A QUANTITATIVE ANALYSIS OF TEACHERS' AND STUDENTS' CONTENT KNOWLEDGE IN PHYSICS

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ABSTRACT

This research examined the extent of content knowledge in Physics of teachers and students, as well as its correlation to the contributing factors that affects the extent of content knowledge in Physics among the teachers and students.

Based on the computed data, the researcher found a significant relationship between the age, sex, undergraduate specialization, and years in service of teacher's profile and the teacher's self-evaluation on the extent of content knowledge in Physics. It was also revealed that the teacher's self-evaluation on the extent of content knowledge in Physics and the following contributing factors: availability of resources, attendance to trainings and seminars, technological fluency, and research engagement in physics related studies. However, the Peer observation and coaching of Contributing Factors was not observed to have any significant relationship to the teacher's self-evaluation on the extent of content knowledge in Physics. The level of student's content knowledge in Physics as to test scores has a descriptive equivalent of Satisfactory and verbally interpreted as Average. Moreover, the availability of resources, exposure to practical work, study habits, and teacher factor of contributing factors was observed to have a significant relationship to the test scores based on the computed data.

Based on the self-evaluation of the teachers and students, it is recommended to conduct targeted seminar or training in least learned competencies in Physics for various proficiency levels of teachers. There are a lot of trainings implemented on the teaching strategies but only none to few focuses on the mastery of subject content. There should be short-term workshops and trainings on the use of laboratory apparatus and equipment to improve teacher's technological fluency. The education sector should also focus on provision of credible and comprehensive learning materials (online or printed) that are aligned with the national standard, appropriate to the level of knowledge of the learners, supplements student learning, and is easy to understand. To bridge learning gaps, it is also recommended to conduct remediation or intervention in Mathematics and English as it has an impact on conceptual understanding of Physics is recommended for students.

Keywords: *content knowledge, pedagogical content knowledge, technological content knowledge, resources, research engagement, coaching, practical work, study habits, teacher factor*

INTRODUCTION

Enhancing the quality of Science Education is still a challenge in a Philippines, especially since the rank of the country lags behind other countries. In the 2018 Program for International Student Assessment (PISA), a student assessment of 15-year-old learners across 79 countries done by the Organization for Economic Co-operation and Development (OECD), it was reported that the Philippines ranked in the low 70s on Reading, Mathematics, and Science. To address the need to enhance the quality of education in the country, the Philippine education sector has been conducting research and implements intervention in the teaching and learning process to bridge the gaps in learning competencies. The challenge for teachers is to create a scientifically literate society while engaging the learners to pursue various science careers which include being a biologist, chemist, or a physicist among many others.

One of the branches of science that are included in the current curriculum for Basic Education is Physics. Physics is a natural science that studies matter, motion, behavior through space and time, energy, and forces. Physics is often perceived to be difficult and often considered as an intellectually challenging subject as there is a need to solve mathematical problems using reason, critical-thinking, and incorporating laws, principles, and mathematical equations. Physics necessitates the learners to understand abstract scientific concepts which may be challenging for some students. As they perceive Physics as challenging, it creates an impression of fear of Physics which results to poor performance in their academics (Atsuwe and Makama, 2021). Despite its relevance to daily life, the poor performance in Physics has been a concern by the Department of Education (DepEd).To address the concern of having consistent poor performance in Physics, it is important to identify the factors that contribute to the academic performance of learners. It is also important to identify how teachers can enhance their quality of teaching by knowing the factors that influence it.

It is important to identify how the Department of Education may provide support and how they may help upskill the teachers to enhance the quality of education. According to Santos and Castro (2021), the application of Technological Pedagogical Content Knowledge (TPACK) is important in the teaching and learning process and must therefore be applied in all aspects of learning. TPACK pertains to the effectiveness of the delivery of the lesson with technology integration. To help the teachers, especially in public schools, to implement 21st century learning with the integration of technology, Santos and Castro (2021) mentioned that more structured alternative approaches and educational technology tools should be designed to enhance the teaching and learning process.

Some of the factors that may contribute to teacher's content knowledge where the education sector may focus on are the provision of trainings and seminars, maintaining and upgrading of the available learning materials and facilities, accessibility to credible database of information, proper coaching and mentoring among teachers, and engaging teachers to research and useful technology.

