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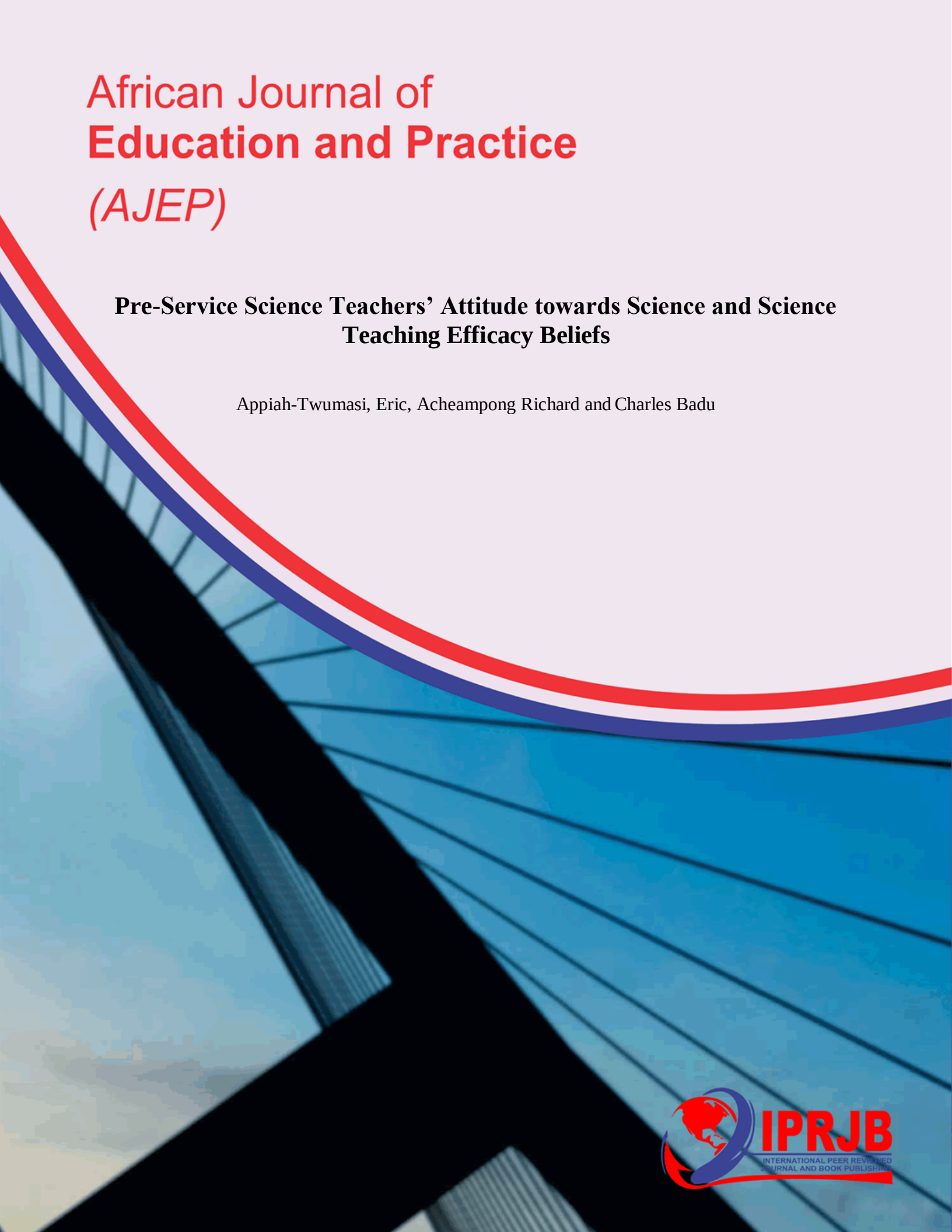

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Pre-Service Science Teachers' Attitude towards Science and Science Teaching Efficacy Beliefs

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Abstract

Purpose: The purpose of this descriptive study was to explore pre-service science teachers' attitude towards science, science teaching outcome expectancy and personal science teaching beliefs. Specifically, the study examined pre-service science teachers' attitude towards science, science teaching outcome expectancy beliefs and personal science teaching efficacy beliefs in relation to gender. Also, this study sought to establish the relationship between pre-service science teachers' attitude towards science and science teaching efficacy beliefs.

