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Abstract

Self-efficacy beliefs play an essential role in determining teaching practices, including choosing appropriate instructional activities, organizing lessons, and preparing oneself to handle challenging situations (Bandura, 1997). Hence, the study focuses on determining and discovering the science teaching attitudes and self-efficacy beliefs in teaching and handling laboratory activities of the purposely selected seventy-one (71) STEM teachers of Agusan del Norte Division. Descriptive statics was employed to determine the quantitative results supported by themes of the open-ended questions. Results show that STEM teachers show high self-efficacy rates in each respective factor provided in laboratory and science teaching efficacy beliefs and possessed positive attitudes towards science teaching. Laboratory & Science Teaching self-efficacy beliefs and science teaching attitudes of STEM teacher participants vary when grouped according to gender. However, there is a significant relationship between the STEM teachers' laboratory self-efficacy beliefs to their respective science teaching attitudes and science teaching efficacy beliefs showing a low positive correlation. This implies that STEM teachers can handle and teach laboratory activities in limited and available learning environment. It is recommended that self-efficacy perception enhancing activities should be intensified in teachers' training such as professional development programs like INSETS and Learning Action Cells (LAC) integrating to address their self-efficacy beliefs for the sustainability of STEM education in the Division of Agusan del Norte.

Introduction

STEM (Science, Technology, Engineering, and Math) strand is integrated into the traditional academic path. Thus, the traditional strategy was replaced with a more inventive approach based on abilities and capacity to consider, according to Montebon (2014). Within the Philippines, the Department of Education (DepEd) has executed K to 12 programs since 2012. One of those is STEM programs, a teaching philosophy that combines four disciplines (Science, Technology, Engineering, and Mathematics) into a single, cross-disciplinary program. A STEM-based curriculum offers instructions in real-life situations and applications to help the student learn. In addition, STEM provides them an environment that emphasizes learning first-hand or hands-on, which mainly happens inside a laboratory. Laboratory works have been a part of science education for a long time. Thus, it became a vital part of teaching Science. Gencer and Zengin 2015 stated in their studies that conducting science laboratory activities have significant impacts capturing the students' attention and ensuring that there is an understanding of the lesson. Teachers must have adequate experience with the tools, procedures, and observation for teachers to lead and teach laboratory activities. However, it is most important to have a greater understanding of Science. Although, according to Gencer and Zengin 2005, most teachers are inexperienced with the laboratory's tools and equipment. This unfamiliarity causes them not to be able to use the materials. The result also revealed that the teachers lack knowledge of the proper maintenance and repair of the Laboratories Tools and Equipment. This current predicament necessitates improved science teacher curricula that meet the present K–12 education programs' modification. Several scholars emphasized the necessity of addressing insufficient science content preparation (Appleton, 2006 & Hechter, 2011).

Several efforts have been undertaken to update the current teacher education curriculum by introducing new subject courses through the Professional Regulation Commission's various issuances of standards, regulations, and recommendations. However, this primarily affects pre-service teachers. In addition, the issue of existing in-service instructors has yet to be resolved. Other researchers have recommended that teachers' self-efficacy beliefs be emphasized (Kazempour & Sadler, 2015 and Leonard, 2011). As previously said, one area that has been disregarded in addressing this problem is the science teacher's self-efficacy (Orbe et al., 2018). Self-efficacy beliefs are a teacher's assessment of his or her skills to facilitate the accomplishment of desired learning objectives and engage pupils in learning and performance. Self-efficacy beliefs in the laboratory are known to be an individual's beliefs on the efficient use of laboratories (Ekici, 2009). The information, capacities, and attitudes to be given to the learners through laboratory studies are directly proportional to teachers' knowledge, capacities, and attitudes (ZENGİN, 2015).

Self-efficacy beliefs are essential in defining teaching behaviors, such as selecting appropriate instructional activities, planning lessons, and preparing for difficult circumstances (Bandura, 1997). In addition, teachers with high self-efficacy are more likely to use inquiry-based teaching methods and create learner-centered settings for their pupils (Watters & Ginns, 2000). Teachers with poor self-efficacy, on the other hand, have grown overly reliant on textbooks and prescribed curriculum, which prevents students from developing critical thinking, creativity, and conceptual understanding (Gassert, et.al, 1996). Because of the importance of examining science teachers' self-efficacy beliefs, science teaching and laboratory self-efficacies have developed and assessed teachers' efficacy beliefs. Different researchers agree that instructors' ideas overlook their future courses (Kazempour & Sadler, 2015; Enochs & Riggs, 1990). Existing in-service instructors are familiar with an older curriculum. They may bring their prior experiences to bear on their current teaching responsibilities, which might be problematic. The views of these teachers must then examine as a starting point for enhancing the teacher education curriculum and offering extra professional development opportunities.

Limited published articles are also available locally on the self-efficacy of science teachers. With that, this research aims to encourage long-term STEM education in the Agusan del Norte division by evaluating the current status of STEM education implementation. This research aims to assess and analyze STEM teachers' attitudes, laboratory self-efficacy beliefs, and science teaching efficacy beliefs while handling and teaching laboratory practices.

Theoretical Framework

This study is primarily base on Bandura's Social Cognitive Theory (1986). Self-efficacy, according to Bandura, is the belief in one's ability to deal with various situations and execute a specific task necessary to achieve certain goals. This belief is based on the individual's beliefs in his or her skills (Bandura, 1997). Teacher efficacy beliefs significantly impact their performance and motivation (Lewandowski, 2005; Tschannen-Moran & Woolfolk-Hoy, 2001). Teachers' nuanced decisions about instructional approaches to use when incorporating STEM concepts into laboratory activities necessitate understanding how teachers relate to their teaching environment and content. Social cognitive theory was the theory driving this analysis in Bandura, 1986. It is vital to look at how individual teacher assessment is connected to STEM integration and instructional methods.