Hence, the researcher found it helpful to conduct this study. This research was developed to further examine and investigate the extent of content knowledge in Physics of teachers and students, as well as the contributing factors that affects the extent of content knowledge in Physics among the teachers and students. Specifically:

1. What is the respondents' profile in terms of:
    1.1. age
    1.2. sex
    1.3. undergraduate specialization
    1.4. years in service
    1.5. years in teaching Physics
2. What is the level of contributing factors to teachers' content knowledge as to:
    2.1. availability of resources
    2.2. attendance to trainings and seminars
    2.3. technological fluency

2.4. research engagement in Physics-related studies
2.5. peer observation and coaching

3. What is the level of contributing factors to student's content knowledge as to:
   3.1. availability of learning resources
   3.2. exposure to practical work
   3.3. study habits
   3.4. teacher factor
4. What is the level of self-evaluation of teachers on the extent of their content knowledge in Physics in terms of:
   4. 1. Mastery of Content Knowledge
   4.2. Pedagogical Content Knowledge
   4.3. Technological Content Knowledge
5. What is the level of self-evaluation of students on the extent of their content knowledge in Physics?
6. What is the level of student's content knowledge in Physics as to test scores?
7. Is there a significant relationship between the teacher's profile and teacher's self-evaluation on the extent of content knowledge in physics?
8. Is there a significant relationship between the contributing factors and teachers' self-evaluation on the extent of content knowledge in physics?
9. Is there a significant relationship between the student's test scores and the contributing factors affecting their extent of content knowledge in physics?

REVIEW OF RELATED LITERATURE

With the implementation of the Enhanced Basic Education Act of 2012 or the K to 12 Basic Education Program, varying undergraduate specializations of teachers has been a concern in teaching Science using the use of spiral progression approach. Its implementation has required Science teachers to gain mastery of these four branches of Science: Physics, Chemistry, Biology, and Earth Science in order to teach the grade level that they are handling.

Physics is perceived as a difficult course for students from secondary school to university and for adults in graduate education (Pardo, 2017). Lacambra (2016) identified the problems encountered by student participants that affected their performance in Physics test that was administered. Those problems include recalling important concepts, principle and theories, student workload (many assessment works, assignments, and projects), and the student's attendance in classes. Pardo (2017) stated that teaching physics has always been a challenge for teachers both in the high school and college levels because of the impression of most students that physics is a difficult subject. Some students even have prior thoughts that physics is a mathematics subject so those who are afraid of numbers would naturally fear physics also. Erinosho (2013) categorized the reasons for learners as to why they find physics difficult according to the nature of subject as having many hard formulae/laws/content to memorize, it being theoretical and too abstract, this subject involving problems that are not easy to solve, this subject having content which is difficult to understand, this subject requiring too many calculations, and this subject being perceived as "not enjoyable". As to the teachers' view, insufficient exposure to practical work, difficulty in the interpretation of questions, and the lacking mathematical skill for solving problems are considered the major reasons why students find physics difficult (Erinosho, 2013).

The study of Lacambra (2016) revealed the correlation between Physics performance of students in the test and the student's grade in its prerequisite subjects, Mathematics courses (Algebra and Trigonometry) and English. This is supported by the study of Reddy and Panacharoensawad (2017) found out that the major hindrance in learning of Physics are poor mathematical skills and lacking of understanding of a problem.

Teachers play an important role in the teaching and learning process, from the careful and integrated designing and planning of lessons to the execution of the lesson plan to the evaluation of the learner. With the goal of educating learners to produce a scientifically literate community, teachers should be literate in science as well as disseminators and facilitators of knowledge. On the study of Walag et. al (2020), the level of scientific literacy among science teachers in elementary and high school in a public school in Cagayan de Oro City was determined. On this study, it was found that the teacher respondents scored satisfactory in terms of scientific literacy. However, differences in the level of scores has been found having respondents scored high in earth science, followed by health and life science, and least in physical science. It was identified that this is due to Physics' abstract nature and difficulty level as reason for having the least score among the other branches of science.

Being the facilitators of teaching and learning process and one of the sources of knowledge in the classroom, teachers need to have competent level of content knowledge to properly deliver the lessons well. Content knowledge refers to the body of knowledge and information that educators teach, and students are expected to acquire it in a given subject or content area (Santos and Castro, 2021). Aside from mastery of content knowledge, the pedagogical content knowledge and technological content knowledge are both expected to be nurtured in a teacher.

Pedagogical content knowledge refers to the content knowledge that deals with the teaching process. Pedagogical content knowledge is different in various content areas as it blends both content and pedagogy with the goal to develop better teaching practices in the content areas. The pedagogical content knowledge is important in teacher's planning and designing of the learning activities to ensure proper delivery of the lesson and to enhance the quality of education in physics. Meanwhile, technological content knowledge refers to knowing websites with online materials for studying the subject area, ICT-applications which are used by professionals in the subject area and can be used to better understand the contents of the subject, and knowing technologies which can be used to illustrate difficult contents in the subject (Santos and Castro, 2021).

Meanwhile, there are several factors that contribute to the level of content knowledge among teachers namely availability of resources, attendance in trainings and seminars, technological fluency, research engagement in Physics-related studies, and peer observation and coaching. On the other hand, the identified contributing factors for students' mastery of content knowledge are availability of resources, exposure to practical work, study habits, and teacher factor.

