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# Research Culture and Productivity of STEM Teachers and Students: Basis for Research Intervention Program

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**Abstract.** The problem of research culture and productivity extends beyond the Philippine education system, representing a global challenge affecting many countries and institutions. This descriptive-correlational study examined the research culture and productivity among Science, Technology, Engineering, and Mathematics (STEM) teachers and students at Esperanza National High School. The research employed complete enumeration, involving 25 teachers and 105 students as respondents. Comprehensive data collection and analysis, like frequency, percentage, mean, standard deviation, and Pearson r correlation coefficient techniques, provided robust insights into research dynamics. The teachers' research culture demonstrated a high overall mean of 4.16, indicating substantial research knowledge, skills, and positive attitudes toward research integration in their professional practice. This high score suggests that teachers have effectively acquired research competencies and view research as an integral component of their teaching methodology, demonstrating a proactive approach to academic scholarship. Students' research culture showed a high overall mean of 3.94, highlighting the school's effectiveness in creating research learning opportunities. The findings particularly emphasized the institution's ability to establish venues for student researchers to learn, relearn, share, and continuously improve their research capabilities. Correlation analysis revealed significant relationships between research culture and productivity. For teachers, a high correlation coefficient of $r = 0.70$ ($p = 0.004$) indicated that a robust research culture directly enhances research performance. Students exhibited a significant correlation of $r = 0.47$ ($p = 0.000$), demonstrating that research exposure positively impacts their academic research capabilities and potential for scholarly engagement. The study recommends implementing research intervention programs based on the ADDIE model, providing targeted methodological workshops, encouraging research collaborations, creating supportive research forums, and developing comprehensive research development strategies to enhance research culture and productivity in educational settings.

**Keywords:** ADDIE model; Descriptive-correlational; Research intervention; Research culture; Research productivity; Intervention program; STEM teachers and students.

## 1.0 Introduction

One global problem regarding research culture and productivity in Basic Education, specifically in senior high schools, is the need for more opportunities for students to engage in research activities. According to Roxas (2020), many high school and senior high school students need more access to research resources and opportunities to improve their research skills and productivity. Moreover, according to Can (2019), teachers refrain from refreshing their knowledge and professional competencies through activities such as research, while Larionow and Gabrys (2024) state that students also need more passion and inventiveness.

Several important internal and external factors, including integration into the Association of Southeast Asian Nations (ASEAN), global competitiveness, globalization, the incorporation of information and communications technology (ICT) in the classroom, and other significant developments, are causing the Philippine educational system to undergo rapid change. When putting the Philippines' Department of Education's new K–12 program into action across all Basic Education institutions, it is important to think about things like evidence-based policy, better student achievement, better curriculum, instruction, and assessment, teacher quality, and teacher professionalism (Castillo, 2018).

In order to institutionalize action research within the Basic Education system, the Department of Education (DepEd) has implemented and launched numerous activities and initiatives. The department has implemented DepEd Order No. 4 Series of 2016, amended DepEd Order No. 43 Series of 2015 and DepEd Order No. 39 Series of 2016, and adopted the Basic Education Research Agenda, among other significant changes and initiatives, concerning action research. In addition, introducing senior high school in the Philippines expanded the range of subjects available to students. Significant changes have been made to the curriculum for grades 11 and 12, including introducing two new applied courses based on research: Practical Research 1 - Qualitative and Practical Research 2 - Quantitative, as well as Inquiries, Investigations, and Immersion, in which the students have the freedom to select whichever of the two methods, or a combination of both, they would like to apply to produce a credible research paper that will be of use to the community (Deysolong, 2023).

In light of these, basic education institutions should consider many significant aspects to meet the requirements of an evolving world. Moreover, one of these elements is including action research as a significant function of a teacher (Saro & Taray, 2024) and doing research for students in grades 11 and 12 as part of the DepEd's K-12 curriculum program (Campos, 2023). The research output of teachers still needs to improve despite the institutionalization of research in basic education as well as the numerous efforts and programs of the DepEd. According to the research carried out by Cariaga (2023), educators working in basic education settings, such as senior high schools, are still adjusting to incorporating research into their educational philosophies and practices. This is the case even though research has been incorporated into basic education settings for some time. In addition, numerous studies have been conducted that have focused on the current state of research productivity of teachers and students (Almerino et al., 2020), but only a small number of studies have been conducted to study the underlying cause of this poor productivity (Onyefulu, 2024).

Since 2004, Esperanza National High School has demonstrated an impressive record of continually turning out high-achieving students and winning multiple accolades in regional and national contests. Among these achievements are the National Science and Technology Fair, the Regional Science Fair, and the Research Conferences. These successes show how strongly teachers and students value research. Rico's 2021 study provides more proof, highlighting how teachers actively engage in action research to enhance student development and performance. Nevertheless, no existing studies have examined the research culture and productivity of STEM teachers and students in the institution since the implementation of the K-12 curriculum. This further justifies the need for the study. This urges the researcher to conduct this study to discover how Science, Technology, Engineering, and Mathematics teachers and students embrace and practice research culture in the field. Furthermore, the study aims to establish a link between the teachers' and students' research culture and their research productivity.

