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STEM Curriculum Implementation and Academic Performance of Senior High School Students

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ABSTRACT

The study primarily focused on determining the extent of implementation of the Science, Technology, Engineering, and Mathematics (STEM) curriculum in the University of Northern Philippines. The research looked into the profile of 12th Grade STEM students including their academic performance. It also determined the extent of implementation of STEM curriculum. This study employed the descriptive-correlational research design in determining students' profile and extent of the STEM curriculum implementation as it correlates to academic performance. It involved 189 student-respondents and five faculty advisers to answer the questionnaires. This study passed through the ethics review committee of the university. Data gathered were analyzed using frequency and percentage, weighted mean and simple correlational analysis. Results showed that majority of the students are female who attended public high school and obtained 85-89 general weighted average rating. The extent of STEM curriculum implementation is very great. There is a significant relationship of students' sex and GWA to their academic performance. However, it showed that the type of Junior high school they graduated from and their academic performance have no significant relationship. Moreover, the extent of STEM curriculum implementation has no significant relationship with students' academic performance. It is recommended that science and mathematics grades could be the basis for academic performance. It is also encouraged that science and mathematics teachers undergo training in curriculum planning and implementation.

Keywords: *descriptive-correlational, mathematics, relevance, science, teaching methods*

INTRODUCTION

Educational systems have been in continuous change due to the global standards, which aim to set a common ground for nations to compete in the international arena. Academic institutions where future leaders are honed and prepared must be continuously updated with these changes to keep their game going. The Philippine education system underwent reforms when it implemented the K to 12 Education Program. This move is a manifestation of the country's commitment to achieving international standards. Significant changes include

decongestion, enhancement, and lengthening of the basic education cycle in order for learners to master fundamental competencies (Marzan, 2016). In implementing the K-12Curriculum, the first and most pressing challenge of the Science, Technology, Engineering, and Mathematics (STEM) education was recognizing what STEM is and what it is not. If the purpose of STEM education is not understood, the implementation will unescapably suffer. This struggle is that students have no idea what the STEM is.

The greatest difficulty then with enacting the STEM education is that they over-congested curriculum. There are 31 total subjects required for the Senior High School, 15 of which are “core” subjects and 16 of which are “track” subjects. The track subjects are composed of seven “contextualized” subjects and nine “specialized” subjects.

To meet the expectations of this education program, a lot of preparations and changes were observed in its structure, curriculum, and assessment. However, despite the education system’s determination to achieve its visions, student achievements and performances are in need of improvement in national assessments and even international competitions, especially in science and mathematics. Hence, this study has been conceptualized to identify the areas for improvement.

The results of this study are noteworthy to the administrators because this can serve as empirical data to revisit the program curriculum not only along Science and Mathematics but all areas of discipline to ensure the full implementation of the K-12 program. Also, this can be a reason for relevant seminars and training to the offered to educators in order to meet the demands of the curriculum, in producing quality students.

To teachers and educators, study results can serve as their motivation to update their teaching methods and approaches, as required in the curriculum.

This study determined the extent of Science, Technology, Engineering, and Mathematics (STEM) curriculum implementation and its relationship to the academic performance of Grade 12 Senior High School STEM students of the University of Northern Philippines during the School Year 2017-2018. Specifically, it looked into the profile of the Grade 12 STEM students in terms of sex, type of Junior high school they graduated from, their 10^{th} Grade general weighted average rating and STEM students’ academic performance. Further, It looked into the extent of implementation of the STEM curriculum along these areas: attainment of objectives, competence in the use of teaching methods and strategies, the relevance of curriculum, teacher’s characteristics and preparedness, supervisory assistance, implementation/use of instructional materials, and the problems encountered in teaching STEM specialized subjects. The significant relationship between the

students' profile and their academic performance and the significant relationship between the extent of STEM curriculum implementation and students' academic performance were also determined.