METHODOLOGY

The research design used in this study was of the descriptive type. This was coupled with correlational research design. Quantitative design, specifically non-experimental research design, is employed in a single group where the group's test score and self-evaluation will be measured. These were used to draw valid conclusions on the self-evaluation of the extent of teachers' and students' content knowledge in Physics and to analyze the test scores of students in a public school in Laguna, Philippines.

With the enhanced basic education curriculum, every science teacher can teach Physics in varying grade levels. Hence, all the science teachers handling Grade 7 to Grade 10 Science of a Junior High School under the Division of Laguna, are selected as the respondents of the study. The researcher was able to survey thirty-six science teachers and purposively selected the Grade 10 students under Science, Technology, and Engineering Program (STE-P) and Special Program in Foreign Language (SPFL) with a total number of sixty-six (66) students.

The main instruments that were used in the study are: 1) the teacher's self-evaluation questionnaire on the level of content knowledge in Physics and how various contributing factors affect the extent of content knowledge in Physics; (2) the students' self-evaluation questionnaire on their level of content knowledge in Physics and how various contributing factors affects the extent of content knowledge in physics; and (3) students' 50-item assessment on Grade 7 to Grade 10 Physics topics. In addition, a thorough review of the available reference materials was accomplished in preparing the questionnaire. The drafted questionnaire was submitted to a statistician for evaluation and were also validated by the researcher's panel members and five (5) Master Teachers in Science. The researcher also conducted a test and retest for eighty-two (82) students to measure the reliability of the assessment. The Pearson correlation coefficient (r) measures a linear correlation, having values 1 (positive correlation) to -1 (negative correlation) as measures of strength and direction of the relationship between the variables (Turney, 2022). From the recorded scores on the first test and its re-test, the researcher calculated a pearson r value of 0.757, which indicates a strong and positive relationship and good reliability of the test.

The teacher's and student's content knowledge and contributing factors that affects the extent of content knowledge was analyzed using appropriate statistical tools to draw out valid conclusions. The mean score on the Physics assessment for students was also computed. The data which were elicited from the responses of the teachers and selected Grade 10 students were gathered and examined to make logical conclusions and generalizations to answer the research questions posed in this study.

RESULT AND DISCUSSION

Teacher's Profile

The dimensions considered for the teachers' profile are age, sex, undergraduate specialization, number of years in service, and number of years in teaching physics.

Age

Out of 36 Teacher-respondents, the age range "*26 to 35 years old*" received the highest frequency of fifteen (15) or 41.67% of the total sample population. Followed by the age range "*36 to 45 years old" and "46 to 55 years old*" with frequency of nine (9) or 25.00% of the total sample population. While the age range "*21 to 25 years old*" received the lowest frequency of three (3) or 8.33% of the total sample population.

Sex

Out of 36 Teacher-respondents, the sex "*Female*" received the highest frequency of twenty-six (26) or 72.22% of the total sample population. While the sex "*Male*" received the lowest frequency of ten (10) or 27.78% of the total sample population.

Undergraduate Specialization

Out of 36 Teacher-respondents, the specialization "*Biology*" received the highest frequency of fourteen (14) or 38.89% of the total sample population. Followed by the specialization "*General Science"* with frequency of eleven (11) or 30.56% of the total sample population. While the specialization "*Chemistry*" received the lowest frequency of four (4) or 11.11% of the total sample population.

Number of Years in Teaching

Out of 36 Teacher-respondents, the years in service "*3 to 6 years" and "7 to 10 years*" received the highest frequency of eight (8) or 22.22% of the total sample population. Followed by the years in service "*14 to 16 years"* with frequency of six (6) or 16.67% of the total sample population. While the years in service "*17 to 19 years*" received the lowest frequency of one (1) or 2.78% of the total sample population.

Table 1. Level of self-evaluation of teachers on the extent of their content knowledge in Physics in terms of Mastery of Content Knowledge

STATEMENTS	MEAN	SD	REMARKS
I think that… *… I have sufficient ability in remembering related equations.*	3.19	0.47	Agree
… I have enough practice on problem solving during my undergraduate classes.	3.25	0.60	Agree
… I have sufficient mathematical skills in algebra (for basic equations), trigonometry (for force diagrams and angled systems), and geometry (for dealing with volume, area, and others).	3.03	0.65	Agree
… I can use my drawing skills for recording observed data such as in making ray and circuit diagrams and plotting graphs.	3.14	0.54	Agree
… I have good comprehensive skills on definitions, laws, and basic principles of Physics.	3.33	0.48	Strongly Agree
Weighted Mean	3.19		
SD	0.56		
Verbal Interpretation	High		

Table 1 illustrates the level of self-evaluation of teachers on the extent of their content knowledge in Physics in terms of Content Knowledge

From the statements above, "*I think that I have good comprehensive skills on definitions, laws, and basic principles of Physics*" yielded the highest mean score *(M=3.33, SD=0.48)* and was remarked as Strongly Agree. This is followed by "*I think that I have enough practice on problem solving during my undergraduate classes*" with a mean score *(M=3.25, SD=0.60)* and was also remarked as Agree. On the other hand, the statement "*I think that I have sufficient mathematical skills in algebra (for basic equations), trigonometry (for force diagrams and angled systems), and geometry (for dealing with volume, area, and others)*" received the lowest mean score of responses with *(M=3.03, SD=0.65)* yet was also remarked Agree.