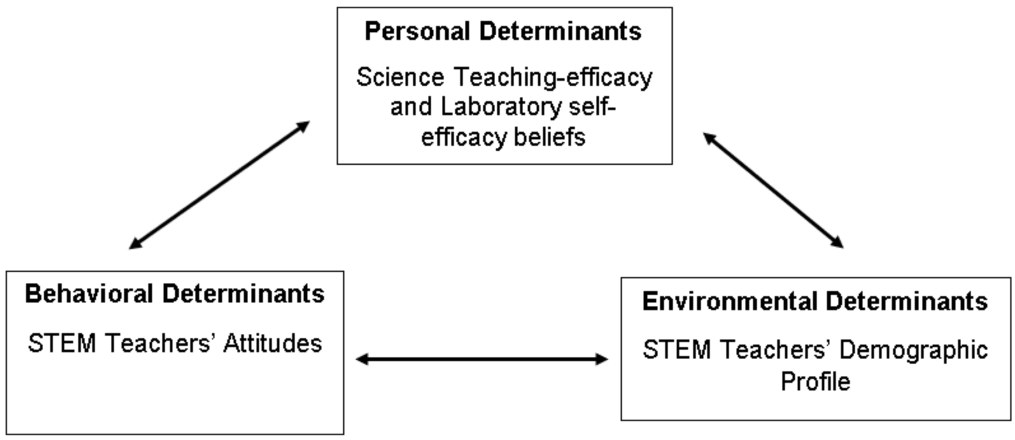

Figure 1. The Application of Social Cognitive Theory to the Conduct of Laboratory Activities by STEM Teachers (Adapted from Bandura, 2002)

The interaction of social-cognitive theories is the interaction of personal, environmental, and behavioral influences. Teachers' attitude toward Science teaching is the first behavioral influence. The demographic profile of the STEM teacher participants is one of the environmental variables (Bandura, 2002). Humans, according to Bandura (1986), are self-regulating and self-organizing. According to Bandura (1986), human functioning is the interaction of personal, environmental, and behavioral influences.

Method

The study is quantitative research where this study used a descriptive research design. The descriptive survey gathers information about people’s behaviors, views, values, viewpoints, and other characteristics (Mcmillan, 2004). In measuring the participants’ attitudes and self-efficacy beliefs, the researchers employed a quantitative approach of data determined by the following adopted research instruments. Questionnaires, the Science

Teaching Efficacy Belief Instrument (STEBI-A), Laboratory Self-Efficacy Beliefs Scale" (LSEBS), and Science Teaching Attitude Scale (STAS), with some self-constructed questions, was used as a data collection instrument to assist the researcher in assessing teachers' attitudes, laboratory self-efficacy beliefs and science teaching efficacy beliefs of STEM teachers in the Division of Agusan del Norte in conducting laboratory activities. The research was conducted in the public secondary schools offering STEM education in Agusan del Norte, Caraga Region, Philippines. The division of Agusan del Norte is a study area because of the researchers' convenience and direct availability of data to be gathered. Teacher participants are all Junior and Senior high school STEM teachers. Holding laboratory-related subjects in the public secondary schools offering STEM education.

The key data-gathering instrument was a questionnaire consisting of a 5-point Likert-type scale, demographics, and open-ended questions. Three adapted instrument questionnaires need to be carried out in this research—first, the Science Teaching Efficacy Belief Instrument (STEBI-A). Second, the Laboratory Self-Efficacy Beliefs Scale (LSEBS). Lastly, the Science Teaching Attitude Scale (STAS) and open-ended questions related to each adapted questionnaire certainly needed details on the teachers' lived experiences. Correspondingly, demographic profiles, including sex, years of teaching, and bachelor's preparation, were also considered.

Laboratory Self-Efficacy Beliefs Scale (LSEBS)

(Gülay Ekici, 2009) "Laboratory Self-Efficacy Beliefs Scale" (LSEBS) was used to assess prospective science teachers' self-efficacy beliefs about laboratory use. Personal Factors and External Factors (Factors Based on the Atmosphere-Students) are the two factors on the 5-point Likert scale. The first factor has eight items (1, 2, 3, 4, 5, 6, 7, & 8) while the second factor has ten items (9, 10, 11, 12, 13, 14, 15, 16, 17, & 18). The questionnaire had a KMO (Kaiser-Meyer-Olkin) value of 0.86 and a Barlett Test value of 3027.11. The overall Cronbach-Alpha reliability coefficient was estimated to be 0.90. For the dimension of personal factors, the Cronbach-Alpha reliability coefficient was 0.90. For the dimension of external factors, it was 0.85.

Science Teachers' Efficacy Belief Scale (STEBI-A)

The Science Teachers' Efficacy Belief Scale (STEBI-A) was developed by (In Riggs, I. & Knochs, L., 1990) and tested for reliability. Personal Science Teaching Efficacy Belief (PSTE) and Science Teaching Outcome Expectancy (STOE) are the two sub-scales in the STEBI-A built for in-service teachers. PSTE assesses a person's confidence in their ability to do what is required to achieve the desired outcome, which belongs to items; 2, 3, 5, 6, 8, 12, 17, 18, 19, 21, 22, 23, & 24. In contrast, STOE assesses the belief that teaching has a significant impact on student learning which also belongs to items; 1, 4, 7, 9, 10, 11, 13, 14, 15, 16, 20, & 25. The extended version of the STEBI-A has 25 objects, 13 of which are positively written and 12 are negatively written. The Personal Science Teaching Efficacy Belief has a Cronbach alpha coefficient of 0.92. In contrast, the Science Teaching Outcome Expectancy Scale has a Cronbach alpha coefficient of 0.77 (In Riggs, I. & Knochs, L., 1990). This instrument is a valuable resource for in-service teachers. This scale asks teachers to self-report their beliefs.

