

**College of Education Pre-service Teachers' Attitude towards Teaching of Science, Technology,
Engineering and Mathematics (STEM) in Oyo State, Nigeria**

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Abstract

Nigerian Certificate in Education (NCE) is the lowest teaching certificate in Nigeria to teach in the lower, middle and upper basic schools in Nigeria. STEM education is a modern scientific approach of teaching and learning tasks and procedures to combat the challenges of the twenty first century. This study investigated College of Education Pre-service Teachers' Attitude towards Teaching of Science, Technology, Engineering and Mathematics (STEM) in Oyo State, Nigeria. Five public and private Colleges of Education in Oyo State were purposively sampled for the study. Descriptive research of the survey method was used for this study. Purposive sampling technique was used to target 433 final year Biology, Chemistry, Physics, Computer, Agricultural Science, Mathematics and Integrated Science (STEM) students for this study. Three hypotheses were raised for the study. The hypotheses were tested using T- test. It was observed that the level of pre-service teachers' self-efficacy towards STEM teaching was low and pre-service teachers have negative attitudes towards STEM teaching. Also, gender has no influence on the pre-service teachers' self-efficacy and attitude towards STEM teaching. Moreover, school type whether private or public college of education does not influence the level of self-efficacy beliefs of pre-service STEM teachers towards STEM teaching.

Keywords: Pre-service teacher, STEM, Self-efficacy, Attitude, Teaching

INTRODUCTION

Science, Technology, Engineering and Mathematics (STEM) are foundational and fundamental courses that are introduced to learners from the early stages of education. The disciplines preliminarily exist as fragments but are conjoined and presented as a whole to give rise to Science, Technology, Engineering and Mathematics (STEM) which forms an integral part of science education. STEM involves the study of the living and non-living components of the environment. Students as parts of the living components of the environment deserve STEM background so as to cope successfully with their surroundings and the challenges of the present generation in all facets of

life. Colleges of education are tertiary educational institutions established for the training of people who will function as professional and highly qualified classroom teachers.

. As identified by Hechter (2011), the colleges of education run teacher education program that play critical role in preparing pre-service teachers to teach STEM in schools. It must be noted that one of the aims of federal government of Nigeria is STEM development for national advancement. The objectives of the Federal Government of Nigeria with respect to teacher training is to produce highly motivated, conscientious and efficient classroom teachers for all levels of her educational system FRN, (2013). Furthermore, another objective is to encourage further, the spirit of enquiry and creativity in teachers; to help teachers fit into social life of the community and the society at large. Also, among the objectives is to enhance teachers' commitment to national goals by providing them with the intellectual and professional background adequate for their assignment to help them adapt to changing situations and to enhance their commitment to the teaching profession. Self-efficacy is a social cognitive theory of Albert Bandura. Bandura (1986) defines self-efficacy as people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances. It is not concerned with the skills one has but what one can do with whatever skills one possesses. Therefore, Self-efficacy belief of a teacher is the judgment that the teachers' abilities would be effective for the achievement and learning of students, especially the ones who have difficulty with motivation. Also, Mavuru (2018) said that the performance and activeness of science teachers while teaching is influenced by their attitudes. Also, teachers' qualification or certificate status was considered important in STEM teaching to face the challenges of the twenty first century.

Sequel to the above, teachers' certification status and degree in area of specialization are very significant and are positively correlated with students' learning outcomes in STEM (Kiptum, 2016). Also, Ufonabasi and Friday (2014) opine that teacher are trained and equipped to respond to growing and changing societal challenges. Pertinently, if teachers possessed every other needed for effective STEM teaching without the required attitudes, no success will be attained. Therefore, STEM teaching and learning processes are expected to be carried out by teachers with positive attitude and at certain levels of self-efficacy. As such, a proper investigation is needed to determine the self-efficacy and attitude of pre-service teachers towards the impartation of STEM knowledge in this 21st century.

Literature Review

The roles of STEM knowledge can never be over emphasized in the growth and development of any nation of the world. Akintola (2018) states that for any nation to grow and level up with the world power and advance country of the globe, STEM knowledge is inevitable.

According to McCaslin (2015), STEM education is a critical tool for improving students' knowledge and understanding in the fields of Biology, Physics, Chemistry, Agricultural science, Engineering, Technology and Mathematics. It makes students learn more by actively engaging them rather than merely listening and focusing on the critical thinking and understanding problems conceptually. Tolliver (2016) asserted that STEM helps students to process creativity skills and useful innovation thereby finding solutions to related problems. Nations across the globe place emphases on science education because science and technology are indispensable for national growth and development (Okorie, 2012).

Furthermore, Ajayi, (2017) states that, nations that are considered to be developed and civilized have achieved the status through purposeful STEM education of their citizens. Nigeria

national policy on education as reported by Abimbola, (2013) stated clearly that no educational system can rise above the quality of its teachers. Udofot, (2010) affirmed that the nation places importance on the quality of her teachers and the education they receive is predicated on the high social demand the society is making on education. Teachers are intermediate between the professional scientists, technologist engineers and mathematicians and the learners in a school setting. (Okorie, 2012).