The Science, Technology, Engineering, and Mathematics (STEM) strand of the Philippine K to 12 Enhanced Basic Education Curriculum is designed to produce graduates of secondary level which will take science, research, mathematics, and engineering-related courses at the tertiary level and thereby add to the scientific and scholarly workforce of the country (Estonanto, 2016).

According to the Southeast Asian Ministry of Education Organization (SEAMEO) and Regional Centre for Educational Innovation and Technology (INNOTECH) (2012), the program for SHS consists of a core curriculum that prepares students for college and career pathways that prepare students for employment or engaging in a profitable enterprise after high school. In Grade 11, the more time of the student will be spent on studying core subjects while in Grade XII, more time of the student will be spent on internship or immersion.

STEM is a curriculum based on educating students in four specific disciplines- science, technology, engineering, and mathematics – in an interdisciplinary and applied approach. Rather than teaching the four disciplines as separate and discrete subjects, STEM integrates them into a cohesive learning paradigm based on real-world applications (Homs, 2014).

Magno (2010), as cited by Estonanto (2016), said that a curriculum that has been purposely designed for mathematics and science – inclined students could be the answer to a decade-long problem of the low number of mathematics and science practitioners in the country.

Apillera (2014) alleged that STEM education prepares unique challenges to students and teachers alike. He also explained that:

> *"The volatility of the technology powering many STEM disciplines means students and teachers must stay diligent or else let their education become obsolete. Moreover, that is all on top of the technically complex material that students must master. Mastery (or non-mastery) of mathematical and scientific concepts becomes painfully clear when students must demonstrate a working knowledge of the subject matter."*

These findings in the study of Estonanto (2016) showed low acceptability of the new curriculum among stakeholders. This study also revealed that the main problems along the implementation of the curriculum were in the areas of the facility and instructional materials. The difficulty level of the problems was high. Finally, it has been found out that there was a significant inverse correlation

between the curriculum's acceptability level and the problem's difficulty level. Thus, the study concludes that the acceptability level of curriculum is significantly related to the difficulty level of problems encountered by the school along its implementation.

METHODOLOGY

This study employed the descriptive-correlational research design in determining students' profiles in terms of sex, junior high school attended, and general weighted average, and the extent of STEM curriculum implementation as it correlates to students' academic performance. Descriptive-correlational research has been used to describe a situation, subject, behavior, or phenomenon and how it correlates to other factors or aspects. It has been used to answer the who, what, when, where, and how they are associated with a particular research question or problem.

This research study has been extensively used in educational research. It can provide a rich data set that often brings to light new knowledge or awareness that may have otherwise gone unnoticed or encountered.

The study involved all the five (5) STEM faculty advisers of Senior High School of the University of Northern Philippines during the School Year 2017-2018. The respondents were enumerated.

Two research instruments were used in gathering pertinent data.

Student-Profile Questionnaire. It is an instrument that includes columns on students' sex, type of junior high school attended, and general weighted average of students in Grade 11 and 12. It has been filled up by the respective advisers of the STEM strand and taken from the records to gather the data needed for the 189 Grade 12 STEM students.

Survey Questionnaire. The questionnaire used was adopted from the study of Benitez (2017). It is a 5-point scale questionnaire that comprises of items regarding attainment of objectives, competence in the use of teaching methods and strategies, the relevance of the curriculum, teachers' characteristics and preparedness, supervisory assistance, implementation/use of instructional materials, and on problems encountered in teaching STEM specialized subjects. The questionnaire includes items, which are rated as Fully implemented (5), Much Implemented (4), Occasionally Implemented (3), Rarely Implemented (2), and Not Implemented (1).

The researchers requested permission from the STEM faculty advisers to gather data needed for the study. After the request was granted, the researchers

personally distributed the questionnaires to the respondents and retrieved the survey forms to prepare statistical treatment, analysis, and interpretation of data.

The researchers set the norm in determining the profile of the academic performance of the students. The following has been used.