Methods: Data was collected by administering three set of questionnaires to 145 pre-service science teachers. Mean scores, percentages, t-test, regression and ANOVA were used to analyse the data.

Results: The results showed that, pre-service science teachers used for this study have positive attitude towards science, high science teaching outcome expectancy and personal science teaching efficacy beliefs. The results also showed that, science teaching outcome expectancy beliefs and personal science teaching efficacy beliefs were gender-related. The findings of the study also revealed that, there is significant relationship between pre-service science teachers' attitude towards science, science teaching outcome expectancy beliefs and personal science teaching efficacy beliefs.

Unique contribution to theory, practice and policy: It was recommended that, more emphasis should be placed on science teaching methods as part of Colleges of Education training programme to equip pre-service science teachers' pedagogical skills in the areas where the results revealed some lack.

Keywords: *Pre-service, Science Teachers, Attitude towards Science, Self-efficacy Beliefs*

1.0 INTRODUCTION

1.1Background to the Study

Attitude is defined as feelings that can be unfavourable or favourable, positive or negative and are typically directed towards some specific object (Stiggins, 1994). The Theory of Reasoned Action (TRA) by Ajzen and Fishbein(1967), as cited by Haase (2009) describes an individual's attitude towards any object as a function of the individual's beliefs about the object as well as the implicit evaluative responses associated with those beliefs. TRA theory adds that, a person who believes that performing a given behaviour will lead to mostly positive outcomes will hold a favourable attitude toward performing the behaviour. However, a person who believes that performing the behaviour will lead to mostly negative outcomes will hold an unfavourable attitude. Hence by TRA, science teachers who hold positive attitude towards science will hold a favourable attitude toward the teaching and learning of science and stand better position to facilitate effective teaching and learning in the classroom.

Self-efficacy is the personal belief that one is capable of performing in an appropriate and effective manner to attain certain goals (Ormrod, 2006). Literature, Pintrich and Shank (2007) suggests that self-efficacy is as individuals' judgment about their abilities that cause to organise and performance some efforts to achieve aimed functions. Teacher effectiveness may comprise self-efficacy in teaching and managing learning expectations or learning outcomes of students. Teachers' self-efficacy beliefs help us to predict their motivation and choice and to ascertain their actions in class (Aydin & Boz, 2010). In educational context, teacher self-efficacy is the teacher's personal belief in ability to plan teaching and accomplish instructional objectives.

Teacher self-efficacy was developed within the context of Bandura's social-cognitive theory. Bandura defined self-efficacy as the belief about one's own capabilities to organise and execute a certain task (Bandura, 1997). Bandura theory on self-efficacy has two components: efficacy expectation and outcome expectancy**.** The theory suggests that, efficacy expectation is the belief that one has with regards ones, ability, knowledge, and skills to successfully execute the behaviour or actions required to produce the desired outcomes whiles outcome expectancy represents a person's estimate of the likely impact of performing a task at the self-expected level of performance to be successful. Literature suggests that science teacher must have both high efficacy expectations and high outcome expectancy. Example, Gavora (2010) noted that, if the teacher has the efficacy expectation and not the outcome expectancy, it is unlikely that the teacher will be successful even if he/she is professionally or well-qualified.

Teacher self-efficacy is different from teacher competence which is usually explained in the teacher's professional knowledge and skills. Gavora (2010) argues that teacher self-efficacy is a broader concept and in fact high self-efficacy underlies and enables successful use of professional knowledge and skills, or conversely. Azar (2010) also suggested that the self-efficacy beliefs of the teachers has been analysed in terms of students' achievement and established that self-efficacy of the teacher positively affects the achievements and attitude of the students. Azar further noted that, teacher self-efficacy has been found to be consistently related to positive teaching behaviour and strong pupil achievement. Azar concluded that pupils learn more from teachers who have high self-efficacy and highly self-efficacious teachers are more likely to use open-ended questions, inquiry methods, or small group learning activities for students.

Studies by Henson (2001) and Ross and Bruce (2007) have shown that teachers who have high self-efficacy are more persistent at a task, take more risks, and are more likely to use innovative elements in their teaching. They added that teachers with high self-efficacy also are more opened to new ideas, more willing to adopt innovations, are less likely to experience burn-out, support pupils' autonomy to a greater extent, and are more attentive to low ability students. To suggest by logical inferences from these literature (Henson, 2001; Ross & Bruce, 2007),teachers with high self-efficacy may display better enthusiasm for teaching, have greater commitment for teaching, and are more likely to advance in their teaching profession.