Finally, this study's findings served as a foundation for interventions to close gaps, enabling research culture to become fully embedded in the system for research productivity to become an integral part of school functions and, thus, a more reform-responsive educational environment to emerge. The Proposed Research Intervention Program is a training package that offers to close the gaps so that research culture becomes fully embedded in the DepEd and research productivity becomes an integral part of school function. The Analysis, Design, Development, Implementation, and Evaluation (ADDIE) model guides the intervention program. The ADDIE model provides a robust framework for developing systematic and effective intervention programs in educational research. This instructional design model offers a structured approach to creating targeted interventions, particularly enhancing research culture and productivity.

## 2.0 Methodology

### 2.1 Research Design

The study utilized the descriptive-correlational research design to investigate the relationship between research culture (independent variable) and research productivity (dependent variable) of STEM teachers and students. The independent variable, research culture, comprises three specific indicators: research attitude and adaptability, research knowledge and skills, and support for the research forum. The dependent variable, research productivity, is measured through two indicators: research outputs and research involvement. In this correlational research approach, the study examined how the indicators of research culture potentially correlate with research productivity among STEM teachers and students. By employing a descriptive-correlational method, the research will objectively analyze the natural relationships between these variables without attempting to manipulate or establish direct causation. Miksza and Elpus (2018) define descriptive research as observing behavior to describe attributes objectively and systematically. Steinberg and Lam (2011) describe correlational research as a method that predicts how variables are naturally related in the real world. This methodological approach provides insights into the potential connections between research culture indicators and research productivity indicators in STEM educational environments.

### 2.2 Research Locale

The study was conducted in Esperanza National High School (ENHS), Mabolo Street, Brgy. Poblacion, Esperanza, Sultan Kudarat.

### 2.3 Research Participants

The study's respondents were 25 STEM teachers and 105 Grade 12 students of STEM of Esperanza National High School for the school year 2023 – 2024. This study employed complete enumeration as a sampling technique for all the grade 12 STEM students and teachers. Complete enumeration, also known as a census, is a sampling technique involving every population in the study. This technique is often used when the population size is small and the cost and time required for sampling are minimal (Ajithakumari, 2024). The criteria for inclusion in the study were that teachers needed to be STEM instructors at Esperanza National High School. At the same time, students had to be enrolled in Grade 12 STEM at the same institution during the specified academic year. They should also be willing to participate in the study.

### 2.4 Research Instrument

This study employed two (2) sets of research instruments. The first set is an adapted research survey questionnaire from Tagaro (2015). It determined the level of STEM teachers' and students' research culture regarding research attitude and adaptability, research knowledge and skills, and support for the research forum. The second set is a researcher-made survey questionnaire. It determined the level of STEM teachers' and students' research productivity regarding research outputs and involvement. Each research instrument was validated and tested for reliability to ensure that it produced accurate answers in response to the study question. The researcher gave his advisor a first draft of his two sets of research instruments to review for formatting and indicator errors related to the study's primary variables. His advisor and the other examining committee members were approached periodically to solicit advice and feedback on the instrument's structure, content, and presentation. Experts in the field were asked to review both sets of questionnaires and indicate whether or not they agreed with the study's aims by marking them with a checkmark (/), a single ex (X), or a double ex (XX), respectively. The statements from the survey questionnaire that the content experts validated were incorporated into the final version of the instrument. When an item's agreement ratio was not high enough, it was either fixed or discarded. After making the necessary changes to each item, the research and validation instruments developed by Good and Scates (1954) and revised by Abdullah and Cerado (2015) were sent to the panel of content validators for review. After tallying and averaging the responses from five (5) content validators, the Survey Questionnaire was given an overall mean score of 4.90. Please refer to the section below for a detailed explanation of how to make sense of the validation result.

The instrument's reliability for internal consistency was obtained using Cronbach's Alpha. In terms of the research culture of teachers, it has a Cronbach Alpha of 0.93. The following reliability coefficients comprised research attitudes and adaptability of teachers (.89), research knowledge and skills of teachers (.96), and support for

research forums for teachers (.93). While in research productivity of teachers, the Cronbach Alpha resulted in 0.91. The following reliability coefficients include research outputs (.89) and research involvement (.92). Regarding the research culture of students. It has a Cronbach Alpha of 0.91. The following reliability coefficients consisted of research attitudes and adaptability of students (.75), research knowledge and skills of students (.91), and support for the research forum of students (.78). Hence, in students' research productivity, it has a Cronbach Alpha of 0.84. The following reliability coefficients included the research outputs (.84) and research involvement (.83). The reliability coefficient values are at least (.60) and considered acceptably reliable. It was supported by Kilic (2016), who states that a Cronbach's Alpha value of .60 and above indicates that the test items have internal consistency. The study used Spearman's rank correlation. Spearman's rank correlation in this study is highly appropriate given the 5-point Likert scale used to measure research culture and productivity. Spearman's correlation is ideal for analyzing ordinal data, such as Likert items, as it does not assume equal intervals between scale points or require normally distributed data. This method effectively captures monotonic relationships between variables, which is suitable for educational research where relationships may not be strictly linear. Additionally, Spearman's correlation is robust to outliers, making it reliable for Likert scale data that may not meet parametric test assumptions.