The level of self-evaluation of teachers on the extent of their content knowledge in Physics in terms of Content Knowledge attained a weighted mean score of 3.19 and a standard deviation of 0.56 and was High among the respondents. The teacher should have a broad and current understanding of the core topics in Physics such as mechanics, electricity and magnetism, heat and thermodynamics, waves and light, optics, and modern physics (Wenning and Vieyra, 2020). Attaining the familiarity of the unifying principles in physics and mastery of major content areas in physics was enabled by the general understanding of its closely allied fields like chemistry and mathematics.

Table 2. Level of self-evaluation of teachers on the extent of their content knowledge in Physics in terms of Pedagogical Content Knowledge

STATEMENTS	MEAN	SD	REMARKS
I know how to guide students in solving problems involving Physics-related concepts.	3.50	0.51	Strongly Agree
I know how to guide students in collaborative/group works as they share their thoughts with each other in the subject (Physics) that I am teaching.	3.42	0.50	Strongly Agree
I know how to guide students in planning their own learning in the subject (Physics) I am teaching.	3.31	0.47	Strongly Agree
I know how to improve students' creative thinking in the subject (Physics) I am teaching.	3.28	0.45	Strongly Agree
I feel that the class size or number students per class does not affect how I deliver the lesson.	2.92	0.65	Agree
Weighted Mean	3.28		
SD	0.55		
Verbal Interpretation	Very High		

Table 2 illustrates the level of self-evaluation of teachers on the extent of their content knowledge in Physics in terms of Pedagogical Content Knowledge

From the statements above, "*I know how to guide students in solving problems involving Physics-related concepts*" yielded the highest mean score *(M=3.50, SD=0.51)* and was remarked as Strongly Agree. This is followed by "*I know how to guide students in collaborative/group works as they share their thoughts with each other in the subject (Physics) that I am teaching*" with a mean score *(M=3.42, SD=0.50)* and was also remarked as Strongly Agree. On the other hand, the statement "*I feel that the class size or number students per class does not affect how I deliver the lesson*" received the lowest mean score of responses with *(M=2.92, SD=0.65)* yet was also remarked Agree.

The level of self-evaluation of teachers on the extent of their content knowledge in Physics in terms of Pedagogical Content Knowledge attained a weighted mean score of 3.28 and a standard deviation of 0.55 and was Very High among the respondents. According to Wenning and Vieyra (2020), pedagogical content knowledge of teachers allows teachers to understand what constitutes effective teaching such as the planning and preparation of lesson plans that integrates lecture discussions with essential learning activities such as laboratory work, homework, presentations, assessment, student research projects, and extracurricular activities that maximizes their learning.

Table 3. **Level of self-evaluation of teachers on the extent of their content knowledge in Physics in terms of Technological Content Knowledge**

STATEMENTS	MEAN	SD	REMARKS
I know various websites offering online materials that can be used in studying Physics.	3.17	0.56	Agree
I know ICT-applications which are used by professionals in Physics.	2.97	0.45	Agree
I know ICT-applications that can be used to better understand the contents of Physics.	3.00	0.53	Agree
I know technologies that can be used to illustrate difficult contents in Physics.	3.08	0.55	Agree
I can operate a number of software applications which can effectively illustrate various Physics problems.	2.92	0.55	Agree
Weighted Mean	3.03		
SD	0.53		
Verbal Interpretation	High		

Table 3 illustrates the level of self-evaluation of teachers on the extent of their content knowledge in Physics in terms of Technological Content Knowledge.

From the statements above, "*I know various websites offering online materials that can be used in studying Physics*" yielded the highest mean score *(M=3.17, SD=0.56)* and was remarked as Agree. This is followed by "*I know technologies that can be used to illustrate difficult contents in Physics*" with a mean score *(M=3.08, SD=0.55)* and was also remarked as Agree. On the other hand, the statement "*I can operate a number of software applications which can effectively illustrate various Physics problems*" received the lowest mean score of responses with *(M=2.92, SD=0.55)* yet was also remarked Agree.