From the attributes of science teachers self-efficacy highlighted, Aydin and Boz (2010) recommended that before planning suitable activities to enhance pre-service teachers' efficacy, data should be gathered to determine whether their self-efficacy is high or low. Consequently, an early detection of low self-efficacy in science teaching is critically important in any science teacher preparation programme. From foregoing, research into pre-service science teachers' self-efficacy in teaching and attitude towards science in the Colleges of Education in Ghana is of great importance in order to gather data for professional development and other services that would help pre-service science teachers know how well they are prepared to take their task after graduating from the Colleges.

It was based on this background that the Researchers decided to explore pre-service science teachers' attitude toward science, science teaching outcome expectancy beliefs and personal science teaching efficacy beliefs using 2017/18 academic year final students of St. Joseph College of Education in the Brong Ahafo Region of Ghana.

1.2Statement of the Problem

Pre-service science teachers' courses are designed to produce competent science teachers, self-efficacious science teachers and teachers who are committed to their field of teaching. However, the Researchers observed negative attitude towards science teaching in the interview conducted with regard to College of Education pre-service teachers between the periods of 2015 and 2017 academic years. Some of the second year Diploma in Basic Education student interviewed on the kind of subjects they would like to teach after graduating from College of Education revealed that they would be more comfortable to teach the social science courses rather than the science related courses.This prompted the Researchers to conduct this descriptive study to explore pre-service science teachers' attitude towards science, science teaching outcome expectancy beliefs, and personal science teaching efficacy beliefs.

1.3. Research objectives

The objectives of this descriptive study were to explore pre-service science teachers Attitude towards Science (ATS), Science Teaching Outcome Expectancy (STOE) beliefs and Personal Science Teaching Efficacy (PSTE) beliefs and relationship between ATS, STOE and PSTE. In addition, the Researchers attempted to test if ATS, STOE and PSTE are gender related. Based on the aforementioned, the Researchers addressed the following specific research questions and hypotheses, which guided this study:

1. What is the level of pre-service science teachers' attitude towards science?
   Hypothesis 1: There is no significant difference between males and females' pre-service science teachers' attitude towards science.
2. What are the strengths of pre-service science teachers' science teaching outcome expectancy beliefs and science teachers' personal science teaching efficacy beliefs?
3. What difference exists between pre-service science teachers' males and females' science teaching outcome expectance beliefs and personal science teaching efficacy beliefs?

   Hypothesis 2: There is no significant difference between pre-service science teachers' science teaching outcome expectancy beliefs and science teachers' personal science teaching efficacy beliefs by males and females.
4. Are there any significant relationships between pre-service science teachers' attitude towards science:
   (a). and science teaching outcome expectancy beliefs?
   (b). and personal science teaching efficacy beliefs?

2.0 Methodology

2.1 Research Design

This study utilised descriptive research design using three different sets of questionnaires to collect data on pre-service science teachers Attitude towards Science (ATS), Science Teaching Outcome Expectancy (STOE) beliefs and Personal Science Teaching Efficacy (PSTE) beliefs using sampled from St. Joseph College of Education in the Brong Ahafo Region of Ghana.

Descriptive studies are mostly used to collect information concerning the current status of the phenomena to describe what exits with respect to variables or conditions in a study site without changing or manipulating these variables. Consequentially, descriptive survey was used because, the focus of this study was to explore and report the levels of pre-service science teachers' attitude toward science, science teaching outcome expectancy and personal science teaching efficacy without altering any variable available.

2.2 Samples for the Study

A convenient sampling technique was used to obtain sample for the study from St. Joseph College of Education for the study due to the fact that is the only Science College of Education in the Brong Ahafo region of Ghana and the Researchers are also tutors in the same region. A total number of 145 (99 males and 48 females, mean age 24.7 year) pre-service science teacher who were receiving training to become Basic Education School science teachers and were in their last year of College of Education were conveniently sampled for the study.