### 2.5 Data Gathering Procedure

The researchers secured all necessary Communication Letters from the Graduate School of Sultan Kudarat State University. For the validity and reliability tests of the two (2) sets of research instruments, they asked permission from the research experts to validate the research instrument. After ensuring the research instrument's validity and reliability, they requested the approval of the Schools Division Superintendent of the Division of Sultan Kudarat to administer the survey questionnaire to the Grade 12 STEM teachers and students of Esperanza National High School. An approval letter from the Office of the Schools Division Superintendent was attached to seek permission from the Principal of Esperanza National High School. After all survey questionnaires were gathered, the results were consolidated for data analysis.

### 2.6 Ethical Considerations

This research study followed ethical guidelines. The respondents' participation was voluntary, and they could leave the study anytime if they felt uncomfortable. There was no physical, social, psychological, or other harm to the respondents' participation. The dignity and well-being of teachers and students who responded were always protected. The research data remained confidential throughout the study, and the respondents' rights were protected to maintain scientific or academic integrity. In addition, this research study is plagiarism-free and without research misconduct.

## 3.0 Results and Discussion

### 3.1 Research Culture of STEM Teachers

The level of the research culture of STEM teachers was measured through its three indicators: research attitude and adaptability, research knowledge and skills, and support for the research forum (see Table 1). It yielded an overall mean of 4.16, which is described as high. This finding implied a positive research culture for STEM teachers with positive attitudes, strong knowledge and skills, high adaptability, and strong institutional support. This indicates that research is well integrated and valued within the educational environment and the context of their professional practice. Moreover, the overall standard deviation is 0.74, less than 1, indicative of a minimal range of dispersion.

*Research Attitude and Adaptability of STEM Teachers*

As shown, the section mean of 4.14 is described as High. This high level of STEM teachers research attitude, and adaptability was confirmed by four indicators, which were described as very high, and six with a high description. It indicates that STEM teachers had positive feelings and opinions about research. It also signifies that they accepted and embraced research as part of their daily routine in the teaching profession. In particular, the highest mean of 4.80 with a description of Very High shows that teachers believed that through research, they discovered new teaching strategies and principles that can suit different learning styles of students. In addition, they considered research as a stepping stone toward a successful career. Differently, teachers accepted the task of conducting action research as manifested by 3.72, which was described as high. However, some of them were hesitant to accept research assignments due to their hectic schedule in teaching. It was validated by the lowest

mean they acquired in this indicator. In support of this result, Wajid and Jami (2020) emphasized that positive research attitudes are needed to become effective classroom facilitators since most of the actions taken are anchored to the findings and recommendations of the action research conducted by the teachers. In addition, Milner-Bolotin (2018) underscored that research-informed teacher education and professional development are critical components for effectively executing STEM education changes.