Mean Range	Descriptive Rating
90 – 100	Outstanding
85 – 89	Very Satisfactory
80 – 84	Satisfactory
75 – 79	Poor
74 and below	Needs Improvement

In determining the extent of STEM curriculum implementation in terms of attainment of objectives, competence in the use of teaching methods and strategies, the relevance of the curriculum, teachers' characteristics and preparedness, supervisory assistance, and implementation/use of instructional materials, the following norm has been used:

Mean Range	Item Descriptive Rating	Overall Descriptive Rating
4.21 – 5.00	Fully implemented	Very Highly Implemented
3.41 – 4.20	Much implemented	Highly Implemented
2.61 – 3.40	Occasionally implemented	Moderately Implemented
1.81 – 2.60	Rarely implemented	Fairly Implemented
1.00 – 1.80	Not implemented	Unimplemented

Meanwhile, in determining the extent of STEM curriculum implementation in terms of Problems Encountered in Teaching STEM Specialized Subjects, the following norm has been used:

Mean Range	Item Descriptive Rating	Overall Descriptive Interpretation
4.21 – 5.00	Very serious	Not implemented
3.41 – 4.20	Serious	Rarely implemented
2.61 – 3.40	Fairly Serious	Occasionally implemented
1.81 – 2.60	Quite Serious	Much implemented
1.00 – 1.80	Not Serious	Fully implemented

Data gathered in this study were analyzed using frequency and percentage, weighted mean and simple correlational analysis.

Ethical considerations were strictly considered. The respondents had been recruited properly with the full consent. The respondents were not subjected to any harm, discrimination, or any form of violence. Their participation was voluntary, and their anonymity was safeguarded. The data collected were strictly for this study only. All records were kept safely and confidentially. The records were destroyed

and thrown away a year after the research was finished. Any type of communication had been done with honesty and transparency.

RESULTS AND DISCUSSION

Profile of the Grade 12 STEM students in terms of sex, type of junior high school graduated from, and General Weighted Average in Grade X

Table 1 presents the students profile.

Table 1
Grade XII senior high school students' profile

Variables	f	%
Sex		
Male	81	42.90
Female	108	57.10
Total	189	100.00
Type of Junior High School		
Public	109	57.70
Private	80	42..30
Total	189	100.00
Grade 10 General Weighted Average		
90-100	54	28.57
85-89	83	43.92
80-84	50	26.46
75-79	2	1.06
Total	189	100.00

Majority (108 or 57.10%) of the students were females. Only a great percentage (81 or 42.90%) of the students were males. Majority (109 or 57.70%) of the students attended Public Junior High School, while a great percentage (80 or 42.30%) attended private schools. A great percentage (83 or 43.92%) of the students obtained "85-89" rating. On the other hand, 2 or 1.06 percent of the students obtained a "75-79" rating.

Majority (109 or 57.67%) of the students obtained a "Very Satisfactory" rating. A great percentage (61 or 32.28%) and (19 or 10.05%) of the students obtained "Outstanding" rating and "Satisfactory" rating, respectively. This implies that the students were performing at an above average level.

Extent of implementation of STEM Curriculum in Senior High School in terms of the following: attainment of objectives, competence in the use of teaching methods and strategies, the relevance of the curriculum, teachers' characteristics and preparedness, supervisory assistance, implementation/use of instructional materials, and problems encountered in teaching STEM specialized subjects.

Table 2
The extent of STEM curriculum implementation along attainment of objectives

Items	$\bar{x}$	DR
1. Students have demonstrated understanding and skills in science and mathematics subjects.	4.40	Fully Implemented
2. Students have shown proper handling and manipulation of tools in science activities and calculating devices in mathematics problems.	4.00	Much Implemented
3. Students have accurately performed all tasks required by the course guide in science and math subjects.	4.00	Much Implemented
4. Students have demonstrated an understanding of concepts and skills related to science and math.	4.20	Much Implemented
5. Students have demonstrated accuracy and mastery of concepts and skills in science and math.	4.00	Much Implemented
6. Students have shown their abilities in solving real-life situations related to science and math.	4.40	Fully Implemented
7. Students have visualized or concretized scientific and mathematical ideas.	4.60	Fully Implemented
8. Students have presented alternative solutions to problems using technology and apply them in real-life situations.	4.40	Fully Implemented
Overall Mean	4.25	Very Highly Implemented