2.3. Research Instruments

Attitude toward Science (ATS) scale, Science Teaching Outcome Expectancy (STOE) beliefs and Personal Science Teaching Efficacy (PSTE) beliefs sub-scales were used to gather data to answer the research questions. Attitude toward Science (ATS) instrument was constructed by the Researchers and

was pilot tested with second year science students of the same College of Education. The Cronbach Alpha reliability coefficient for the pilot testing was 0.76.

STOE and PSTE sub-scales constituted from STEBI-B were developed by Enochs and Riggs (1990) and it is widely used to measure pre-service and in-service teachers' efficacy beliefs regarding teaching science. The STEBI-B is a five-point Likert type scale ranging from one (strongly disagree) to five (strongly agree). According to Enoch and Riggs, the science teaching outcome expectancy reflects science teacher's beliefs that student learning can be influenced by effective teaching while the personal science teaching efficacy beliefs refer to the extent that science teachers have the capacity to positively affect students' achievement.

STOE and PSTE beliefs subs-scales original constructed by Enochs and Riggs (1990) requires respondents to rate their level of agreement with statements on a 5 point Likert scale ranging from strongly disagree to strongly agree with Cronbach Alpha reliability coefficients of .76 and .90 respectively. The instrument (STEBI-B) is a valid and reliable tool for studying pre-service teacher's science teaching efficacy beliefs. Ngman-Wara (2012) adopted and used STEBI-B instrument in Ghana and reported values of alpha coefficients for the items of the scale ranged from .73 to .78 with the with overall Cronbach's alpha for the whole scale as .76, which indicates high reliability of the instrument. This implies that, the STEBI-B is effective to measure both STOE and PSTE in Ghanaian science teaching context.

2.4. Data Analysis

The data relating to the research questions was analysed using descriptive statistics such as percentages, means and standard deviation. However, inferential statistics such as t-test was used to test the hypotheses at significant level of 0.05.

3.0. Results

RQ1: *What is the level of pre-service science teachers' attitude towards science?*

This research question sought to determine the pre-service science teachers' attitude towards science. Items 1 to 10 were used to collect information on the pre-service science teachers' attitude towards science. Descriptive statistics (mean scores, standard deviations and sub-mean scores) were used for the analysis. The results of the analysis are presented in Table 1. Sub-mean score above or below 3 was considered positive and negative attitude towards science respectively. Also, sub-mean mean score of 3 was considered as undecided.

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Table 1: Descriptive Analysis of Responses on Attitude towards Science (ATS)

		Gender					
		Males		**Females**		**Total**	
S/N	**ITEMS**	***M***	***SD***	***M***	***SD***	***M***	***SD***
1	I like science courses	*4.74*	*.51*	*4.48*	*.77*	*4.65*	*.610*
2	Science courses are difficulty for me	*3.95*	*1.01*	*3.02*	*.99*	*3.97*	*1.00*
3	Science courses are very interesting	*4.62*	*.65*	*4.17*	*.88*	*4.47*	*.760*
4	I was regular at science lectures	*4.68*	*.64*	*4.54*	*.71*	*4.63*	*.660*
5	Studying science is not important for my life	*4.71*	*.64*	*4.47*	*.99*	*4.64*	*.780*
6	I cannot get good grades in science courses	*4.39*	*.88*	*3.98*	*1.06*	*4.26*	*.960*
7	I will still pursue at higher level after college	*4.58*	*.89*	*4.00*	*1.25*	*4.39*	*1.06*
8	Studying science is a waste of time.	*4.78*	*.59*	*4.64*	*.61*	*4.72*	*.590*
9	Males are not naturally better than females in Sciences	*3.04*	*1.37*	*3.01*	*.75*	*3.53*	*1.29*
10	Females are just as good as males in science	*3.39*	*1.28*	*3.81*	*1.39*	*3.53*	*1.33*
	A Sub-Mean Score (SMS)/SD	**4.27**	**.85**	**4.00**	**.94**	**4.18**	**.90**

As indicated in Table 1, 7-items (1, 3, 4, 5, 6, 7 and 8) had mean scores ranged within 4.26 to 4.72 with corresponding standard deviations within .59 to 1.06. Also, 3-items (2, 9 and 10) had mean scores ranged within 3.53 to 3.97 with standard deviations from 1.00 to 1.33. The mean scores, 4.26 to 4.72 and 3.53 to 3.97 shows that the responses to the ten-items in Table 1.0 by the respondents are spread around strongly agree and agree for the positive items and strongly disagreed and disagree for the negative items. The sub-mean score of 4.18(SSD=.90) which is above the hypothetical mean score of 3.0 shows that generally, the respondents have positive attitude towards science in the areas assessed.