Science Teaching Attitude Scale (STAS)

Thompson, C. L., & Shrigley, 1986 created the Revised Science Attitude Scale to assess in-service teachers' attitudes toward science teaching. The revised version is a Likert-type instrument created to enhance the original instrument's content and establish validity. In-service teachers respond to 12 positive and ten negative statements by selecting one of five Likert intervals. There are four general subscales for the 22 attitude claims. Nine objects express the main subscale, ease, and comfort of teaching science items (1, 3, 6, 7, 9, 11, 14, 18, & 19). The need for science is represented by five items (2, 8, 15, 21, & 22). The science equipment is represented by five items (5, 10, 12, 16, & 17). Moreover, the time required to teach science is represented by three items (4, 13, & 20). For the full scale, the internal quality reliability is 0.89. The subcomponents' alpha values range from 0.63 to 0.73, and the R-values of the subcomponents range from 0.46 to 0.73. According to Thompson and Shrigley (1986), this instrument is reasonably accurate and effective for determining in-service teachers' attitudes toward teaching science.

Moreover, students' raw scores in laboratory activities are also considered as data in the study to ensure the quality of attitudes and self-efficacy towards handling and teaching laboratory activities. The developed, validated, and approved research questionnaire was then developed through Google Forms for a web-based survey device (Raju & Harinarayana, 2016). The developed online survey questionnaire was reviewed and assessed by the Division Science EPS before being released. The google form link of the research instrument was directly sent to the respective DepEd Gmail address of the STEM Science Teachers. Following the IATF strict protocols, the researchers decided to do an online survey. The participants of the study are given an hour to answer the questionnaires. The duration of the data gathering starts from April 28, 2021, to May 14, 2021. The researchers personally administered the collection of data. After obtaining permission from the relevant authorities and entities, data was collected. Encoding, tabulation, and data analysis were thoroughly done to assure the quality of the entire study. The following statistical tools were used to compute data and were tested at a 0.05 level of significance. Descriptive statistics (frequency count, percentage, mean, and standard deviation) were used to interpret the data. Additionally, an independent samples t-test and a one-way variance analysis (ANOVA) were used. To understand the relationship between attitudes and self-efficacy beliefs, the Pearson product-moment correlation coefficient test was used. The range of means with descriptive interpretations used to analyze the data to be obtained after the survey; 4.50 – 5.00 (Strongly Agree), 3.50 – 4.49 (Agree), 2.50 – 3.49 (Uncertain), 1.50 – 2.49(Disagree), 1.00 – 1.49 (Strongly Disagree).

The study's participation was entirely voluntary, and the confidentiality and anonymity of all questionnaires and responses of all participants were given top attention. Necessary measures were also considered to ensure that the participants were not harmed in any way. Prior to data collection, all participants were given a thorough explanation of the study's goals (Walag et al, 2018). The method, as well as the research instrument utilized in this study, were thoroughly reviewed for ethical considerations by the university research office through our research program officers and external reviewers, which served as the ethics review board.

Results

Demographic Profile of STEM Teachers

A total of seventy-one (71) public JHS and SHS STEM teachers across the division of Agusan del Norte, Caraga Region, responded to the survey questionnaire. The majority of the respondents are forty-six (46) females (65%), while only it consists of twenty-five (25) males (35%). STEM teacher participants are primarily located in rural areas (63%), forty-five (45) of them. In comparison, the remaining came from urban areas (37%), which is twenty-five teachers. Teacher-respondents are distributed as per the level of education they have taught. Most of them are (56%) Junior High School STEM teachers consisting of forty (40) STEM teachers. They were then followed by (38%) Senior High School teachers comprising of twenty-seven STEM teachers. The remaining four (4) STEM teachers are teaching both Junior and Senior High School STEM (6%). STEM teacher participants are also numbered according to their bachelors' preparation. Typical of the teacher participants involving fifty-five (55) teachers are being prepared according to their specialization (77%). In comparison, the remaining sixteen (16) teachers are being equipped for teaching to the non-specialized field (23%). In terms of specialization, utmost of the teacher participants is twenty-nine (29) biology teachers (42%), followed by eleven (11) chemistry teachers (15%), then ten (10) general science teachers (14%), and only five (5) physics teachers. In contrast, non-specialized teachers are twelve licensed professionals (31%), and the remaining four (4) teachers came from their baccalaureate degrees which are (6%). This is because some professionals left their graduated professions such as (nursing, engineering, physical therapy, biology) and other science-related professions, which led them to shift to teaching. As for years of teaching, most of the teachers have an average of 9 years of teaching experience (with $\bar{x}$=9.14)

Attitudes and Self Efficacy Beliefs of STEM Teachers

The STEM teacher participants show a high laboratory self-efficacy rate considering the personal factors (with $\bar{x}$=3.61) and external factors (with $\bar{x}$=4.02). The STEM teacher participants show a neutral science teaching efficacy rate (with $\bar{x}$=3.10) for Personal Science Teaching Efficacy (PSTE) and high science teaching efficacy rate (with $\bar{x}$=3.68) Science Teaching Expectancy Outcome (STEO). The STEM teacher participants are neutral in possessed positive attitudes in science teaching (with $\bar{x}$=2.88) for comfort/discomfort in teaching science, for the need for science, (with $\bar{x}$=3.98) for science equipment, and (with $\bar{x}$=3.92) for the time required in teaching science (see Table 1).