**Table 1.** *Consolidated findings of the level of research culture of STEM teachers*

| Indicators/Items | Mean | SD | Verbal Description |
|---|---|---|---|
| **A. Research Attitude and Adaptability** | | | |
| 1. I believe that research is an important step toward discovering new pedagogies and teaching practices. | 4.80 | 0.50 | Very High |
| 2. I clearly understand the benefits of conducting research. | 4.52 | 0.77 | Very High |
| 3. I feel fulfilled when I finish conducting a research paper. | 4.36 | 0.59 | Very High |
| 4. I recognize that conducting research is one of the jobs of a teacher. | 4.32 | 0.85 | Very High |
| 5. I always welcome the idea of gathering data. | 4.08 | 0.64 | High |
| 6. I was pleased when I heard the word research. | 4.04 | 0.73 | High |
| 7. I am happy to think of the work of a researcher. | 3.96 | 0.68 | High |
| 8. I like to read research papers. | 3.88 | 0.73 | High |
| 9. I enjoy conceptualizing research problems. | 3.76 | 0.72 | High |
| 10. I always welcome assignments to conduct research. | 3.72 | 0.79 | High |
| **Section Mean** | **4.14** | **0.70** | **High** |
| **B. Research Knowledge and Skills** | | | |
| 1. I can present data in tables and graphical forms. | 4.40 | 0.76 | Very High |
| 2. I can collect a review of related literature. | 4.24 | 0.66 | Very High |
| 3. I can make a conclusion and recommendation based on the study results. | 4.24 | 0.66 | Very High |
| 4. I can identify a research problem. | 4.20 | 0.58 | Very High |
| 5. I can identify an appropriate sampling method. | 4.20 | 0.76 | Very High |
| 6. I can make references based on the findings of the study. | 4.16 | 0.75 | High |
| 7. I can analyze and interpret data. | 4.12 | 0.67 | High |
| 8. I can prepare a conceptual framework for the study. | 3.96 | 0.73 | High |
| 9. I can construct a data collection instrument. | 3.96 | 0.73 | High |
| 10. I can formulate a working research title. | 3.92 | 0.64 | High |
| **Section Mean** | **4.14** | **0.69** | **High** |
| **C. Support for Research Forum** | | | |
| 1. The school has a pool of research advisers, statisticians, and grammarians. | 4.48 | 0.77 | Very High |
| 2. There is visible administrative support the research programs like the school research congress. | 4.36 | 0.81 | Very High |
| 3. All teachers in school are encouraged to complete at least 1 research paper yearly. | 4.36 | 0.86 | Very High |
| 4. Research works of teachers are given due recognition. | 4.36 | 0.70 | Very High |
| 5. The school conducts seminars and workshops on research. | 4.32 | 0.85 | Very High |
| 6. Teachers' research outputs are presented in a forum like a school/division/regional research congress. | 4.12 | 0.97 | High |
| 7. Issues and concerns concerning the research productivity of teachers are addressed regularly. | 4.12 | 0.88 | High |
| 8. There is a mentoring program conducted by teachers who are research experts to assist and develop the competence of beginning teachers. | 4.04 | 0.73 | High |
| 9. Research activities are funded. | 3.96 | 0.89 | High |
| 10. The school provides financial support for teachers who want to participate in scholarly conferences/seminar workshops. | 3.84 | 0.99 | High |
| **Section Mean** | **4.19** | **0.84** | **High** |
| **Overall Mean** | **4.16** | **0.74** | **High** |

**Note:** *4.21 - 5.00 (Very High), 3.41 - 4.20 (High), 2.61 - 3.40 (Moderately High), 1.81 - 2.60 (Low), 1.00 - 1.80 (Very Low)*

### *Research Knowledge and Skills of STEM Teachers*

This indicator reveals a section mean of 4.14, described as High. This high extent of teachers' research knowledge and skills was established by five indicators described as very high and five indicators with a description of high. It connotes that STEM teachers have acquired enough information, facts, and skills in research. It also implies that they can examine, gather, understand, and assess information about their study. Specifically, the highest mean of 4.40 with a description of Very High illustrates that teachers can present their research outputs using tables and in graphical forms. On the other hand, teachers can construct a working research title, as demonstrated by 3.92, which is described as high. Some of them struggled to craft a good research title, for they needed to be more confident in their acquired research skills and clearly understand the research as confirmed by the lowest mean score for this indicator. The findings corroborate Caingcoy's (2020) assertion that educators possessing adequate

research knowledge and skills can enhance their confidence and credibility, thereby leading to improved teaching performance that is both effective and efficient. Furthermore, Bugwak (2021) indicated that educators frequently encounter difficulties when confronted with unfamiliar topics beyond their expertise, such as research procedures. Evardo (2024) corroborates this challenge, indicating that out-of-field educators may encounter self-doubt and diminished self-esteem when assigned to unfamiliar disciplines such as research. This study revealed a high level of overall research competency; however, Harrell-Williams et al. (2015) observed that teachers frequently exhibited diminished confidence in more intricate statistical concepts, such as hypothesis testing and group comparison.

*Support for Research Forum of STEM Teachers*

As Shown, the section mean of 4.19 shows that support for research forums for teachers was high. It is confirmed by five indicators described as very high and five indicators with a description of high. It demonstrates that the institution has established a venue for teacher researchers to get constructive comments from experts in areas/disciplines for improvement of their research outputs and the opportunity to share the results of their study. It also denotes that the school supports recognize the teachers' research work. Notably, the highest mean of 4.48 with a Very High description proves that the school has a pool of research advisers, statisticians, and grammarians. On the contrary, the institution provides financial support for the teachers who want to participate in scholarly conferences/seminar workshops, as revealed by 3.84, which is described as high. However, sometimes, the school needs more funds to provide financial assistance to the teachers as confirmed by the lowest mean score for this indicator. Calma (2010) stressed that the administration's research experience, training, and financial and technical support influence the research output and dissemination. This is consistent with the study by Taylor (2016), which found that teacher research can become the stepping-stone for school improvement formulated, led, and disseminated by teachers serving as teacher leaders. Interestingly, while this study found high overall support for research forums, Harrell-Williams et al. (2015) discovered that teachers often had lower confidence in more complex statistical concepts. This suggests that even with institutional support, there may be specific areas where teachers require additional assistance in their research endeavors.

**3.2 Research Culture of STEM Students**

The research culture of STEM students was measured in terms of research attitude and adaptability, research knowledge and skills, and support for the research forum (see Table 2). It yielded an overall mean of 3.94, which is described as high. This suggests that a positive research culture for STEM students with positive attitudes, high knowledge, and skills place research as a high integral part of academic standard. More so, the overall standard deviation is 0.74, less than 1, indicative of a minimal range of dispersion in the respondent's response.