The level of self-evaluation of teachers on the extent of their content knowledge in Physics in terms of Technological Content Knowledge attained a weighted mean score of 3.03 and a standard deviation of 0.53 and was High among the respondents. Technological Content Knowledge refers to the knowledge of how teachers utilize technology to enhance learner's practice and understand concepts in a specific area (Santos and Castro, 2021). With the availability and accessibility of technology, the use of Information and Communication Technology (ICT) has become very common in the teaching and learning process of a 21st century learning environment. The five (5) contributing factors affecting the teacher's content knowledge in Physics that were identified and measured are the availability of resources, attendance to trainings and seminars, technological fluency, research engagement in Physics-related studies, and peer observation and coaching.

Table 4. Level of contributing factors to teachers' content knowledge as to availability of resources

STATEMENTS	MEAN	SD	REMARKS
I think there is sufficient Physics teaching and learning materials (hard copy like textbooks and modules) that I can use in studying Physics.	3.28	0.66	Strongly Agree
I think there is sufficient Physics teaching and learning materials (soft copy like learning websites and online handouts) that I can use in studying Physics.	3.42	0.55	Strongly Agree
I feel that the textbooks available are comprehensive and easy to understand.	3.06	0.63	Agree
I can use Physics equipment available in the laboratory which can help in the attainment of learning objectives.	3.11	0.71	Agree
I feel that the apparatus in the laboratories is adequate and in proper working condition.	3.11	0.67	Agree
Weighted Mean	3.19		
SD	0.65		
Verbal Interpretation	High		

Table 4 illustrates the level of contributing factors to teachers' content knowledge as to availability of resources.

From the statements above, "*I think there is sufficient Physics teaching and learning materials (soft copy like learning websites and online handouts) that I can use in studying Physics*" yielded the highest mean score *(M=3.42, SD=0.55)* and was remarked as Strongly Agree. On the other hand, the statement "*I feel that the textbooks available are comprehensive and easy to understand*" received the lowest mean score of responses with *(M=3.06, SD=0.63)* yet was also remarked Agree.

The level of contributing factors to teachers' content knowledge as to availability of resources attained a weighted mean score of 3.19 and a standard deviation of 0.65 and was High among the respondents. Having a low rating on how the existing Physics textbooks are easy to understand by teachers is a persisting issue, especially since some non-major teachers rely on textbooks for clarifications of concepts. As textbooks still remain to be one of the major learning aids in all levels of education globally, there is a need to subject textbooks to critical analysis to ensure its curricular usefulness (Bansiong, 2019). Reference materials such as textbooks and modules should be ensured to be aligned with the Department of Education's content standards, free of conceptual errors, readable, and comprehensive to its intended users.

Table 5. Level of contributing factors to teachers' content knowledge as to attendance to trainings and seminars

STATEMENTS	MEAN	SD	REMARKS
I feel that the school offers various training/programs/learning action cell sessions which help in improving the teachers' Physics content mastery.	3.00	0.68	Agree
I feel that the school offers various training/programs/learning action cell sessions which help in improving the teachers' Physics pedagogic mastery.	2.94	0.71	Agree
I have attended various trainings/seminars aiming to elevate my content and pedagogical knowledge in Physics.	2.69	0.67	Agree
I think that studying Physics will be beneficial to my future career as a teacher.	3.64	0.49	Strongly Agree

I am determined to do well in Physics even if there is no given incentives (getting high grades, gift bonuses) when I did well.	3.56	0.50	Strongly Agree
Weighted Mean	3.17		
SD	0.71		
Verbal Interpretation	High		

Table 5 illustrates the level of contributing factors to teachers' content knowledge as to attendance to trainings and seminars

From the statements above, "*I think that studying Physics will be beneficial to my future career as a teacher*" yielded the highest mean score *(M=3.64, SD=0.49)* and was remarked as Strongly Agree. On the other hand, the statement "*trainings/seminars aiming to elevate my content and pedagogical knowledge in Physics*" received the lowest mean score of responses with *(M=2.69, SD=0.67)* yet was also remarked Agree.

The level of contributing factors to teachers' content knowledge as to attendance to trainings and seminars attained a weighted mean score of 3.17 and a standard deviation of 0.71 and was High among the respondents. Teachers may be helped in enhancing their quality of teaching by giving targeted trainings towards developing the essential skills that teachers need and mastery of the subject content as well.

Table 6 illustrates the level of contributing factors to teachers' content knowledge as to Technology Fluency

From the statements above, "*I can navigate online platforms which may help in teaching Physics-related concepts and I can effectively present in class various lessons in Physics with the use of ICT*" yielded the highest mean score *(M=3.11, SD=0.46)* and was remarked as Agree. On the other hand, the statement "*I can use Physics laboratory equipment well*" received the lowest mean score of responses with *(M=2.92, SD=0.55)* yet was also remarked Agree.