Table 1. Mean Distribution of the Participants' Laboratory Self-Efficacy Beliefs

Laboratory Self-Efficacy Beliefs Scale (LSEBS)	**Mean**	**SD**	**Verbal Description**	**Qualitative Interpretation**
The factor I (Personal Factors)				
1. I feel more productive when I plan all my lessons in the laboratory.	4.30	0.83	Agree	The extent of the effect is high
2. I feel that I can easily demonstrate my	4.15	0.82	Agree	The extent of the

knowledge and skills in the laboratory.				effect is high
3. I feel very comfortable lecturing in the laboratory.	4.03	0.90	Agree	The extent of the effect is high
4. I feel better that I am a qualified teacher in a laboratory lesson.	3.90	0.91	Agree	The extent of the effect is high
5. I believe I have a special talent for teaching in the lab.	3.87	0.89	Agree	The extent of the effect is high
6. I feel that I am capable of solving all the problems we may encounter in the laboratory.	3.66	0.95	Agree	The extent of the effect is high
7. I feel nervous about working in the lab.	2.63	1.27	Uncertain	The extent of the effect is neutral
8. I feel insufficient to work in the laboratory.	2.37	1.06	Disagree	The extent of the effect is low
Weighted Mean	**3.61**	1.27	**Agree**	**The extent of the effect is high**
Factor 2 (External Factors-Factors Arising from the Student and the Environment)				
1. I feel better when there is a suitable working environment in the laboratory.	4.38	0.92	Agree	The extent of the effect is high
2. Students' interest in the work done in the laboratory increases my self-confidence.	4.34	0.70	Agree	The extent of the effect is high
3. It always reassures me to have enough equipment in the laboratory.	4.24	1.21	Agree	The extent of the effect is high
4. I feel competent in developing rules for classroom discipline to provide an effective teaching environment in the laboratory.	4.15	0.81	Agree	The extent of the effect is high
5. It makes me feel good that I am encouraged to do lessons in the laboratory by the students - other teachers - the school administration.	4.08	0.83	Agree	The extent of the effect is high
6. I feel competent to prepare projects in which I can use my skills with students and other teachers in the laboratory.	4.04	0.89	Agree	The extent of the effect is high
7. I feel competent in creating the physical conditions and equipment required in the laboratory.	3.93	0.85	Agree	The extent of the effect is high
8. I feel sufficient in motivating students who are not interested in the laboratory	3.93	0.76	Agree	The extent of the effect is high

course.				
9. I feel competent in solving the problems posed by other teachers in the laboratory.	3.77	0.80	Agree	The extent of the effect is high
10. I feel anxious when the number of students in the lab is large	3.32	0.71	Uncertain	The extent of the effect is neutral
Weighted Mean	**4.02**	**0.89**	**Agree**	**The extent of the effect is high**

Legend: 4.50 – 5.00 (Strongly Agree), 3.50 – 4.49 (Agree), 2.50 – 3.49 (Uncertain), 1.50 – 2.49 (Disagree), 1.00 – 1.49 (Strongly Disagree)

The overall efficacy rate of STEM teachers on personal factors based on their laboratory self-efficacy beliefs is 3.61, a high-level efficacy rate. The highest-level personal factor is indicating that the STEM teachers feel more productive when they plan their lessons in the laboratory. Correspondingly, their external factors have a self-efficacy belief of 4.02, which is also a high self-efficacy rate. The highest-level external factor was found out which indicates that the STEM teachers feel better when there is a suitable working environment in the laboratory. Thus, both external and personal factors of the teacher participants carried to result from a high self-efficacy rate. However, some of the STEM teachers are uncertain when it comes to the feeling of nervousness and insufficient from working in the laboratory implicating that STEM teachers are able to adjust into different working laboratory environment. Lastly, STEM teachers can handle laboratory class even it has a big number of learners in a certain classroom. It is evident that in a classroom in every public secondary schools consists and average of 30 to 40 students per classroom (see Table 2).

Table 2. Mean Distribution of the Participants' Science Teaching Efficacy Beliefs

Science Teaching Efficacy Belief Instrument B (STEBI-B)	Mean	SD	Verbal Description	Qualitative Interpretation
Personal Science Teaching Efficacy Belief (PSTE)				
1. I am continually finding better ways to teach Science.	4.62	0.51	Strongly Agree	The extent of the effect is very high
2. When teaching Science, I usually welcome student questions.	4.46	0.73	Agree	The extent of the effect is high
3. I know the steps necessary to teach science concepts effectively.	3.86	0.74	Agree	The extent of the effect is high
4. I understand science concepts well enough to be effective in teaching STEM Education.	3.85	0.90	Agree	The extent of the effect is high
5. I am typically able to answer students' science questions.	3.80	0.74	Agree	The extent of the effect is high

6. When a student has difficulty understanding a science concept, I am usually at a loss as to how to help the student understand it better.	2.77	1.21	Uncertain	The extent of the effect is neutral
7. I wonder if I have the necessary skills to teach Science.	2.75	1.18	Uncertain	The extent of the effect is neutral
8. I am not very effective in monitoring science experiments.	2.68	1.16	Uncertain	The extent of the effect is neutral
9. I find it difficult to explain to students why science experiments work.	2.52	1.11	Uncertain	The extent of the effect is neutral
10. Even when I try very hard, I don't teach science and most subjects.	2.42	1.22	Disagree	The extent of the effect is neutral
11. I don't know what to do to turn students on to Science.	2.39	1.12	Disagree	The extent of the effect is low
12. I generally teach Science ineffectively.	2.15	1.17	Disagree	The extent of the effect is low
13. Given a choice, I would not invite the principal to evaluate my science teaching.	2.14	1.18	Disagree	The extent of the effect is low
Weighted Mean	**3.10**	**0.51**	**Uncertain**	**The extent of the effect is neutral**
Science Teaching Outcome Expectancy (STOE)				
1. The inadequacy of a student's science background can be overcome by good teaching.	4.25	0.85	Agree	The extent of the effect is high
2. When the science grades of students improve, it is most often due to their teacher has found a more effective teaching approach.	4.14	0.77	Agree	The extent of the effect is high
3. When a student does better than usual in Science, it is often because the teacher exerted a little extra effort.	4.06	1.09	Agree	The extent of the effect is high
4. 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.	3.96	0.74	Agree	The extent of the effect is high
5. When a low achieving child progresses in Science, it is usually due to the extra attention given by the teacher.	3.94	0.95	Agree	The extent of the effect is high