*Research Attitude and Adaptability of STEM Students*

As shown, the section mean of 3.97 is described as high. This high level of STEM students research attitude, and adaptability was established by four indicators described as very high, 5 with a description of high, and 1 with a description of low. It demonstrates that STEM students have favorable attitudes and thoughts regarding research. It also indicates that they were open to and enthusiastic about participating in research as part of their academic curriculum in senior high school. In particular, the highest mean of 4.69 with a description of Very High indicates that students believe research is a crucial stage in discovering new learning opportunities and practices. On the other hand, students do not look forward to formulating a research problem. It is demonstrated by a mean of 3.29, which is described as low and is the lowest mean score they have. Roxas (2020) supported this finding by stating that students with sufficient knowledge and research abilities might do research papers with confidence and save time preparing the parts of their papers, resulting in a more productive research journey in senior high school. Nevertheless, according to Aityan (2022), one of the most challenging components of conducting any research is identifying and formulating the problem that has to be investigated. So, rookie researchers like students require utmost caution in the early phases of the research process, which causes them to struggle when trying to conceptualize the problem in the research.

**Table 2.** *Consolidated findings of the level of research culture of STEM students*

| Indicators/Items | Mean | SD | Verbal Description |
|---|---|---|---|
| **A. Research Attitude and Adaptability** | | | |
| 1. I believe that research is an important step toward discovering new learning opportunities and practices. | 4.69 | 0.58 | Very High |
| 2. I recognize that conducting research is one of the requirements in the senior high school curriculum. | 4.58 | 0.58 | Very High |
| 3. I feel fulfilled when I finish conducting a research paper. | 4.57 | 0.60 | Very High |
| 4. I clearly understand the benefits of conducting research. | 4.44 | 0.69 | Very High |
| 5. I always welcome the idea of gathering data. | 3.90 | 0.75 | High |
| 6. I am happy to think of the work of a researcher. | 3.82 | 0.79 | High |
| 7. I like to read research papers. | 3.55 | 0.77 | High |
| 8. I was pleased when I heard the word research. | 3.49 | 0.81 | High |
| 9. I always welcome assignments to conduct research. | 3.48 | 0.81 | High |
| 10. I enjoy conceptualizing a research problem. | 3.29 | 0.77 | High |
| **Section Mean** | **3.97** | **0.71** | **High** |
| **B. Research Knowledge and Skills** | | | |
| 1. I can make references based on the findings of the study. | 3.91 | 0.74 | High |
| 2. I can collect a review of related literature. | 3.89 | 0.70 | High |
| 3. I can make a conclusion and recommendation based on the study results. | 3.75 | 0.81 | High |
| 4. I can identify a research problem. | 3.74 | 0.76 | High |
| 5. I can prepare a conceptual framework for the study. | 3.64 | 0.72 | High |
| 6. I can construct a data collection instrument. | 3.64 | 0.72 | High |
| 7. I can formulate a working research title. | 3.55 | 0.73 | High |
| 8. I can analyze and interpret data. | 3.49 | 0.68 | High |
| 9. I can present data in tables and graphical forms. | 3.46 | 0.75 | High |
| 10. I can identify an appropriate sampling method. | 3.39 | 0.64 | High |
| **Section Mean** | **3.64** | **0.73** | **High** |
| **C. Support for Research Forum** | | | |
| 1. The school has a pool of research advisers, statisticians, and grammarians. | 4.56 | 0.73 | Very High |
| 2. All graduating students are encouraged to complete at least 1 research paper before graduation. | 4.50 | 0.72 | Very High |
| 3. There are visible administrative supports of research programs like school research congress for students. | 4.48 | 0.79 | Very High |
| 4. Research works of teachers are given due recognition. | 4.41 | 0.69 | Very High |
| 5. The school conducts seminars and workshops on research. | 4.36 | 0.75 | Very High |
| 6. Teachers' research outputs are presented in a forum like a school/division/regional research congress. | 4.17 | 0.75 | High |
| 7. Issues and concerns concerning the research productivity of teachers are addressed regularly. | 4.02 | 0.83 | High |
| 8. There is a mentoring program conducted by teachers who are research experts to assist and develop the competence of beginning teachers. | 3.93 | 0.74 | High |
| 9. Research activities are funded. | 3.89 | 0.90 | High |
| 10. The school provides financial support for teachers who want to participate in scholarly conferences/seminar workshops. | 3.77 | 0.99 | High |
| **Section Mean** | **4.21** | **0.78** | **Very High** |
| **Overall Mean** | **3.94** | **0.74** | **High** |

### *Research Knowledge and Skills of STEM Students*

This indicator reveals a section mean of 3.64, described as high. This high extent of STEM students' research knowledge and skills was confirmed by one indicator described as moderately high and nine indicators with a description of high. It suggests that students in STEM fields have obtained sufficient knowledge, facts, and abilities in the research process. It indicates that they can investigate, collect, comprehend, and evaluate material about their research. Specifically, the highest mean of 3.91 with a description of high indicates that students can draw references based on the results of their research. Moreover, students can identify an appropriate sampling method in their study, as shown by 3.39, which is described as moderately high. Nonetheless, some needed help finding an appropriate sampling method for their research. It was proper because they achieved the lowest mean scores in this indicator. The study of Aporbo (2022) supported this finding when they stated that students with sufficient knowledge and abilities of research might do research papers with confidence and save time preparing the parts of their papers, resulting in a more productive research journey in senior high school.