Testing Hypothesis one

To determine whether there are differences between the pre-service science teachers' males and female attitude towards science were statistically significant, research question one was formulated into a null hypothesis and tested. It was hypothesized that:

H_{01}: *There is no significant difference between males and females' pre-service science teachers' attitude towards science*

To test this hypothesis, an independent sample *t*-test was performed on results on attitude towards science by gender on items in Table 2 and the results are presented in Table 2. The results as indicated in Table 2 showed that, males (M=4.27, SD= .67) and females (M=4.00, SD=.76) scores on the attitude towards science are similar, [t (*145*) =.21, p>.05]. Therefore, it is apparent that there is no statistically significant difference between pre-service science teachers' male and female attitudes towards science. Hence the null hypothesis was retained.

Table 2: Inferential Statistics for Mean Score Difference on Attitude Towards Science by Gender

Sex	**N**	***Mean***	***SD***	***df***	***p-value***	***Remarks***
						Not Significant.
Males	99	4.27	.67	145	.21*	
Females	48	4.00	.79			

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Research Question Two: *What are the strengths of pre-service science teachers' science teaching outcome expectancy beliefs and science teachers' personal science teaching efficacy beliefs?*

The items 11 to 20 on Table 3 were used to collect information on the pre-service science teachers' science teaching outcome expectancy beliefs while items 21 to 30 in Table 3 were also used to collect information on the pre-service science teachers' personal science teaching efficacy beliefs. Mean scores, standard deviations, sub-mean scores (SMS) and sub-standard deviation (SSD) were used for the analyses. The results for pre-service science teachers' science teaching outcome expectancy beliefs and personal science teaching efficacy beliefs are presented in Tables 3 and 4 respectively. A sub-mean score above or below 3 was considered high strength and strength low respectively. Also, sub-mean score of 3 was considered as undecided.

Table 3: Descriptive Analysis of Responses on Science Teaching Outcome Expectancy (STOE) Beliefs

S/N	ITEMS	*M*	*SD*	*SMS/SSD**
11	When a student does better than usual in science, it is often because the teacher exerted a little extra effort	*3.86*	*1.26*	
12	When the science grades of students improved, it is often due to their teacher having found a more effective teaching approach	*4.20*	*1.05*	
13	If students are underachieving in science, it is most likely due to ineffective science teaching approach	*3.74*	*1.07*	
14	The inadequacy of a student's science background can be overcome by good teaching method	*4.25*	*.86*	
15	The low science achievement of some students cannot be generally be blamed on their teachers	*3.59*	*1.13*	***3.92/1.05***
16	When a low-achieving child progresses in science, it is due to extra attention given by their teachers	*4.15*	*.97*	
17	Increased effort in science teaching produces little change in some students' science achievement	*3.38*	*1.21*	
18	The teacher is generally responsible for the achievement of students' in science	*3.75*	*.99*	
19	Students' achievement in science is directly related to their teachers' effectiveness in teaching science	*4.16*	*.79*	
20	If parents comment that their child is showing more interest in science at school, it is probably due to the performance of the child's teacher.	*4.12*	*1.14*	

**SMS/SSD-Sub Mean Scores/ Sub-Standard Deviation*# Sources (Enochs & Riggs, 1990)

Table 3 presents the descriptive results of the 10-item used to assess **STOE** beliefs. The items mean ranging from 3.75 to 4.16, with item-12 with higher mean score and item-17 with least mean score. It could be inferred from Table 3 that, most of the respondents have strong science teaching outcome expectancy beliefs. In specific items (12, 14, 16, 19 and 20) had mean scores above 4.0 while items (11, 13, 15, 17 and 18) had mean scores above 3.0. The sub-mean score for the 10-items, 3.92(SD=1.05) is above the hypothetical mean score of scale (3.0). The results as presented in Table 4 revealed that the respondents have high **STOE** beliefs in the areas assessed.