6. The low science achievement of some students cannot generally be blamed on their teachers.	3.93	1.14	Agree	The extent of the effect is high
7. Students' achievement in Science is directly related to their teacher's effectiveness in science teaching.	3.70	0.91	Agree	The extent of the effect is high
8. Increased effort in science teaching produces little change in some students' science achievement.	3.58	1.21	Agree	The extent of the effect is high
9. The teacher is generally responsible for the achievement of students in Science.	3.52	1.17	Agree	The extent of the effect is high
10. If students are underachieving in Science, it is most likely due to ineffective science teaching.	3.25	1.11	Uncertain	The extent of the effect is neutral
11. Effectiveness in science teaching has little influence on the achievement of students with low motivation.	3.17	1.13	Uncertain	The extent of the effect is neutral
12. Even teachers with good science teaching abilities cannot help some kids learn Science.	2.65	1.27	Disagree	The extent of the effect is low
Weighted Mean	**3.68**	**1.03**	**Agree**	**The extent of the effect is high**

Legend: 4.50 – 5.00 (Strongly Agree), 3.50 – 4.49 (Agree), 2.50 – 3.49 (Uncertain), 1.50 – 2.49 (Disagree), 1.00 – 1.49 (Strongly Disagree)

The overall Personal Science Teaching Efficacy Beliefs (PSTE) based on the STEM teachers' science teaching efficacy beliefs is 3.10, which is at the neutral level efficacy rate. The highest level of PSTE was found that STEM teachers possess high confidence that they will find different teaching strategies to teach Science effectively. However, the overall Science Teaching Expectancy Outcome (STOE) of the STEM teacher participants possessed a high efficacy rate with a mean of 3.68.

The highest level of teaching outcome expectancy was determined demonstrating the inadequacy of a students' science background can be overcome by good teaching. PSTE and STEO influenced a high self-efficacy rate which implies that STEM teachers are being innovative and resourceful in finding ways to deliver quality content to students despite the limited resources available in the learning environment. STEM teachers are uncertain when it comes to monitoring science experiments and find it challenging to explain to students why science experiments work. Also, the necessary skills to teach science and when a student has difficulty in understanding a science concept they usually at loss to help the student understand it better (see Table 3).

Table 3. Mean Distribution of the Participants' Science Teaching Attitudes

Revised Science Teaching Attitude Scale (STAS)	Mean	SD	Verbal Description	Qualitative Interpretation
Comfort/Discomfort of Teaching Science				
1. Science would be one of my preferred subjects to teach if given a choice.	4.41	0.76	Strongly Agree	The extent of the effect is very high
2. I hope to be able to excite my students.	4.39	0.68	Agree	The extent of the effect is high
3. I feel comfortable with the science content in the science curriculum.	3.63	0.84	Agree	The extent of the effect is high
4. I fear that I will be unable to teach Science adequately.	2.65	1.39	Uncertain	The extent of the effect is neutral
5. I am afraid that students will ask me questions that I cannot answer.	2.41	1.26	Disagree	The extent of the effect is low
6. I have a difficult time understanding Science.	2.35	1.05	Disagree	The extent of the effect is low
7. I am not looking forward to teaching Science in my classroom.	2.14	1.39	Disagree	The extent of the effect is low
8. I will feel uncomfortable teaching science.	2.01	1.31	Disagree	The extent of the effect is low
9. I fear teaching Science.	1.92	1.12	Disagree	The extent of the effect is low
Weighted Mean	**2.88**	**1.09**	**Uncertain**	**The extent of the effect is neutral**
Need for Science				
1. The teaching of science processes is vital in the classroom.	4.63	0.63	Strongly agree	The extent of the effect is very high
2. Science is as important as the 3 Rs.	4.34	0.67	Agree	The extent of the effect is high
3. I plan to integrate Science into other subject areas.	4.32	0.76	Agree	The extent of the effect is high
4. I would be interested in working in an experimental JHS & SHS STEM classroom.	3.62	1.03	Agree	The extent of the effect is high
5. Children are not curious about the scientific matter.	2.56	1.14	Uncertain	The extent of the effect is neutral
Weighted Mean	**3.90**	**0.85**	**Agree**	**The extent of the effect is high**
Science Equipment				

1. I will enjoy helping students construct science equipment	4.32	0.65	Agree	The extent of the effect is high
2. I will enjoy the lab period in the science courses that I teach.	4.18	0.84	Agree	The extent of the effect is high
3. I enjoy manipulating science equipment.	4.14	0.91	Agree	The extent of the effect is high
4. I am not afraid to demonstrate science phenomena in the classroom.	3.99	0.91	Agree	The extent of the effect is high
5. In the classroom, I fear science experiments won't turn out as expected.	3.25	1.21	Uncertain	The extent of the effect is neutral
Weighted Mean	**3.98**	**0.90**	**Agree**	**The extent of the effect is high**
Time required to teach Science				
1. I am willing to spend time setting up equipment for a lab.	4.34	0.71	Agree	The extent of the effect is high
2. Teaching Science takes too much effort.	3.93	0.94	Agree	The extent of the effect is high
3. Teaching Science takes too much time.	3.48	1.14	Uncertain	The extent of the effect is neutral
Weighted Mean	**3.92**	**0.93**	**Agree**	**The extent of the effect is high**