*Support for Research Forum of STEM Students*

As shown, the section mean of 4.21 is described as Very High. This extent of STEM students' support for the research forum was supported by five indicators described as very high and five indicators with a description of high. It demonstrates that the school has established a venue for student researchers to learn, relearn, and unlearn things for the improvement of their research papers as well as the opportunity to share the results of their study. Furthermore, the highest mean of 4.56 with a description of Very High denotes that the school has a pool of teachers such as statisticians, grammarians, and research advisers. More so, student research activities are funded, as revealed by 3.77, described as high. However, due to budget constraints, the school is occasionally unable to support some of the research activities of the students. It was confirmed by their lowest mean score for this indicator. Lei et al. (2018) also showed that supporting student research can improve academic achievement and overall student success. Additionally, the availability of resources, such as funding and research advisers, can significantly impact the success of student research outputs (Adebayo, 2020).

### 3.3 Research Productivity of STEM Teachers

The level of research productivity of STEM teachers was measured in terms of research outputs and research involvement (see Table 3). The total measure, with an overall mean score of 2.95 and a standard deviation of 1.26, indicates that most teachers cannot publish their work in educational journals. Moreover, whereas teachers have a hard time sharing their studies at research forums or conferences, they perform slightly better in presenting titles, defending proposals, and attending research congresses.

**Table 3.** *Consolidated findings of the level of research productivity of STEM teachers*

| Indicators/Items | Mean | SD | Verbal Description |
|---|---|---|---|
| **A. Research Outputs** | | | |
| 1. I helped students to complete their research paper/s. | 4.08 | 0.91 | High |
| 2. I developed research proposal/s. | 3.20 | 1.22 | Moderately High |
| 3. I had a complete research paper/s. | 3.08 | 1.26 | Moderately High |
| 4. My research paper was accepted for Basic Education Research Fund (BERF). | 2.28 | 1.21 | Low |
| 5. I was able to publish a research paper/s in an educational journal. | 1.88 | 1.13 | Low |
| **Section Mean** | **2.90** | 1.14 | **Moderately High** |
| **B. Research Involvement** | | | |
| 1. I served as an adviser to student researchers. | 3.64 | 1.58 | High |
| 2. I served as a member of the research examining committee. | 3.52 | 1.58 | High |
| 3. I have attended research conferences and presentations. | 3.32 | 1.31 | Moderately High |
| 4. I have been a lead researcher in a research study. | 2.36 | 1.15 | Low |
| 5. I was able to present a research paper/s in a research forum/conference. | 2.20 | 1.26 | Low |
| **Section Mean** | **3.00** | **1.37** | **Moderately High** |
| **Overall Mean** | **2.95** | **1.26** | **Moderately High** |

*Research Outputs of STEM Teachers*

The section mean of 2.90, which is described as moderately high. This extent of STEM teacher research outputs was established by one indicator described as high, two as moderately high, and two as low. It connotes that the developed research proposals, completed research papers, and published research papers of teachers are low. The highest mean was 4.08, with a description of high displays showing that teachers helped their students complete their research papers. The majority of the teachers, on the other hand, could not publish research papers in an educational journal. It was demonstrated by a mean of 1.88, which is described as low and is the lowest mean score they have. This is supported by the study of Amalia and Willis (2021), who state that teachers tend to be reluctant to document and report their academic efforts in a research paper like action research. In addition, Yazon et al. (2019) revealed that the academics of teachers of the Department of Education were evaluated and showed moderate research productivity.

*Research Involvement of STEM Teachers*

As shown, the section mean of 3.00 is described as moderately high. This extent of Science, Technology, Engineering, and Mathematics teachers' research involvement was supported by two indicators described as high, one as moderately high, and 2 with a description of low. The teacher's involvement in research, such as presenting the title, defending the research proposal, and attending the research congress, could be higher. In addition, the highest mean of 3.65 with a description of high denotes that teachers have served as advisers of student-researchers. On the other hand, the dominant teachers could not present their study in a research

forum/conference. It was demonstrated by a mean score of 2.20, which is described as low and is the lowest mean score they have. Ulla et al. (2017) stated that participation in research facilitates a focused examination of one's practice and fosters confidence in educators as professionals. Furthermore, accomplished teacher-researchers can enhance their credibility and confidence, resulting in more effective and efficient teaching (Hatch et al., 2005). On the contrary, Tarrayo et al. (2019) emphasized that teachers are constrained by the notion that their primary responsibility is to teach despite their appreciation of the benefits that research can bring to their duties and responsibilities. This is because they have limited time to conduct research. They require assistance in recognizing themselves as data analysts and information processing professionals.

