .621	.5 84	
Self-Efficacy Scores		Medium	-.201	-.318	
		High	**-1.03**	**-1.73**	

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The results presented in Table 2 show the relationship between the two teacher efficacy variables (TSES and SEBTMTS) and the low, medium and high scores of students' Geometry efficacy investigated using correlation, there was a negative correlation among the two variables from the fact (P< 0.05) for all the correlations displayed. The null hypothesis was therefore retained; this implies that there is no significant relationship between the general teaching efficacy (two teacher efficacy variables) (TSES and SEBTMTS) and students' Geometry efficacy.

Table 3: Correlation's Analysis between Teacher Efficacy Variables (TSES and SEBTMTS) and Students' Performance

		TSES	SEBTMTS	
Students' Geometry		Low .213	.17 6	
Performance Test Scores		medium .301	.218	
		High .143	**.073**	

The results presented in Table 3 showed the relationship between the two teacher efficacy variables (TSES and SEBTMTS) and the low, medium and high scores of students' Geometry a performance investigated using correlation, there was a negative correlation among the two variables from the fact that (P< 0.05) for all the correlations displayed. The null hypothesis was therefore retained; this implies that there is no significant relationship between the Mathematics teaching efficacy and students' Geometry performance.

Research questions three and four were answered based on the interview and discussion conducted with the 12 teachers about their Geometry teaching experiences. Teachers were either classified as having high Geometry teaching efficacy or low Geometry teaching efficacy. According to the interview findings, 7 teachers were classified as having high Geometry teaching efficacy while 5 teachers were classified as having low Geometry teaching efficacy. Then the students were grouped based on the teachers' level of teaching efficacy scores from the interview findings. The students of the teachers with high Geometry teaching efficacy formed one group (Sh) while the students of the teachers with low Geometry teaching efficacy formed another group (Sl). The means of SGSES and SGAT scores were computed for both groups and then compared.

Research Question Three

Is there any difference between the Geometry self-efficacy of students of high and low Geometry teaching efficacy teachers? Data used to answer this research question is presented in Table.

Table 4: Results of z-test Related to Sh and Sl Groups' Scores from Students' Geometry Self-Efficacy Scale (SGSES)

	N	Mean	SD	df	z-cal.	Sig.	Decision
Sh	257	19.51	10.63	368	5.07	0.000	Reject H_o
Sl	113	15. 03	13.56				

From Table 4, students of teachers with high Geometry teaching efficacy had a mean score of 19.51 and a standard deviation of 10. 63 while the students of teachers with low Geometry teaching efficacy had a mean score of 15. 03 and a standard deviation of 13.56 in that order.

Hypothesis Three

There is no significant difference between the Geometry self-efficacy of students of high and low Geometry teaching efficacy teachers. From Table 4, the computed z-value of 5.07 (df=368) is significant at p=0.000 which is also significant at 0.05 since p-value of (0.000) is less than 0.05 set as level of significance, the null hypothesis was rejected. The finding signifies that there is significant difference between the Geometry self-efficacy of students of high and low Geometry teaching efficacy teachers. Hence, the conclusion drawn is that that the students of teachers who had higher Geometry teaching self - efficacy score also had higher Geometry self-efficacy than the students of teachers who had lower Geometry teaching efficacy.

Research Question Four

Is there any difference between the mean Geometry performance score of students of high Geometry teaching efficacy teachers and the mean score of students of low Geometry teaching efficacy teachers? Data used to answer this research question is presented in Table.

Table 5: Results of Z-test on differences in the Mean Performance of Sh and Sl Groups' Scores from Students Geometry Performance Test (SGPT)

	N sion	Mean	SD	df	z-cal.	Sig.	
Sh	257	4.05	1. 57	368	5.07	.701	Not Rejected H_o
Sl	**113**	**3.53**	**2.39**				

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Table 5 shows that the students of high Geometry teaching efficacy teachers had a Geometry performance mean score of 4.05 and a standard deviation of 1.57 while the students of low Geometry teaching efficacy teachers had a Geometry performance mean score of 3.53 and a standard deviation of 2.39 respectively.

Hypothesis Four

There is no significant difference between the mean Geometry performance mean score of students of high Geometry teaching efficacy teachers and the mean score of students of low Geometry efficacy teachers

As indicated in Table 5, the calculated Z-value of 5.07 is not significant at p=0.701 and df= 368 is equally not significant at 0.05 from the fact that p>0.05. The hypothesis was not rejected but retained. This implies that there is no significant difference between the Geometry performance mean score of students of high Geometry teaching efficacy teachers and the mean score of students of low Geometry efficacy teachers.

Discussion of the Findings

Regarding the research questions one and two, the findings of this study revealed that there is no significant relationship between general teaching efficacy and student Geometry efficacy, or between Mathematics teaching efficacy and student Geometry efficacy. This finding is in line with the earlier view of Bandura (1997) recommendation of measuring self-efficacy as specifically as possible for the intended task. The possible cause of this finding could be as a result of measuring teacher efficacy from a broader perspective than the intended specificity, which may be inadequate to identify the relationship with student Geometry self-efficacy.

However, these findings disagree with that of Sarac (2017); Alvefaei (2015); Ashton and Colleagues (1983) who conducted researches on the relationship between teacher efficacy and students' Trigonometry self-efficacy and achievement or Mathematics teaching efficacy and students' related variables and found significant relationship. The observed difference between these researches and the present study is that these researches investigated students' general achievement in academic areas while this study deals with Geometry performance. These unpredictable findings can realistically be ascribed to the difference in specificity in the variables that were measured.

Regarding the research question three on the difference between the Geometry self-efficacy of students of high and low Geometry teaching efficacy teachers, the finding revealed that there is significant difference between the Geometry self-efficacy of students of high and low Geometry teaching efficacy teachers. This finding is in conformity with Nelson (2007); Rose and Medway (1981) who in their separate studies

found that teacher efficacy is related to students' motivation and attitudes toward the lessons. The finding has really shown that teacher efficacy is a significant factor in predicting students' Geometry self-efficacy and can be associated with beliefs of students about their competence to solve Geometry task.

Regarding research question four on the difference between the mean Geometry performance mean score of students of high Geometry teaching efficacy teachers and the mean score of students of low Geometry efficacy teachers in terms of Geometry performance test scores, no significant difference was found. This finding disagrees with that of Gordon (2001); Cousins and Walker (2000) who in their different studies found that teacher' efficacy beliefs are related to their classroom management styles, management of classroom problems and teaching methods. Thus, it was expected that teachers' self-efficacy may be related to the students' performance.

Conclusion

The study investigated the relationship between teacher efficacy, and students' Geometry self-efficacy and performance in Yobe State of Nigeria. Conclusively, the findings of this study have revealed no significant relationship between the general teaching efficacy and Mathematics teaching efficacy to student Geometry self-efficacy; significant difference between the Geometry self-efficacy of students of high and low Geometry teaching efficacy teachers, no significant difference between the mean Geometry performance mean score of students of high Geometry teaching efficacy teachers and the mean score of students of low Geometry efficacy teachers in that order.

Recommendations

Based on the findings therein, the study provides the following recommendations:

1. Teachers should put more efforts to teaching and use different techniques or methods in classroom which might yield different findings since the present study has revealed no significant relationship between general teaching efficacy and student Geometry efficacy, or between Mathematics teaching efficacy and student Geometry efficacy;
2. Similarly, Teachers should put more efforts to teaching and apply different methods in classroom which might yield different findings since the present study has also revealed no significant difference between the Geometry performance mean score of students of high Geometry teaching efficacy teachers and the mean score of students of low Geometry efficacy teachers.

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