Table 6. Level of contributing factors to teachers' content knowledge as to Technology Fluency

STATEMENTS	MEAN	SD	REMARKS
I think there is a sufficient laboratory practice towards the specific domain of Physics subject.	2.94	0.58	Agree
I can use Physics laboratory equipment well.	2.92	0.55	Agree
I am well-oriented on the functions of the different Physics laboratory equipment.	2.94	0.67	Agree
I can navigate online platforms which may help in teaching Physics-related concepts.	3.11	0.46	Agree
I can effectively present in class various lessons in Physics with the use of ICT.	3.11	0.46	Agree
Weighted Mean	3.01		
SD	0.55		
Verbal Interpretation	High		

The level of contributing factors to teachers' content knowledge as to Technology Fluency attained a weighted mean score of 3.01 and a standard deviation of 0.55 and was High among the respondents. Based on the data, it can be implied that teachers are fluent in the use of online platforms and can manipulate and transform it as a learning material. However, teachers have low confidence in using laboratory equipment as a technological aid in their laboratory activities. Provision of trainings to gain a hands-on experience and familiarization on how to use the available equipment will support teachers in facilitating laboratory activities effectively.

Table 7. Level of contributing factors to teachers' content knowledge as to research engagement in Physics-related studies

STATEMENTS	MEAN	SD	REMARKS
I know where to find credible research in Physics.	2.97	0.61	Agree
I am aware of the current research in Physics on the national and international level.	2.75	0.65	Agree
I have an internet connection available to supplement my research of concepts in Physics.	3.22	0.64	Agree
I am highly inclined in developing research related in the Physics subject.	2.75	0.55	Agree
I am interested in discovering new concepts/facts/innovations which are outcomes of the recent Physics-related researches conducted.	3.28	0.57	Strongly Agree
Weighted Mean	2.99		
SD	0.64		
Verbal Interpretation	High		

Table 7 illustrates the level of contributing factors to teachers' content knowledge as to research engagement in Physics-related studies

From the statements above, "*I am interested in discovering new concepts/facts/innovations which are outcomes of the recent Physics-related researches conducted*" yielded the highest mean score *(M=3.28, SD=0.57)* and was remarked as Strongly Agree. On the other hand, the statement "*I am aware of the current research in Physics on the national and international level and I am highly inclined in developing research related in the Physics subject*" received the lowest mean score of responses with *(M=2.75, SD=0.65, 0.55)* yet was also remarked Agree.

The level of contributing factors to teachers' content knowledge as to research engagement in Physics-related studies attained a weighted mean score of 2.99 and a standard deviation of 0.64 and was High among the respondents. Smither (2014) stated that research engagement may contribute to actively develop teacher education by enhancing teaching and learning by using it to make informed decision-making policies and programs, using it to structure teacher education programs, using it to equip educators in discerning correct information, and using to conduct their own research to investigate whether a particular intervention may affect the educational practice.

Table 8. Level of contributing factors to teachers' content knowledge as to peer observation and coaching

STATEMENTS	MEAN	SD	REMARKS
I feel that there is no risk in giving wrong answers with regards to classroom culture.	2.69	0.89	Agree
I do not feel helpless as if I am not good enough when solving Physics problems.	2.97	0.61	Agree
I feel like I am getting motivation from my fellow Physics teachers.	3.36	0.59	Strongly Agree
I receive extra support from my fellow Physics teachers in creating more engaging learning activities.	3.36	0.54	Strongly Agree
I adapt the best practices of my colleagues and superiors in teaching the content of the Physics subject more effectively.	3.47	0.51	Strongly Agree
Weighted Mean	3.17		
SD	0.70		
Verbal Interpretation	High		

Table 8 illustrates the level of contributing factors to teachers' content knowledge as to peer observation and coaching

From the statements above, "*I adapt the best practices of my colleagues and superiors in teaching the content of the Physics subject more effectively*" yielded the highest mean score *(M=3.47, SD=0.51)* and was remarked as Strongly Agree. On the other hand, the statement "*I feel that there is no risk in giving wrong answers with regards to classroom culture*" received the lowest mean score of responses with *(M=2.69, SD=0.89)* yet was also remarked Agree.

The level of contributing factors to teachers' content knowledge as to peer observation and coaching attained a weighted mean score of 3.17 and a standard deviation of 0.70 and was High among the respondents. The presence of peer coaching and mentoring among teachers in the Science department has been found to be positive and informative. Based on the responses, it can be said that conducting mentoring sessions provides an avenue for professional development where teachers share teaching ideas and helps give feedback on development of lesson and teaching strategy.

Table 9 presents the level of student's content knowledge in Physics as to test scores. Out of a total number of sixty-six respondents, the score *"26 to 31"* received the highest frequency of forty (40) or 60.61% of the total sample-population with descriptive equivalent of *Fairly Satisfactory*. The score *"42 to 37"* received the frequency of twenty-one (15) or 22.73% of the total sample-population with descriptive equivalent of *Satisfactory***.** While the score *"25 and below"* received the lowest frequency of eleven (11) or 16.67% of the total sample-population with descriptive equivalent of *Did not meet Expectation*.