### 3.4 Research Productivity of STEM Students

The level of research productivity of STEM students was measured in terms of research outputs and research involvement (see Table 4). The findings suggested that students helped their co-researchers complete their research papers but could not publish them in a research journal. Moreover, students can present their research titles to their research adviser/teacher but cannot participate in a school research congress.

**Table 4.** *Consolidated findings of the level of research productivity of STEM students*

| Indicators/Items | Mean | SD | Verbal Description |
|---|---|---|---|
| **A. Research Outputs** | | | |
| 1. I helped my co-researchers to complete their research paper/s. | 4.19 | 0.84 | High |
| 2. I submit the research paper/s to the research coordinator for final checking. | 4.08 | 1.21 | High |
| 3. I had a complete research paper/s. | 3.80 | 1.05 | High |
| 4. I developed research proposal/s. | 3.71 | 0.84 | High |
| 5. I was able to publish a research paper/s in a research journal. | 1.02 | 0.20 | Very Low |
| **Section Mean** | **2.90** | **0.82** | **Moderately High** |
| **B. Research Involvement** | | | |
| 1. I was able to present the research title/s to my research adviser/teacher. | 4.26 | 1.09 | Very High |
| 2. I was able to defend my research proposal/s to my research panelists. | 4.08 | 1.05 | High |
| 3. The findings of my research paper/s were successfully defended before the panelists. | 3.41 | 1.28 | High |
| 4. I have been a lead researcher in a research undertaking. | 3.08 | 1.32 | Moderately High |
| 5. I attended a school research congress. | 1.23 | 0.59 | Very Low |
| **Section Mean** | **3.21** | **1.07** | **Moderately High** |
| **Overall Mean** | **3.01** | **0.95** | **Moderately High** |

#### *Research Outputs of STEM Students*

The section mean of 2.90, which is described as moderately high is shown in the table. This level of Science, Technology, Engineering, and Mathematics students was established by four indicators described as high and one as low. It connotes that the research output of the students could be higher. Specifically, the highest mean of 4.19 with a description of high shows that students helped their co-researchers to complete their research papers. Most students, on the other hand, could not publish their papers in a research journal. It was confirmed by a mean of 1.02, which is described as low and is the lowest mean score they have. The result is supported by Aporbo (2021), who mentions that time constraints and a lack of funding are obstacles to publishing research, leading to a relatively low number of student publications.

#### *Research Involvement of STEM Students*

As shown, the section mean of 3.21 is described as moderately high. This high extent of Science, Technology, Engineering, and Mathematics (STEM) students' research involvement was confirmed by one indicator described as very high, two as high, one as moderately high, and 1 with a description of very low. The involvement of students in research could be higher. Specifically, the highest mean of 4.26 with a very high description indicates that students can present their research titles to their research adviser/teacher. However, students were not able to participate in a school research congress. It was proven true because they achieved the lowest mean score of 1.23 in this indicator with a very low description. The result is supported by Alyami et al. (2021), who mention that time constraints and a lack of funding are obstacles to publishing research, leading to a relatively low number of student publications. Niehaus et al. (2018) also emphasize that students who have broad exposure to research activities can use those experiences to see the practical application of their classroom experience represented in research projects.

### 3.5 Research Culture and Research Productivity of STEM Teachers

Table 5 shows that the Spearman rank correlation was run to examine the relationship between research culture and teacher research productivity.

**Table 5.** *Correlational analysis between the research culture and the research productivity of STEM teachers*

| Variables | *r* | p | Interpretation |
|---|---|---|---|
| Research Culture<br>Research Productivity | .70 | 0.004426568 | Significant/Moderate or Substantial |

*Note: ns - not significant at .05 level*

Significant, moderate, or substantial correlations exist between the two variables, r = .70, p = 0.004426568. The null hypothesis, "There is no significant relationship between the research culture and productivity of teachers," is rejected. It means that teachers' research culture and productivity are directly related, as proven by the positive correlation coefficient (r = 0.70). These findings suggest that research culture is highly significant in predicting productivity among STEM teachers. The results have important implications for educational policymakers and practitioners in promoting research culture among STEM teachers to enhance their productivity. In support of this study, Ulla et al. (2017) found that teachers who constantly engaged in research had various opportunities to expand the evidence-based research outputs and tremendously increased their understanding of teaching and learning practices. Further, Tagaro (2015) emphasized that research culture covers teachers' behaviors, values, expectations, attitudes, and standards. They added that research culture shapes teachers' academic careers and influences their interest in participating in different research undertakings. Moreover, Naldo and Ubayubay (2024) noted that research culture helps teachers expand their knowledge and build credibility. They added that research culture develops teachers' shared values that consistently help them set high goals and facilitate performing activities of greater significance.