Table 4: Descriptive Analysis of Responses on Personal Science Teaching Efficacy (PSTE) Beliefs

S/N	ITEMS	*M*	*SD*	*SMS/SD**
21	I will continually find better way to teach science.	*4.47*	*.84*	
22	Even if I try very hard, I will not teach science as well as I will teach other subject	*3.90*	*1.10*	
23	I know the steps necessary to teach science concepts effectively.	*3.92*	*.83*	
24	I will generally teach science ineffectively.	*3.95*	*1.17*	
25	I understand science concepts well enough to be effective in teaching basic science.	3.91	*.67*	
26	I will find it difficult to explain to students why science experiments work.	*4.08*	*.98*	***3.71/.97***
27	I will typically be able to answer students' science questions.	*3.81*	*1.14*	
28	when teaching science, I will usually welcome students questions.	*4.65*	*.53*	
29	I do not know what to do to turn students on to Science.	*2.12*	*.99*	
30	When a student has difficulty understanding a science concept, I will usually be at be at a lost on how to help the students understand it better	*2.69*	*1.55*	

***SMS/SD-Sub Means Scores/ Sub-Standard Deviation*.#** Sources (Enochs & Riggs, 1990)

Table 4 presents the descriptive results of the 10-items used to assess **PSTE** beliefs. The items mean ranging from 2.12 to 4.65, with item-28 with higher mean score and item-29 with least mean score. It could be inferred from Table 4 that, most of the respondents have high PSTE beliefs. In specific terms, items (21, 26 and 28) had mean scores ranging from 4.08 to 4.65. Also, items (22, 23, 24 and27) had mean scores ranging from 3.81 to 3.95. Also, items 29 and 30 had mean scores of 2.12 and 2.69 respectively. The sub-mean score value 3.71(SD=.97) is above the hypothetical mean score of scale (3.0)

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suggests that the respondents have high **PSTE** beliefs in items 21 to 28. However, the results also suggest that the respondents lack **PSTE** beliefs as highlighted by items 29 and 30in Table 4

Research Question Three: *What difference exists between pre-service science teachers' males and females' science teaching outcome expectance beliefs and personal science teaching efficacy beliefs*?

This research question sought to determine if there is any difference between the **STOE** and **PSTE** by Gender. Items 11 to 20 were used to collect information on these variables as indicated in **STOE** and **PSTE** by gender. Descriptive statistics (mean scores, standard deviations and sub-mean scores) were used were used for the analysis. The results of the analyses are presented in Table 5.

Table 5: Descriptive Summary for Science Teaching Outcome Expectancy (STOE) and Personal Science Teaching Efficacy (PSTE) by Gender

	Male(n=99)	**Female**		**Male**	**Female(n=48)**
ITEMS	**M(*SD*)**	**M(*SD*)**	**ITEMS**	**M(*SD*)**	**M(*SD*)**
11	3.80*(1.29)*	4.00(*1.17*)	**21**	4.45*(.90)*	4.50*(.71)*
12	4.12*(1.16)*	4.38*(.84)*	**22**	4.00*(.97)*	3.71(*1.32*)
13	3.74*(1.02)*	3.75(*1.18*)	**23**	3.94*(.78)*	3.90(*.92*)
14	4.22*(1.81)*	4.31*(.94)*	**24**	3.93(*1.25*)	3.97(*1.90*)
15	3.57*(1.11)*	3.63(*1.16*)	**25**	4.14(*1.96*)	3.93(*1.00*)
16	4.07*(1.04)*	4.31*(.80)*	**26**	3.89(*1.09*)	3.62(*1.23*)
17	3.26*(1.26)*	3.62(*1.08*)	**27**	4.37(*0.67*)	4.42*(.73*)
18	3.67*(1.03)*	3.89*(.90)*	**28**	4.37*(.55*)	4.60*(.49*)
19	4.12*(.820)*	4.25*(.72*)	**29**	2.09*(.88*)	2.11(*1.19*)
20	4.07*(1.15)*	4.25(*1.11*)	**30**	2.70(*1.55*)	2.67(*1.55*)
SMS/SD				**3.83(1.11)**	**3.76(1.05)**

*Standard deviation in parenthesis

Table 5 shows that the males mean scores ranged from 2.09 to 4.45 with corresponding standard deviations from .55 to 1.29. Also, the females had means scores ranging from 2.11 to 4.60 with corresponding standard deviation from .49 to 1.55. The calculated sub-mean score for males and the females are 3.83(SD=1.11) and 3.76(SD=1.05) respectively. These sub-mean scores are above the hypothetical mean score of 3.0, suggesting that both males and females have high science teaching outcome expectancy and personal science teaching efficacy beliefs. However, as revealed by the analysis, the males seem to have relatively high sub-mean scores of STOE and PSTE than their female counterpart.