With a *(Weighted Mean = 33.40, SD = 1.40), lowest score of 14 and highest score of 37* it shows that the level of student's content knowledge in Physics as to test scores has a descriptive equivalent of *Satisfactory* and verbally interpreted as *Average*.

Table 9. **Level of student's content knowledge in Physics as to test scores**

Score	f	%	Descriptive Equivalent
44 - 50	0	0	Outstanding
38 - 43	0	0	Very Satisfactory
32 - 37	15	22.73	Satisfactory
26 - 31	40	60.61	Fairly Satisfactory
25 and below	11	16.67	Did not meet Expectation
Total	**66**	**100**	
Weighted Mean		***33.40***	
Lowest Score		***14***	
Highest Score		***37***	
SD		***1.40***	
Verbal Interpretation		***Average***	

Table 10. **Level of self-evaluation of students on the extent of their content knowledge in Physics**

STATEMENTS	MEAN	SD	REMARKS
I can easily interpret and answer Physics questions.	2.53	0.58	Agree
I believe that my mathematical skill for solving problems is sufficient.	3.49	0.66	Strongly Agree
I think that I have good comprehensive skills on definitions, laws, and basic principles of Physics.	2.59	0.61	Agree
I have no difficulty in converting one unit of measurement to another.	2.42	0.66	Moderately Agree
I can apply my problem-solving skills in thinking of solutions.	3.04	0.62	Agree
I know how to determine the relationship between quantities involved.	2.71	0.61	Agree

I do not usually encounter difficulties in accomplishing written outputs.	2.59	0.75	Agree
I do not have difficulty in the use of English language in expressing ideas.	3.35	0.70	Strongly Agree
I have the ability to research appropriate concepts in times where there is an unfamiliar concept.	3.25	0.60	Agree
I know how to utilize the available technology (browsing internet, using learning applications, MS Office) to maximize my learning of Physics.	3.39	0.65	Strongly Agree
I can easily interpret and understand what it shows when graphs, flow charts, and diagram are given.	3.21	0.68	Agree
I believe that my knowledge of natural laws in various fields including optics, classical and quantum mechanics, and electricity, are developed during High School.	2.82	0.70	Agree
I memorized basic equations so I can apply it to derive equations and solve more complex physics problem.	2.36	0.73	Moderately Agree
I continuously improve my mathematical skills in algebra, trigonometry, and geometry.	2.63	0.75	Agree
I can use my drawing skills for recording observed data such as in making ray and circuit diagrams and plotting graphs.	2.92	0.68	Agree
Weighted Mean	2.82		
SD	0.75		
Verbal Interpretation	High		

Table 10 illustrates the level of self-evaluation of students on the extent of their content knowledge in Physics.

From the statements above, "*I believe that my mathematical skill for solving problems is sufficient*" yielded the highest mean score *(M=3.49, SD=0.66)* and was remarked as Strongly Agree. On the other hand, the statement "*I memorized basic equations (like calculating force, velocity, and work) so I can apply it to derive equations and solve more complex physics problem*" received the lowest mean score of responses with *(M=2.36, SD=0.73)* yet was also remarked Moderately Agree.

The level of self-evaluation of students on the extent of their content knowledge in Physics attained a weighted mean score of 2.82 and a standard deviation of 0.75 and was High among the respondents.

Table 11. Level of contributing factors to student's content knowledge as to availability of learning resources

STATEMENTS	MEAN	SD	REMARKS
I think there is sufficient Physics learning materials (hard copy like textbooks and modules) that I can use in studying Physics.	3.04	0.73	Agree
I think there is sufficient Physics learning materials (soft copy like learning websites and online handouts) that I can use in studying Physics.	3.41	0.62	Strongly Agree
I feel that the textbooks available are comprehensive and easy to understand.	2.96	0.69	Agree
I feel that the conduciveness of the classroom allows me to easily focus and concentrate in class.	3.08	0.64	Agree
I feel that the number of students is fitted to the size of our classroom.	3.30	0.59	Strongly Agree
I am aware that our school has separate Physics laboratory.	2.78	0.79	Agree

I think that the apparatus in the laboratories is adequate and in proper working condition.	3.04	0.59	Agree
I have an internet connection available to supplement my research of concepts in Physics.	3.44	0.63	Strongly Agree
I can see that my teachers utilize available technology like projector and television in providing visual aids for the class.	3.42	0.59	Strongly Agree
I think that I can afford supplementary materials or tutoring whenever needed.	2.92	0.72	Agree
Weighted Mean	3.14		
SD	0.70		
Verbal Interpretation	High		

Table 11 illustrates the level of contributing factors to student's content knowledge as to availability of learning resources.