### 3.6 Research Culture and Research Productivity of STEM Students

The correlational analysis, which aims to determine the relationship between research culture and STEM students' research productivity, indicates that it is significantly positively correlated (r = 0.47, p = 0.00000035).

**Table 6.** *Correlational analysis between the research culture and the research productivity of STEM students*

| Variables | *r* | p | Interpretation |
|---|---|---|---|
| Research Culture<br>Research Productivity | 0.47 | 0.000000335 | Significant/Moderate or Substantial |

*Note: ns - not significant at .05 level*

This data implies that students' research production positively correlates with a more robust research culture. Consequently, the alternative hypothesis was accepted, and the null hypothesis was rejected. The findings suggest that a strong research culture in STEM education can increase research productivity. These results have important implications for educators and policymakers in promoting research culture in STEM education. In layman's language, students' exposure to different research activities allowed them to perform well in their research subjects and other research undertakings. This finding is confirmed by Moore et al. (2016), who stated that research culture helps students pursue their interests, learn something new, refine their problem-solving skills, and challenge their lives in new ways. Working on a group-initiated research project allows them to collaborate closely with their research teacher. Further, Niehaus et al. (2018) support the above finding by noting that the research culture provides a broader educational experience whereby students can explore societal issues through research. They added that students who have broad exposure to research activities could use those experiences to see the practical application of their classroom experience represented in research projects. In addition, Paurillo (2019) stated that research culture develops students' skills in critical analysis and the capacity to make judgments and come to conclusions. They noted that research culture allows students to develop reflexivity as they consider what and how they learn. It enables them to notice quick changes in knowledge. In short, students' high level of research culture improves their participation in research activities in and outside the school.

### 3.7 Proposed Intervention Program

The research intervention program will be implemented using the ADDIE model. From the Analysis phase, key issues in STEM research culture and productivity have been identified. The goals and strategies to address these issues are in the Design phase. Training materials, mentorship programs, and educational resources will be developed in the Development phase. These materials and programs will be delivered to STEM teachers and

students during the Implementation phase, including organizing research forums. The program's effectiveness will be assessed in the Evaluation phase by measuring the increase in research output and skill improvement. This approach is suitable to ensure that the needs identified in STEM research culture and productivity are adequately addressed for the intervention program.

The Proposed Research Intervention Program is a training package that offers to close the gaps so that research culture becomes fully embedded in the system and research productivity becomes an integral part of school function. The Analysis, Design, Development, Implementation, and Evaluation (ADDIE) model guides the intervention program.

*Analysis*
The following key issues were identified:
- STEM teachers must be encouraged to document and report their research activities.
- STEM students must develop better research skills, particularly in sampling methods.
- STEM teachers and students need more exposure to research activities to improve their research culture and productivity.

*Design*
The following are the goals and objectives of the intervention program:
- Boost STEM teachers' and students' productivity and research culture.
- Enhance STEM students' research abilities, especially with sample techniques.
- Motivate STEM educators to record and share their research endeavors.
- Increase the exposure of STEM educators and learners to research activities.

*Development*
Develop the intervention program, which includes creating the training materials, mentorship program, research forums, and educational materials.

*Implementation*
Implement the intervention program, which involves disseminating the training materials, mentorship program, research forums, and educational materials to STEM teachers and students.

*Evaluation*
Evaluate the effectiveness of the intervention program by measuring the impact on STEM teachers' and students' research culture and productivity. The following are the evaluation metrics:
- Increase in the number of research proposals, completed research papers, and published research papers by STEM teachers.
- Improvement in STEM students' research skills, particularly in sampling methods.
- Increase in the number of student publications.
- Increase the number of STEM teachers and students attending research forums and conferences.

## 4.0 Conclusion

STEM teachers have positive feelings and opinions about research and accept and embrace research as part of their daily routine in the teaching profession. They can examine, gather, understand, and assess information about their study. The institution has established a venue for teacher researchers to receive constructive comments from experts in different areas/disciplines, aiming to improve their research outputs and provide them with the opportunity to share the results of their study. STEM students can investigate, collect, comprehend, and evaluate materials for their research. However, some require assistance in finding an appropriate sampling method for their research. The research productivity of both STEM teachers and students has the potential for improvement. While they have developed research proposals and completed and published research papers, their involvement in research activities, such as attending research forums/conferences, is significant. The research culture and productivity of teachers are directly related to each other. A high extent of research culture among teachers tends to increase their research productivity. The higher the level of research culture among teachers, the better their performance in research undertakings. Furthermore, the research culture of students influences their research

productivity. Students' exposure to different research activities allows them to perform well in their research subjects and other research undertakings.

## 5.0 Contributions of Authors

The principal author contributes to the study's writing and implementation. The co-author edits and supervises the data.

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## 7.0 Conflict of Interests

The authors assert no conflicts of interest regarding the publication of this paper.

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