Testing of Hypothesis with Respect to Research Question Two

To determine whether the difference between males and females' pre-service science teachers' science teaching outcome expectancy and personal science teaching efficacy beliefs were statistically significant, research question four was formulated into a null hypothesis and tested. It was hypothesized that:

Hypothesis 2: *There is no significant difference between pre-service science teachers' science teaching outcome expectancy beliefs and science teachers' personal science teaching efficacy beliefs by males and females.*

To test this hypothesis, an independent sample *t*-test was performed on the results of the respondents of males and females 11-30 and the results are presented in Table 6.

Table 6: Inferential Statistics for Males and Female Mean Score Difference on STOE and PSTE

Gender	N	*M*	*SD*	*df*	*t*	*P*	*Remarks*
	STOE						
Male	99	3.86	.92	145	-5.31	.00*	*Significant*
Female	48	4.03	.78				
	PSTE						
Male	99	4.01	.56	147	1.33	.56#	*Not Significant*
Female	48	3.99	.67				

The results as indicated in Table 6 showed that, males (M=3.86, SD= .92) and females (M=4.03, SD=.78) scores on STOE are different, [t (*145*) =.00, p<.05]. It is therefore apparent that there is statistically significant difference between male and female pre-service science teaching outcome expectancy beliefs in favour of the females. Hence the null hypothesis was rejected.

Also, the results as indicated in Table 6 showed that, males (M=4.01, SD=.56) and females (M=3.99, SD=.67) scores of PSTE are similar, [t (*145*) =.56, p>.05]. The result on PSTE indicated that the significant value (.56) is higher than the alpha value (.05). It is therefore apparent that there is no statistically significant difference between male and female personal science teaching efficacy beliefs. Hence the null hypothesis was retained.

Research Question Four:

Are there any significant relationships between pre-service science teachers' attitude towards science:
(a). and science teaching outcome expectancy beliefs?
(b). and personal science teaching efficacy beliefs?

The mean scores of attitude towards science, science teaching outcome expectancy and personal science teaching efficacy beliefs of respondents were used to establish the relationship between these variables. The results are presented in Table 7 and 8.

Table 7: ***Linear Regression Analysis showing Attitude towards Science as the Predictor of Science Teaching Outcome Expectation Beliefs***

R	R Square	Adjusted R Square			Std. Error
.50	.25	.16			1.82
		ANOVA			
Model	**Df**	**SS**	**MS**	**F**	***Significance F***
Regression	1	.47	.47	2.73	.00
Residual	8	1.38	.17		
Total	9	1.85			

Table 7 shows that there was a contribution of the independent variable (attitude towards science) to the pre-service science teachers' science teaching outcome expectancy beliefs. This yielded a coefficient regression R=.50, Multiple R^2 of .25 accounting for about 25% of the variation in the independent variable. Table 7 further indicates that, the linear relationship between pre-service science teachers' attitude towards science and science teaching outcome expectation beliefs was significant [$F_{(1, 9)}$ =2.73, p<.05].

Table 8: ***Linear Regression Analysis showing Attitude towards Science as the Predictor of Personal Science Teaching Efficacy Beliefs***

R	R Square	Adjusted R Square			Std. Error
.15	0.02	-.09			.48
			ANOVA		
Model	**Df**	**SS**	**MS**	**F**	***Significance F***
Regression	1	.04	.46	.20	.70
Residual	8	1.81	.23		
Total	9	1.85			

Table 8 shows that there was a contribution of the independent variable, attitude towards science to the pre-service science teachers' personal science teaching efficacy beliefs. This yielded a coefficient regression R=.15, Multiple R^2 of .02 accounting for about 20% of the variation in the dependent variable. However, Table 8 further indicates that, the linear relationship between pre-service science teachers' attitude towards science and personal science teaching efficacy was insignificant [$F_{(1, 9)}$ =.20, p>.05].