More so, teachers' attitude toward STEM teaching is a strong indicator of both quality and quantity of science taught to the students because a positive attitude towards STEM teaching results in effectiveness and quality time spent on teaching (Ngman-Wara & Edem, 2016). Asiegbu, Powei and Iruka (2012) opined that attitude is a learned disposition to respond in a consistently favourable or unfavorable manner with respect to a given subject, object or event. Ngman- Wara and Edem, (2016) affirmed that attitudes are rooted in experience and as such become automatic routine conduct. The same author submitted that attitude is a state of readiness or a tendency of a person to respond in a certain manner when confronted with a certain stimulus which when positive improves performance but when negative, causes failure or decline in performance. Apart from attitude to STEM teaching, self-efficacy is also important.

According to Ali (2010), self-efficacy is the belief in one's capabilities to deal with different situations and to perform a certain task that is required to produce given attainment. This belief is dependent on individual's abilities and the belief is also necessary for organizing ascertain behaviour and realizing that behaviour to reach a certain goal. Researchers such as Bilali, (2013), Wright and Holtum, (2010) among others have compared the self -efficacy and attitudes of male and female in some facets of life. The study of Bilali, (2013) showed that pre-service teachers showed negative attitudes to STEM teaching. Also, male pre-service teachers showed positive attitudes to STEM teaching than female pre-service teachers. Furthermore, Wright and Holtum (2010) revealed in their study that college type influenced the self-efficacy of STEM teachers. Ali (2010), study showed that female teachers shown low self-efficacy to science teaching than their male counterparts.

Considering the importance of STEM teaching to the society, nation and world at large, since colleges of education pre-service teachers will graduate to become classroom teachers in the fields of Chemistry, Biology, Physics, Integrated Science, Agricultural science, Technology, Engineering and Mathematics who will be saddled with the responsibility of imparting STEM knowledge unto learners. The work starts right from laying basic scientific education foundation for her citizens from childhood because children begin career exploration at a very younger age as implied by Enemarie, Ogbeba and Ajayi, (2019). As such, it becomes imperative to investigate the self- efficacy and attitude of the to - be professionals that will nurture the future leaders in STEM education so as to be equipped to face the challenges of the 21st century.

Purpose of the Study

The general purpose of the study is to find out College of Education Pre-service Teachers' Attitude towards Teaching of Science, Technology, Engineering and Mathematics (STEM) in Oyo State, Nigeria. Specifically, the study investigated:

1. The self - efficacy belief of male and female College of Education pre-service teachers towards STEM teaching.

2. The attitude of male and female College of Education pre-service teachers towards STEM teaching.
3. The levels of self-efficacy beliefs of public and private Colleges of Education pre-service teachers towards STEM teaching.

Research Hypotheses

- H₀₁ There is no significant difference in the self - efficacy belief of male and female pre-service teachers towards STEM teaching.
- H₀₂ There is no significant difference in the attitude of male and female pre-service teachers towards STEM teaching.
- H₀₃ There is no significant difference in the levels of self-efficacy beliefs of public and private Colleges of Education pre-service teachers towards STEM teaching.

METHOD

Research Type

Descriptive research of the survey method was used for this study. It is not concerned with characteristics of individuals but it is generalized statistics that result when data are abstracted from a number of individual cases.

Population of the Study

The population for this study comprised all final year pre-service teachers from physics, chemistry, biology, Agricultural science, integrated science, technical education and Mathematics departments in both private and public colleges of education in Oyo State. The year three students that have gone for three months compulsory teaching practice were the population for the study. The period of three months corresponds to an academic term in primary and secondary schools' calendar. Both male and female pre-service teachers were involved in this study because gender is a variable in this research work.

Sample and Sampling Technique

From the Colleges of Education in Oyo State, purposive sampling technique was used to sample the final year STEM students for this study. The students had completed three months mandatory teaching practice programme in primary and secondary schools out of the three years of Nigerian Certificate in Education (NCE) programme run by colleges of education. Using random sampling technique, 65% of the students in Physics, Chemistry, Biology, Agricultural Science, Integrated Science, Computer Science, Technical education and Mathematics were involved in the study. The sum of 433 pre-service STEM students were involved in the study.

Instrument for Data Collection

The instruments for the study was College of Education Pre-service Science, Technology, Engineering and Mathematics Teachers' Self -Efficacy and Attitudes Questionnaire (CEPSTEMTSAQ) was adapted from Self-Efficacy Beliefs towards Science Teaching (STEBI-B) developed by Riggs and Enochs (1990) and Science Teaching Attitude Scale (STAS) developed by Thompson and Shringly (1986) were adapted to collect data for the study.

The instrument consists of twenty-two items Self -Efficacy and Attitudes of College of Education Pre-service Science, Technology, Engineering and Mathematics Teachers using a five-point Likert-type scale. The personal science teaching efficacy belief refers to the extent of teachers believe and how teachers' capacity can positively affect students' achievement. The Science, Technology, Engineering and Mathematics Teachers' teaching outcome expectancy reflects how

science teachers' beliefs and students' learning can be influenced by effective teaching. Each item of the scale consists of a statement followed by five responses which are: strongly agree (5), agree (4), not certain (3), disagree (2), and strongly disagree (1). The respondents answered the questions by selecting one of the responses that best expressed their opinion on the item.