Table 2 presents a description of the extent of STEM curriculum implementation along attainment of objectives with an overall mean of 4.25, which means this dimension has been "Very Highly Implemented." It has been revealed by the data that the students have visualized or concretized scientific and mathematical ideas with the highest mean of 4.60, In contrast, items 2, 3, and 5 have the lowest mean of 4.00, which means they are "Much Implemented." This implies that students desired to do activities such as mathematical investigation and they were exposed to different instructional materials.

Table 3 presents a description of the extent of STEM curriculum implementation along competence in the use of teaching methods and strategies with an overall mean of 4.67, which means this dimension is "Very Highly Implemented." The items 8, 9, 11, and 12 have the perfect score with the highest rating of 5.00, which indicates that the most common approach as in teaching in Senior High School are deductive and inductive reasoning, discovery method, and lecture/discussion method. This implies that teachers use different approaches/strategies or methods to improve the teaching and learning processes an educational environment. However, it has been revealed that the least approach used is team teaching with a mean rating of 3.80.

Table 3
The extent of STEM curriculum implementation along competence in the use of teaching methods and strategies

Items	$\bar{x}$	DR
1. Integrated approach	4.60	Fully Implemented
2. Collaborative learning	4.80	Fully Implemented
3. Cooperative learning	4.80	Fully Implemented
4. Telecollaborative approach (ICT integration)	4.40	Fully Implemented
5. Team teaching approach	3.80	Much Implemented
6. Problem-based teaching	4.60	Fully Implemented
7. Content-based approach	4.80	Fully Implemented
8. Deductive method	5.00	Fully Implemented
9. Inductive method	5.00	Fully Implemented
10. Process approach	4.80	Fully Implemented
11. Discovery method	5.00	Fully Implemented
12. Lecture/discussion method	5.00	Fully Implemented
13. Practical work	4.40	Fully Implemented
14. Mathematical/scientific investigation	4.60	Fully Implemented
15. Laboratory method	4.40	Fully Implemented
Overall Mean	4.67	Very Highly Implemented

This outcome is consistent with the words of the National Research Council (2011). Questions about effectiveness can only be addressed in the context of the purposes or goals that are being measured. Three broad and widely held goals for K-12 STEM education capture the breadth of STEM education's purposes and reflect the types of intellectual capital required for the nation's growth and development in an increasing science- and technology-driven world. These objectives include increasing advanced training and careers in STEM fields, expanding the STEM-capable workforce, and increasing scientific literacy among the general public.

According to the National Research Council (2014), assessment tasks that are aligned with performance expectations will need to have multiple components—that is, they will need to be comprised more than one type of activity or question. They must include opportunities for students to participate in practices to demonstrate their ability to apply them. A task designed to elicit evidence that a student can develop and apply models to support explanations about structure-function relationships in the context of a core idea, for example, will require several components. It may be necessary for students to articulate a claim about specific structure-function relationships, develop or describe a model to support the claim, and provide justification that links evidence to the claim (such as an explanation of an observed phenomenon described by the model).

Table 4
The extent of STEM curriculum implementation along relevance of the curriculum

Items	$\bar{x}$	DR
1. Subject matter contents has been arranged logically and sequentially.	4.20	Much Implemented
2. Performance standards and learning competencies has been formulated, and generated towards the acquisition of knowledge, attitudes and skills of the learners.	4.40	Fully Implemented
3. Performance standards and learning competencies are in congruence with the K-12 Basic Education program.	4.80	Fully Implemented
4. Values Orientation is observable.	4.60	Fully Implemented
5. There are sufficient activities for both mastery of contents and skills.	4.60	Fully Implemented
6. The students are provided with opportunities to discover/enhance their aptitudes and interests.	4.60	Fully Implemented
7. Content standards and learning competencies require practical applications that are true-to-life experiences/situations.	4.60	Fully Implemented
8. The topics are paced and suited to the level of the learners.	4.40	Fully Implemented
9. The content standards are relevant to the learner in the dynamic world.	4.80	Fully Implemented
10. The time allotment is enough and reasonable for both the teachers and the students.	4.40	Fully Implemented
Overall Mean	4.54	Very Highly Implemented