Legend: 4.50 – 5.00 (Strongly Agree), 3.50 – 4.49 (Agree), 2.50 – 3.49 (Uncertain), 1.50 – 2.49 (Disagree), 1.00 – 1.49 (Strongly Disagree)

When it comes to teaching science attitudes, the comfort and discomfort of teaching science were carried out to have a mean of 2.88, which is a neutral efficacy rate. The highest comfort/discomfort of teaching was found out that STEM teacher participants preferred only to teach Science if only given a choice. Added with the need for Science, the STEM teacher participants show a mean of 3.90, a high efficacy rate. The highest attitude in need for Science was carried that the teaching of the scientific process is essential in the classroom. Further, the attitude of teacher participants when it comes to science equipment resulted in a mean of 3.98, which is a high efficacy rate. The highest attitude for science equipment was found out that the STEM teacher participants enjoy helping students construct science equipment. Moreover, the attitude of teacher participants when it comes to the time required in teaching Science leads to a mean of 3.92, which is a high efficacy rate. The highest attitude in time was determined that STEM teachers are very willing to spend time setting equipment for a laboratory. STEM teachers are developing their teaching profession during their teaching experience. They seek advice to their principal and co-teachers by having teacher mentoring that benefits their career-related and psychosocial but still remains uncertain due to lack of intensive engagement with other professional co-workers. STEM teachers believe that good and effective teaching in science influence student performance as well as interest to science. To develop their effective science teaching abilities is a great way to motivate students as well.

Relationship of STEM Teachers' Demographic Profile & Self-efficacy Beliefs

Comparing STEM teachers' attitudes, laboratory self-efficacy beliefs, and science teaching efficacy beliefs when grouped according to their respective demographic profiles shows a significant difference. The significant value for laboratory self-efficacy beliefs 0.006 for gender, science teaching efficacy beliefs 0.008 for gender, 0.007 years of teaching, and 0.032 for bachelors' degree preparation, and science teaching attitudes 0.003 for gender is lower than the tested level of significance 0.05. Laboratory self-efficacy beliefs and science teaching attitudes of STEM teacher participants vary when grouped according to gender. Science teaching efficacy beliefs of STEM teacher participants vary according to gender, years of teaching, and Bachelor's degree preparation (see Table 4).

Table 4. One–way Analysis of Variance of the Participants' Self-efficacy Beliefs and Attitudes towards Conducting Laboratory Activities according to their Profile

Domain	Demographic Profile		Sum of Squares	Df	Mean Square	F	Sig.
Laboratory Self-efficacy	Gender	Between Groups	10.331	30	.344	2.348	.006*
		Within Groups	5.867	40	.147		
		Total	16.197	70			
Science Teaching Efficacy	Years in teaching	Between Groups	2572.508	34	75.662	2.320	.007*
		Within Groups	1174.083	36	32.613		
		Total	3746.592	70			
	Gender	Between Groups	11.064	34	.325	2.282	.008*
		Within Groups	5.133	36	.143		
		Total	16.197	70			
	Bachelor's degree preparation	Between Groups	7.928	34	.233	1.879	.032*
		Within Groups	4.467	36	.124		
		Total	25.746	70			
Science Teaching Attitudes	Gender	Between Groups	10.814	31	.349	2.527	.003*
		Within Groups	5.383	39	.138		
		Total	16.197	70			

The relationship between STEM teachers' laboratory self-efficacy beliefs to its science teaching attitudes and science teaching efficacy beliefs has a low positive correlation where the significant values of science teaching attitudes and science teaching efficacy beliefs are 0.001 and 0.000, respectively are more significant than the tested level of significance 0.05 (see Table 5).

Table 5. Correlation Analysis of the Participants' Science Teaching Attitudes and Science Teaching Efficacy towards Laboratory Self-efficacy Beliefs

Variables	N	Mean	SD	R	Sig. (2-tailed)	Relationship	Significance
Laboratory Self – Efficacy beliefs	71	3.84	.51				
vs.							
Science Teaching Efficacy	71	3.38	.49	0.393	0.001*	Low Positive Correlation	Significant
Science Teaching Attitudes	71	3.50	.45	0.473	0.000*	Low Positive Correlation	Significant

Level of significance: α = .05*

Themes Responses of STEM Teachers

As to the qualitative data gathered by the researchers, on both theme 1 and theme 2, it was found out that positive and negative experiences of teachers do affect their self-efficacy in conducting laboratory and in teaching science such as lack of facilities and materials, the unfamiliarity of science teachers towards handling of equipment, students' academic performance and interest in Science.

Themes	Positive Responses	Negative Responses
1. Experiences that affect efficacy as a teacher in conducting laboratory activities	*"It is more active in participating a learner to learner and teacher to learners' way of activity."*	*“There are not enough amenities in the science laboratory-like presence of Bunsen burner, water supply, and other facilities that facilitates the activity to be done correctly and properly.”*
	"Having proper training in handling laboratory equipment is a positive experience that affects my efficacy as a lab teacher."	*"There are insufficient equipment and complete set up in our laboratory such as accessible water source in case of emergency in handling chemicals."*
		"I am not equipped and not familiarized with all the laboratory materials, tools, equipment, and chemicals, etc."
2. Experiences that affect efficacy as a teacher in teaching science	*"My positive experiences that affect my efficacy as a teacher in teaching science are the students have the interest about science, they get high grades and they*	*"Availability of equipment and resources helps more interest of the students in learning science the same way with the teacher."*

	can apply what they learn in science."	
		"Students have no interest in learning."
3. Effects of attitudes in teaching science and handling laboratory activities	*"Willingness to learn and perform the activities."*	*"Lack of interest due to lack of resources and when students show no interest in science"*
4. Effects of attitudes, laboratory self-efficacy beliefs, and science teaching efficacy beliefs on the students' performance	*"It affects my students in a way that they can self-reflect from what attitude I am showing to them. If I am lousy, it can be the same. If I am lazy, they aren't interested as well. But if I am motivated and have enjoyed the activity, they can reflect and get inspired by it. So, my attitude matters when it comes to teaching science and in the laboratory."*	*"It affects a lot because when the teacher is not that efficient, students may not be interested anymore in the learning area."*