The Science Teaching Attitude Scale was used to collect data on pre-service science teachers' attitude toward science teaching. The scale is also a five Likert-type with twenty items. The responses are categorized with weightings as neutral (5), agree (4), not certain (3) strongly disagree (2), and disagree (1). Hypotheses 1-3 were tested and answered at .05 alpha level of significant using t-test.

RESULTS

Hypothesis 1: There is no significant difference in the self-efficacy belief of male and female pre-service teachers towards STEM teaching.

Table 1

T- test Analyses of Pre-service Teachers' Self-efficacy towards STEM Teaching Based on Gender

Self-efficacy of pre-service teachers	N	Mean	SD	Df	T	Sig
Male	104	41.82	5.738	413	0.122	.903
Female	311	41.73	6.842			

Table 1 presents the t-value observed indicating the difference in pre-service STEM teachers' self-efficacy towards STEM teaching based on gender. The $t_{(413)} = 0.122$ $p > 0.05$. Since p is greater than 0.05, there was no significant difference. Hence, the null hypothesis that there is no significant difference in the self-efficacy belief of male and female pre-service STEM teachers towards STEM teaching was not rejected. It implies that the self-efficacy of both male and female STEM pre-service teachers towards STEM teaching is similar.

Hypothesis 2: There is no significant difference in the attitude of male and female pre-service teachers towards STEM.

Table 2

T-test Analyses of Pre-service teachers' Attitude toward STEM Teaching Based on Gender

Attitude of Pre-service teachers	N	Mean	SD	Df	T	Sig
Male	104	47.25	7.837	413	0.910	.363
Female	311	46.55	6.451			

Table 2 presents the t-value observed indicating the difference in pre-service STEM teachers' attitude towards STEM teaching based on gender. The $t_{(413)} = 0.910$ $p > 0.05$. Since p is greater than 0.05, there was no significant difference. Hence, the null hypothesis that there is no significant

difference in the attitude of male and female pre-service STEM teachers towards STEM was not rejected. It implies that there is no significant difference in the attitude of male and female pre-service STEM teachers towards STEM. The attitudes of both male and female STEM pre-service teachers towards STEM teaching were similar. Both male and female pre-service teachers had negative attitudes to STEM teaching.

Hypothesis 3: There is no significant difference in the self-efficacy beliefs of public and private Colleges of Education pre-service teachers towards STEM teaching.

Table 3

T-test Analyses of STEM Pre-service Teachers' Self-efficacy Beliefs Toward STEM Teaching Based on School Type

School type	N	Mean	SD	Df	T	Sig
Private	73	40.96	7.302	413	1.132	.258
Public	342	41.92	6.410			

Table 3 presents the t-value observed indicating the difference in pre-service STEM teachers' self-efficacy beliefs towards STEM teaching based on school type. The $t_{(413)} = 1.132$ $p > 0.05$. Since p is greater than 0.05, there was no significant difference. Hence, the null hypothesis is not rejected. It implies that there is no significant difference in the self-efficacy beliefs of public and private colleges of education pre-service STEM teachers towards STEM teaching. Both male and female pre-service teachers had low self-efficacy for STEM teaching.

Discussion of Findings

The result of this study revealed that there was no significant difference in the self-efficacy and attitude of pre-service teachers towards STEM teaching based on gender. The study revealed that the pre-service teachers' self-efficacy and attitude were similar irrespective of gender. This finding is similar to that of Bilali, (2013) who discovered that male and female teachers had similar self-efficacy, and that there was no significant difference in the level of their sense of efficacy across gender. However, this study disagrees with that of Wright and Hottlum, (2010) whose study was in the field of Mathematics and Science and found out that male and female teachers are different in their self-efficacy. The attitudes of pre-service STEM teachers were negative. Also, their self-efficacy to STEM teaching was low irrespective of gender.

Moreover, there was no significant difference in the self-efficacy of pre-service STEM teachers based on type of school. The self-efficacy of pre-service teachers in private colleges of education and public colleges of education were similar. Majority of the pre-service STEM teachers irrespective of whether from private or public colleges of education had low-self-efficacy towards the teaching of science.

Conclusion

Based on the findings of this study, it was inferred that pre-service STEM teachers have low self - efficacy towards STEM teaching in both public and private colleges of education in Oyo State. Also, both male and female Colleges of Education Pre-service STEM teachers showed negative attitudes to STEM teaching in the study areas.

Recommendations

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

1. The pre-service STEM teachers' curriculum should be revised and revitalized to include more courses that can improve self- efficacy and attitude towards STEM teaching.
2. There should be no special treatment to Pre-service STEM teachers based on gender during their study periods in terms of projects, assignment, laboratory work among others
3. The Pre-service STEM teachers should be exposed to ethics, processes and attitude of science through subject, course and departmental seminars during their periods of studentship.

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