Table 4 presents the analysis of the extent of STEM Curriculum Implementation along the relevance of the curriculum with an overall mean rating of 4.54, which means this dimension is “Very Highly Implemented”. The performance standards and learning competencies congruence with the K-12 Basic Education Program has the highest rating of 4.80. The table shows that almost all the items under this indicator were “Fully Implemented” except for item 1, which states that subject matter contents are arranged logically and sequentially with the mean rating of 4.20, which means “Much Implemented”. It implies that the curriculum content should have been aligned with the STEM learners.

In their study, Margot and Kettler (2019) stated that teachers believe that students' perseverance and interest in STEM challenges are extremely valuable and that students eventually begin to feel motivated and empowered by their ability to solve complex problems. STEM challenges' complex, open-ended design also leads to increased academic achievement among students. Teachers have stated that incorporating engineering into their math and science curricula brings them to life. They also believe that students are genuinely interested in STEM issues. During

Table 5
The extent of STEM curriculum implementation along teacher's characteristics and preparedness

Items	$\bar{x}$	DR
1. Effective managers and facilitators of the teaching-learning process	4.60	Fully Implemented
2. Skilled in the use of more interactive and integrative modes of teaching	4.20	Much Implemented
3. Effectively utilized strategies for developing critical and creative thinking skills or higher order thinking skills	4.60	Fully Implemented
4. Serves not only as a value model but also one who can contribute towards the gradual unfolding of standards and principles for the learners as anchors in the development of the principles and God-fearing learners	4.60	Fully Implemented
5. Gives initial prototype of materials to enrich the teaching-learning process	4.60	Fully Implemented
Overall Mean	4.52	Very Highly Implemented

STEM education, teachers report an overwhelmingly positive response from students. Furthermore, teachers believed that increasing student enjoyment and engagement was the primary reason for incorporating STEM into their curriculum.

Table 5 presents the analysis of STEM Curriculum Implementation along the teachers' characteristics and preparedness with an overall mean rating of 4.52, which means this dimension is "Very Highly Implemented". Items 1, 3, 4, and 5 having the same numerical rating of 4.60 obtained the highest rating, while only one item, skilled in using more interactive and integrative modes of teaching has the lowest mean rating of 4.20. It implies a need for collaborative work between the teacher and the learner, an activity such as round robin that focuses on a question and answer portion that gives them opportunity to share ideas.

Current STEM education reforms in grades K-12 call for the integration of science, technology, engineering, and mathematics (STEM). Such integration of STEM disciplines at the K-12 level provides students with the opportunity to experience learning in real-world, multidisciplinary contexts; however, there has been little published research on teachers' experiences with integrated STEM instruction. Although it was seen that it was fully implemented, Dare et al. (2018) inform educational researchers, policymakers, and K-12 STEM educators that implementing new STEM initiatives in K-12 education presents several challenges. Their findings show three distinct cases of integration within their sample, representing low, medium, and high levels of STEM integration across curriculum implementations. Interviews with teachers revealed three recurring themes: the nature of integration, the choice between science and engineering, and student engagement and motivation.