While in theme 3 and 4, it was found out, that the positive and negative attitudes of the teachers affect their way of teaching Science and handling laboratory activities such as students' disposition, enjoyment, teacher's preparedness in conducting laboratory for the positive than in terms of the negative teachers feared that they might not do it correctly, the lack of resources and the students showing off no interests' in Science. It was also figured out that the teachers' attitudes, laboratory self-efficacy beliefs, and science teaching efficacy beliefs do affect the student's performance in such a way that what the teachers' mood will be reflected on the students, the consideration of the teachers on the differences of the learners, and the student's contribution to their academic performance.

Discussion

STEM teachers in the division of Agusan del Norte can handle laboratory activities despite having limited available facilities and resources because most of them already adjusted to this kind of learning environment. After all, most of them have an average of 9 years of teaching experience. The result of the study is corroborated with the study of Cantrell, P. et al. (2003) suggest that going through the process of actual teaching, like preparing lessons. Teaching science lessons possesses positive effects on the personal self-efficacy beliefs of the teachers. Teachers' self-efficacy has been frequently proved to be a crucial element for the effectiveness of the teaching activity in studies by Klassen et al. (2009) and Klassen and Tze (2014). This contradicts the findings of Sousa et al. (2012), who found that conservation reduced self-efficacy.

STEM teachers are fully equipped to fully engage students in conducting laboratory activities. Somehow, these teachers have not enough teaching experience whereas trainings to develop their teaching pedagogies in teaching science. According to Bayram 2015, teachers still feel insecure when performing laboratory activities and applying concepts in Science. This even though they know that they have the necessary teaching skills to teach Science. This study correlates with the study of Nowikowski (2016). In his study, the results showed that most of the pre-service teachers' participants', even though having prior experiences with STEM subjects and activities, did not see themselves capable of effectively conveying concepts or conducting and leading STEM activities.

PSTE have an average and STEO influenced a high self-efficacy rate which implies that STEM teachers are being innovative and resourceful in finding ways to deliver quality content to students despite the limited resources available in the learning environment. This study's findings are supported by Gibson & Dembo's (1984) research, which found that teachers with a high outcome expectancy criticize students less than teachers with a low outcome expectancy. They deal with students until they respond suitably before dealing with other students and communicating high school expectations. However, in the study of Choy & Loo (2013), they mentioned that the teacher preparation program is significant. Since teacher efficacy is essential in promoting students' learning achievement and self-efficacy development in the classroom, Kapri (2017) found that students' underachievement and low motivation in Science are also due to secondary school students' school environment case in this study. Thus, the school environment affects the academic achievement of students. Therefore, it means a better school environment results in better achievement in Science. Hence, the ineffective of science teachers is not just the sole reason for the underachievement and low motivation of the learners.

STEM teachers' positive attitudes towards teaching Science play a significant role in shaping students' attitudes towards learning Science. STEM teachers are slowly exploring new and innovative teaching strategies in science where they can divert the attention of students to be interested in science. They find ways to initiate science experiments in fun and simple way delivering the quality content to the learners. Although, there are topics in science that takes too much time and there are topics that are simple. According to Aka (2016), teachers' attitudes toward the laboratory and their laboratory self-efficacy beliefs are linked. The study of teachers reported having a higher sense of self-confidence when teaching science units from written resources. They believed such contextual factors were necessary for teaching (van Aalderen-Smeets et al., 2012). Teaching confidence toward Science occurs when teachers feel well supported, mainly when they are in the early stages of developing an understanding of science ideas (Sharp, Hopkin, & Lewthwaite, 2011). The study of van Aalderen-Smeets et al. (2012) stated that when teachers believe that Science is indeed important and relevant, they are more likely to have a positive attitude towards it. Moreover, this belief had a positive impact on their professional attitude and their way of teaching Science.

The results of the study show inconsistency with the study of Jones and Levin (1994) that Science is a male domain. It was revealed that males show a significantly more positive attitude and confidence in teaching Science than female teachers. As supported by Denessen et al. (2015), this study reveals that female teachers showed fewer positive attitudes towards teaching Science and technology than male teachers. However, in terms of years of teaching, the results show inconsistency with Hassan & Tairab (2012). The study that teaching experience or the years in teaching does not affect the teachers' efficacy belief. The previous study shows disagreement with the study of Palmer (2006) that highly experienced teachers had firmer self-efficacy beliefs compared to less experienced teachers. It means that higher self-efficacy is affected by how long the teachers are in service.

The results show the consistency of the study of Redmon (2007), which suggests that teacher preparation programs such as the one studied influence the growth of teacher self-efficacy. Moreover, Hassan & Tairab (2012) study shows that teachers have more difficulty teaching Physics than teaching Biology or Chemistry to secondary school students. In such a situation, physics teachers' self-efficacy is different from the biology or chemistry teachers' self-efficacy. Thus, the bachelor's degree preparation of the teachers can affect their self-efficacy belief. However, the findings are inconsistent with a research by Sokoye (2009) mentioned in Adeyemi (2013), which claimed that a school's location has a significant impact on a student's academic achievement. Because self-efficacy has the potential to influence both teacher and student performance. Adeyemi (2013) found a significant main effect of school location on students' achievement and attitude. Brown & Susanson (2006), cited in Adeyemi (2013), found in their study that rural schools are typically less active than urban schools. Furthermore, the results show inconsistency with Mojavezi (2012) study, who conducted the same study having all senior high school teachers. It was found that there is a significant relationship between the teachers' self-efficacy beliefs and the students' academic achievement. The findings of the previous study support Bandura's (1994) observation that teachers with a high feeling of self-efficacy regarding their competence can excite their pupils and boost their development.