4.0 Discussion of Results

The overall mean score on attitude towards science 4.18 (SD=.90) shows that the respondents seems to have positive attitude towards science guided by the hypothetical mean score above 3.0 as an indicator. Generally, this study revealed no significant difference between males and females' pre-service science teachers' attitude towards science. However, the results showed that the males' attitude towards science

seems to be relative higher than the females as reflected in the mean scores of 4.27(SD=.67) and 4.00(SD=.79) respectively.

More importantly, the finding on attitude towards science guided by the Theory of Reasoned Action, as cited by (Haase, 2009) indicates the extent to which these pre-service science teachers would be successful in teaching of science. The theory describes an individual's attitude towards any object as a function of the individual's beliefs about the object as well as the implicit evaluative responses associated with those beliefs. Therefore, if the sample used in this study have positive attitude towards science, they will equally have positive attitude towards science teaching too.

The results also suggest that, pre-service science teachers used for the current study have both high science teaching expectancy beliefs and personal science teaching efficacy beliefs as highlighted from Table 2 and 3. The high beliefs as revealed by the analysis are also another vital indication that these pre-service science teachers would be efficient in their science teaching. For example, literature by Gavora (2010) stated that teacher self-efficacy has been found to be consistently related to positive teaching behaviour and strong pupil achievement. He concluded that, pupils learn more from teachers who have high self-efficacy and self-efficacious teachers are more likely to use open-ended questions, inquiry methods, or small group learning activities for students.

These attributes of self-efficacious teachers were collaborated by (Henson, 2001; Ross & Bruce, 2007) that teachers who have high self-efficacy are more persistent at a task, take more risks and are more likely to use innovative elements in their teaching than those who do not. The results of this current study supports Ngman-Wara (2012) findings on a study conducted in Ghana that reported that the pre-service science teachers have very high level of self-efficacy beliefs and the pre-service secondary science teachers' self-efficacy and personal science teaching efficacy beliefs were gender-related. However, the results of the current study contradict Ngman-Wara observation that males have higher self-efficacy beliefs towards science teaching than the females and the latter having higher personal science teaching efficacy than their male counterparts because the results indicates otherwise.

Results on item 29 and 30 suggest lack of pedagogical skills by the sample used for this study in these areas. It is in the same indication that Ngman-Wara and Edem (2016) recommended that science tutors should integrate science content into methods to improve the pre-service' science teachers content and pedagogical content knowledge. The results also suggest that, the pre-service science teachers' attitude towards science accounts for about 25% and 20% of the science teaching outcome expectation beliefs and personal science teaching efficacy beliefs respectively. The implications of the results obtained are that, science tutors should design their lessons to promote pre-service science teachers' positive attitude towards science, since it has potential effects on the science teaching efficacy beliefs.

5.0. Conclusion

The current study explored pre-service science teachers' attitude towards science, science teaching outcome expectancy beliefs and personal science teaching efficacy beliefs using total number of 145 (99 males and 48 females, mean age 24.7 year) pre-service science teachers from St. Joseph College of Education in the Brong Ahafo region of Ghana. In the study, the following observations were made based on the analyses of the results:

- ✓ The sample used for the study have positive attitude towards science
- ✓ The sample used for the study have both high science teaching outcome expectation beliefs and personal science teaching efficacy beliefs
- ✓ Science teaching outcome expectation beliefs and personal science teaching efficacy beliefs are gender-related
- ✓ There are relationships between pre-service science teachers' attitude towards science, science teaching outcome expectation beliefs and personal science teaching efficacy beliefs.

Base on the on the observations made in the study, the Researchers concluded that, the pre-service science teacher used for the study stands a better position to be efficient in the teaching of science. This conclusion is premise on assertion made by Gavora (2010). Gavora contends that if the teacher has the efficacy expectancy and not the outcome expectancy, it is unlikely that the teacher will be successful teacher even if the teacher is professionally or well-qualified. However, in this study, both high science teaching outcome expectancy beliefs and personal science teaching efficacy beliefs were revealed, hence this conclusion.

6.0Recommendation

Results of item 29 and 30 in Table 4 show that, the respondents lack the skills to help challenged science students to over their difficulties in learning science concepts. This may suggest lack of science methodological skills in these areas. This underscores the need for more emphasis to be placed on science teaching methods as part of Colleges of Education training programme to equip pre-service science teachers' with pedagogical skills.

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