Table 6
The extent of STEM curriculum implementation along supervisory assistance

Items	$\bar{x}$	DR
1. Supervisor visits the classroom and observes the teaching of Science and Math.	4.00	Much Implemented
2. He/she writes observations and confers with teachers after observation.	3.80	Much Implemented
3. He/she gives comments and suggestions to improve the teaching of Science and Math.	3.80	Much Implemented
4. He/she provides a class program basic to all teachers in Science and Math.	3.80	Much Implemented
5. He/she organizes free in-service training and techniques in teaching Science and Math.	3.60	Much Implemented
Overall Mean	3.80	Highly Implemented

Table 6 presents the analysis of STEM curriculum implementation along supervisory assistance. The item supervisor visits the classroom and observes the teaching of Science and Mathematics obtained the highest mean rating of 4.00, Items 2, 3, and 4 have the same numerical rating of 3.80, which means they are "Highly Implemented" while the item She/he organizes free in-service and techniques in teaching Science and Mathematics have the lowest mean rating of 3.60. This implies that the supervisor does not have enough time to facilitate or organize in-service training for his/her subordinates.

According to El Nagidi et al. (2018), teachers' perceptions of STEM influenced their conceptions of STEM identity in a variety of ways. With their diverse backgrounds, ages, genders, and subject matter, the teachers developed various conceptualizations of STEM, emphasizing the importance of integration as well as tackling real-world problems. Most teachers saw alignment between these conceptualizations and their teaching philosophies as a critical point; they saw it as a prerequisite for success in a STEM setting. Because STEM teachers came from a variety of subject backgrounds, their ability to identify as STEM teachers remained shaky. Their identity is in flux, resulting in multiple identities for some teachers, such as science and STEM, art and STEM, and so on. Teachers see their identity as STEM teachers as developing and under construction because STEM is a new initiative in their schools. They did, however, emphasize the importance of having a degree of alignment between their understanding of STEM as a teaching and learning approach and their teaching philosophy.

A STEM teacher should possess the same qualities that a STEM student is expected to possess. This is true on all levels, both personal and professional. STEM teachers must be adaptable, open to change, collaborative, problem solvers, and knowledgeable about current trends in teaching and learning. Furthermore, STEM teachers have a teaching philosophy that is congruent with their understanding of STEM education. This alignment reduces internal conflict between what a teacher

Table 7
The extent of STEM curriculum implementation along implementation/use of instructional materials

Items	$\bar{x}$	DR
1. Prototype Lesson Plans	4.00	Much Implemented
2. Teacher's Manuals	4.00	Much Implemented
3. Textbooks	4.40	Fully Implemented
4. Modules	3.80	Much Implemented
5. Laboratory Devices	4.40	Fully Implemented
6. Workbooks	3.80	Much Implemented
7. Blackboards	5.00	Fully Implemented
8. Computers	4.20	Much Implemented
9. Audio-Video Aids	4.20	Much Implemented
10. Periodicals/Journals	4.00	Much Implemented
11. Models	4.40	Fully Implemented
Overall Mean	4.20	Highly Implemented

believes and what he or she is expected to do, as well as an external conflict with other stakeholders while grappling with the process of implementing a STEM focus.

Table 7 presents the analysis of STEM curriculum implementation along implementation/use of instructional materials with an overall mean rating of 4.20, which means this dimension is "Highly Implemented." Only the availability of blackboards has the perfect score with the highest mean rating of 5.00. Items 4 and 6 have the lowest ratings of 3.80 along with modules and workbooks. This implies that there is a limited number of modules and workbooks for the learners.

According to a study published by the Education Alliance at Brown University, in order for growth to occur in school systems, the structures and thinking on how to conduct the business of education must be altered (Ejiwale, 2013). They will be utilized when the measure of leadership is demonstrated in terms of how well agencies connect with the goals of districts and schools for an engaging learning environment. Education leaders must understand STEM education to cultivate rich STEM learning experiences and expertise in their schools. Because of the current economic situation, which has necessitated cutting funds needed to support educational activities, it is very easy for the school system to eliminate the need for STEM programs. Due to this situation, funds may not be available to hire teachers who know how to effectively teach science and mathematics, as well as who know and love their subject well enough to inspire their students. In such a case, qualified volunteers from among the retirees could be sought to ensure that learners are not disadvantaged.