The study results are corroborated with the study of Aka (2016), which was started in the last finding of the research that there is a positive and significant correlation between the teachers' attitudes toward the laboratory course and their laboratory self-efficacy beliefs. The study signifies that attitudes towards the laboratory course are a significant predictor for self-efficacy beliefs in laboratory use. As a result, it can be asserted that when teachers care for the laboratory course more, they trust in themselves about using the laboratory more, as well. The self-efficacy of science teachers is related to their attitudes. Therefore, it is essential to improve the self-efficacy and attitudes of teachers in teaching science subjects. Furthermore, Shaukat, Vishnumolakala, and Hamdan Alghamdi (2020) found that there is a substantial difference between laboratory self-efficacy views and scientific teaching efficacy.

When science instructors' attitudes and opinions regarding laboratory studies are studied, it is found that they have a typically favorable attitude about them. Common occurrence since laboratory studies educates by doing, making the information gained permanent. It fosters students' creativity and problem-solving abilities and a favorable attitude toward the lab among teachers. The importance of laboratory methods in these domains, which are the foundations of Science, cannot be overstated. Furthermore, it is assumed that instructors who have previously attended in-service training courses are familiar with laboratory methodologies and procedures, which they implement in their classrooms.

Conclusion

The STEM teachers of Agusan del Norte can handle laboratory activities despite the limited facilities and resources available. They generally feel more productive when they plan their lessons and work in a suitable working environment in the laboratory. Also, STEM Teacher participants are confident that they can find different teaching strategies to teach science effectively to overcome the inadequacy of science background within the students through exemplary teaching. Correspondingly, the teacher participants develop positive attitudes towards science teaching during their teaching experience. Furthermore, it positively affects students' performance and attitudes towards science. However, not all STEM teachers are fully equipped to fully engage students in conducting laboratory activities. Somehow, these teachers have not enough teaching experience whereas trainings are needed to develop their teaching pedagogies in teaching science.

Likewise, STEM teachers are developing their teaching profession during their teaching experience. They seek advice to their principal and co-teachers by having teacher mentoring that benefits their career-related and psychosocial but still remains uncertain due to lack of intensive engagement with other professional co-workers. Also, STEM teachers applied teaching strategies to assert student interest in science. This comfortable engagement in a classroom towards teacher and students is also a hint that students are being interested in science.

Similarly, STEM teachers are slowly exploring new and innovative teaching strategies in science where they can divert the attention of students to be interested in science. They find ways to initiate science experiments in fun and simple way delivering the quality content to the learners. Although, there are topics in science that takes too much time and there are topics that are simple.

The science teaching attitudes, laboratory self-efficacy beliefs, and science teaching efficacy beliefs towards conducting laboratory activities vary according to gender, years of teaching, school location, and Bachelor's degree preparation. Since most of the respondents are female and most of the STEM teachers have an average of 9 years of teaching experience. There is a significant relationship between the STEM teachers' laboratory self-efficacy beliefs between their science teaching attitudes and science teaching efficacy beliefs since teachers can handle laboratory activities corresponding to their long experience in teaching science. It was also figured out that the teachers' attitudes, laboratory self-efficacy beliefs, and science teaching efficacy beliefs affect the student's performance since teachers can deliver the quality of instruction intended for learning. STEM teachers of Agusan del Norte will improve their science teaching attitudes, laboratory self-efficacy, and science teaching efficacy beliefs when exposed to activities such as Learning Action Cell and Professional Learning Communities training and seminars highlighting to improve their abilities towards teaching and handling laboratory activities.

Recommendations

For these reasons, it is advised that while developing professional development programs for teachers, special emphasis be paid to the specific science subject in which teachers are least confident to teach. Experience in the actual teaching of various science courses must be incorporated into the design of teacher-education curriculum in order to address their self-efficacy views as early as possible. Review training on Laboratory operation, usage, and management must consider exposing STEM teachers to a more engaging laboratory working environment to enhance their capabilities in handling laboratory activities and science teaching. Training on innovative science teaching approaches and pedagogies, assessments, and instructional materials development is also considered to address their science teaching efficacy. The division of Agusan del Norte must design and implement professional learning communities for STEM educators to monitor, assess, and evaluate the sustainability of STEM education in the division by providing action research concerning the science teaching attitudes and self-efficacy beliefs of STEM teachers.

For future researches, subject-specific self-efficacy must be explored in future studies to specify and assess the teacher participants' least confidence in science subjects to teach and if it has a relationship with self-efficacies and attitudes towards teaching science. Also, factors of Science Teaching Attitudes Scale (STAS), Laboratory Self-efficacy Beliefs (LSEBS), and Science Teaching Efficacy Beliefs Scale (STEBI-A) must be also tested to the demographic profile of the teacher participants to more specifically determine the significant difference when grouped accordingly. To explore more on the qualitative results of the science teaching attitudes, laboratory self-efficacy beliefs, and science teaching efficacy beliefs of the teacher participants by incorporating class observations and focus group discussions among teachers to have a more specific empirical result directly. To explore other factors examining the science teaching attitudes, laboratory self-efficacy beliefs, and science teaching efficacy beliefs of teacher participants such as TPACK, Science Process Skills, and Science Literacy, teachers' professional development for sustainable STEM education would be a possible factor in teachers' professional development. To engage into a large sample population directly at a regional level to gather more specific and general results.

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