Table 8 presents the analysis of STEM curriculum implementation along problems encountered in teaching STEM specialized subjects with an overall mean rating of 3.65, which means this curriculum is "Rarely Implemented." It shows a very serious problem with the lack of students' interests on the topics with a mean rating

Table 8
The extent of STEM curriculum implementation along problems encountered in teaching STEM specialized subjects

Items	$\bar{x}$	DR
1. Lack of STEM textbooks	3.80	Serious
2. Inadequate prototype lesson plans	3.60	Serious
3. Lack of workbooks	4.00	Serious
4. Inadequate audio-visual aids	3.00	Fairly Serious
5. Lack of laboratory devices	2.20	Quite Serious
6. Poor ventilation and lighting of classrooms	4.00	Serious
7. Lack of time in preparing adequate activities	4.00	Serious
8. Lack of training of teacher related to teaching STEM specialized subjects	3.80	Serious
9. Difficulty in infusing values in every content lesson	3.00	Serious
10. Poor communication skills of the students	3.00	Serious
11. Poor comprehension of the students	4.20	Serious
12. Lack of students' interests in the topics	4.60	Very Serious
13. The strong influence of mass media to the students	4.20	Serious
Overall Mean	3.65	Rarely Implemented

of 4.60 while lack of laboratory devices obtained the descriptive rating of "Quite Serious" problem with the mean rating of 2.20. It implies that the lack of interest in the topics among the students may occur due to strand misalignment.

Instructional materials play an important role in teaching and learning at all levels of education because they allow children to broaden and deepen their knowledge by providing a variety of firsthand, developmentally appropriate experiences and by assisting children in acquiring symbolic knowledge by representing their experiences. According to Ineu et al. (2017), there is an increasing concern about developing STEM instructional materials to prepare students for a scientifically and technologically advanced society. Concerns have arisen from both research and curriculum perspectives about the lack of a unified focus and the need for greater integration of the four disciplines as the importance of STEM education has been recognized globally. The question then becomes how to achieve more

Table 9
Summary of extent of STEM curriculum implementation

Category	$\bar{x}$	Descriptive Rating
Attainment of Objectives	4.25	Fully Implemented
Competence in the use of Teaching Methods and Strategies	4.67	Fully Implemented
The relevance of the Curriculum	4.54	Fully Implemented
Teachers' Characteristics and Preparedness	4.52	Fully Implemented
Supervisory Assistance	3.80	Occasionally Implemented
Implementation/Use of Instructional Materials	4.20	Much Implemented
On problems encountered in Teaching STEM specialized subjects	3.65	Rarely Implemented
Composite Mean	4.23	Very Highly Implemented

balanced content representation in STEM education. The Philippines faces many challenges in providing access to the essential, high-quality educational materials required for effective STEM education. One is the requirement to revise existing materials so that they align with and support the new curriculum.

Table 9 shows that the STEM curriculum is very highly implemented specifically on attaining objectives, competence in the use of teaching methods and strategies, relevance of the curriculum, and teacher's characteristics and preparedness. However, it was found out that the curriculum is rarely implemented on problems encountered in Teaching STEM specialized subjects. These imply that the STEM curriculum was being successfully instigated but there were still problems encountered.

The outcome is similar to the study of Lee et al. (2019), which is addressing school needs in the design of integrative STEM units that improve or at least maintain students' exam results while also fostering their creative and collaborative authentic problem-solving capacities. Needless to say, this necessitates a very effective pedagogical design. They also highlighted that when doing STEM, technology-supported collaborative learning to prepare learners must be promoted for twenty-first-century workplaces. Current TPACK research indicates that teachers' lesson plans may still be skewed toward didactic instruction.

Even though the outcome is positive, it is critical to highlight the issues that were encountered. Reiterating the work of Margot et al. (2019), they stated that to support teachers and STEM programs in their efforts to develop STEM talent, necessary provisions must be made so that they can act as a facilitating catalyst in the student's development. Teachers require a high-quality curriculum that adheres to district and state standards and includes formative assessment techniques that teachers can use to assess their students' conceptual understanding. Professional development that is attended by the team of teachers who will be using the

curriculum and allows teachers to gain meaningful experience with STEM concepts and pedagogy is also required.

Significant relationship between the students' profile and their academic performance

Table 10 presents the correlation of students' profile with their academic performance.

Table 10
Correlation between students' profile and academic performance

Variables	Students' Academic Performance		
	r-value	r-prob	Decision
Sex	.219**	0.002	Reject Ho
Type of Junior High School	-0.112	0.124	Do not Reject Ho
Grade 10 General Weighted Average	.769**	0.000	Reject Ho

There is a significant relationship between the sex of the respondents and their academic performance. It implies that females had a better performance than that of the males. It further reveals that there is also a significant relationship of their Grade 10 general weighted average to that of their Grade 12 general weighted average. It implies that if they perform low in Grade 10, they tend to have low performance too in Grade 12. Likewise, if they perform better in grade 10, they tend to perform better in Grade 12. However, there is no significant relationship between the type of Junior High School attended and their academic performance.

The findings above support Caroline, Uche, and Oluwaseun (2019) results that demographic differences play a role in explaining performance differences between school types. Likewise, the result is also congruent to the study conducted by Halis and Raiha (2019) that academic achievement and sociodemographic factors were found to be strongly linked, and the relationship varied depending on income level and school type. Their findings showed that the current emphasis on improving academic achievement necessitates taking into account students' sociodemographic circumstances.

Significant relationship between the extent of STEM curriculum implementation and students' academic performance

Table 12 shows the relationship between the extent of STEM curriculum implementation and students' academic performance.

Table 12
Correlation between the extent of STEM curriculum implementation and student's academic performance

Category	Students' Academic Performance		
	r-value	r-prob	Decision
Attainment of Objectives	0.260	0.673	Do not Reject Ho
Competence in the use of Teaching Methods and Strategies	0.864	0.059	Do not Reject Ho
Relevance of the Curriculum	0.150	0.810	Do not Reject Ho
Teachers' Characteristics and Preparedness	0.018	0.977	Do not Reject Ho
Supervisory Assistance	0.590	0.295	Do not Reject Ho
Implementation/Use of Instructional Materials	0.144	0.817	Do not Reject Ho
Problems encountered in Teaching STEM specialized subjects	0.651	0.234	Do not Reject Ho
Composite Mean	0.540	0.347	Do not Reject Ho

The extent of implementation of the STEM curriculum has no significant relationship to the academic performance of the students. It implies that the implementation of the STEM curriculum has no encountered difficulties yet.

Although there is no direct correlation between the extent of STEM curriculum implementation and students' academic performance, Averill (2018) claims that by implementing STEM, classrooms and schools will be able to provide today's students with the skills and abilities they need to compete with other 21st century learners around the world. Perceptions and understanding of STEM programs may have an impact on program implementation and future instructional teaching practices.

CONCLUSIONS

Majority of the students are female who attended Public Junior high School and obtained a GWA rating of 85-89. The extent of implementation of the STEM curriculum has been very high. The majority of the students obtained a "Very Satisfactory" rating. There is a significant relationship between the profile of the respondents and their Grade 10 general weighted average to their academic performance. However, there is no significant relationship between the type of Junior High School and their academic performance. Moreover, the extent of implementation of the STEM curriculum has no significant relationship to the academic performance of the students.

RECOMMENDATIONS

In the light of the findings and conclusions, it is recommended that science and mathematics grades be the basis for academic performance. Science and Mathematics teachers are encouraged to undergo training in curriculum planning and implementation. Curriculum developers should revisit the curriculum for further enhancement. Science and mathematics grades should also be considered in parallel studies to see if they will obtain the same results. Similar studies using other variables should be conducted to determine if the same results are obtained to confirm the conclusion that the extent of implementation of the STEM curriculum has no significant relationship to academic performance.

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