From the statements above, "*I have an internet connection available to supplement my research of concepts in Physics*" yielded the highest mean score *(M=3.44, SD=0.63)* and was remarked as Strongly Agree. This is followed by "*I can see that my teachers utilize available technology like projector and television in providing visual aids for the class*" with a mean score *(M=3.42, SD=0.59)* and was also remarked as Strongly Agree. On the other hand, the statement "*I am aware that our school has separate Physics laboratory*" received the lowest mean score of responses with *(M=2.78, SD=0.79)* yet was also remarked Agree. From the data in Table 12, majority of the respondents have internet at home.

The level of contributing factors to student's content knowledge as to availability of learning resources attained a weighted mean score of 3.14 and a standard deviation of 0.70 and was High among the respondents.

Table 12. Level of contributing factors to student's content knowledge as to exposure to practical work

STATEMENTS	MEAN	SD	REMARKS
I feel that students are given opportunities to perform laboratory experiments in Physics.	2.68	0.70	Agree
I am taught how to use and select appropriate laboratory instruments needed in applying Physics concepts like measuring devices, instruments, and chemicals.	2.70	0.74	Agree
I feel that students are given helpful practice exercises and drills to enhance problem-solving skills and retain physics concepts.	2.94	0.64	Agree
I feel that students are exposed to how the physics concepts can be applied in real life and in their future career.	3.06	0.59	Agree
I believe that attending science exhibits and field trips (like in museum and planetarium) at least once a year help me understand the physics concepts better.	3.39	0.63	Strongly Agree
I am interested in discovering new concepts/facts/innovations which are outcomes of the recent Physics-related research conducted.	3.26	0.69	Strongly Agree
I know where to find credible research in Physics.	2.84	0.77	Agree
I think that my family inspires me in pursuing physics-related learning opportunities.	2.39	0.79	Moderately Agree
I think that my parents provide support whenever I encounter difficulties in my Physics subject.	2.80	0.76	Agree
I think that my peers (friends and classmates) influence my mindset regarding learning of Physics.	3.05	0.68	Agree
Weighted Mean	2.91		
SD	0.75		
Verbal Interpretation	High		

Table 12 illustrates the level of contributing factors to student's content knowledge as to exposure to practical work.

From the statements above, "*I believe that attending science exhibits and field trips (like in museum and planetarium) at least once a year help me understand the physics concepts better*" yielded the highest mean score *(M=3.39, SD=0.63)* and was remarked as Strongly Agree. This is followed by "*I am interested in discovering new concepts/facts/innovations which are outcomes of the recent Physics-related research conducted*" with a mean score *(M=3.26, SD=0.69)* and was also remarked as Strongly Agree. On the other hand, the statement "*I think that my family inspires me in pursuing physics-related learning opportunities*" received the lowest mean score of responses with *(M=2.39, SD=0.79)* yet was also remarked Moderately Agree.

The level of contributing factors to student's content knowledge as to exposure to practical work attained a weighted mean score of 2.91 and a standard deviation of 0.75 and was High among the respondents. In practice of science, students can directly find the problem and find solutions for problems, improve decision making, gain reliable knowledge from the experience, identify discrepancies and conclude true statements. Since the application of science is present in real-life, it is beneficial to learners to acknowledge real-life problems and relate it to scientific theory (Delmoro, 2022). The following are examples of hands-on activities that will help learners in enhancing science literacy and allows students to experiment and explore, and other forms of experiential learning: collaborative problem-solving, peer-to-peer instruction, field trips, laboratory activities, and science projects.

Table 13. Level of contributing factors to student's content knowledge as to study habits

STATEMENTS	MEAN	SD	REMARKS
I take down notes to better retain Physics concepts and study it regularly.	2.91	0.71	Agree
I thoroughly read the text and worked through many realistic examples that demonstrate physics concepts.	2.98	0.64	Agree
I prepare for the test days or weeks before the test proper whenever there is an examination in Physics.	2.88	0.76	Agree
I do not find difficulty in combining studying in Physics and having leisure time.	2.49	0.76	Moderately Agree
I relate physics to what I already knew instead of memorizing essential knowledge in physics the way it is presented.	2.97	9,67	Agree
I believe that in physics, problem-solving entails matching problems with facts or equations, then plugging in values to get a number.	3.01	0.59	Agree
I believe that to use an equation in a problem, I need to know more than just what of word in the equation means.	3.23	0.61	Agree
I believe that finding the right equation to use is the most important part of solving a physics problem.	3.41	0.63	Strongly Agree
I give up and leave a word problem if I failed to solve it within 10 minutes.	2.40	0.94	Moderately Agree
I believe that higher grades are given to students who can memorize facts than those who think things through.	2.82	0.86	Agree
Weighted Mean	2.91		
SD	0.78		
Verbal Interpretation	High		

Table 13 illustrates the level of contributing factors to student's content knowledge as to study habits.

From the statements above, "*I believe that finding the right equation to use is the most important part of solving a physics problem*" yielded the highest mean score *(M=3.41, SD=0.63)* and was remarked as Strongly Agree. This is followed by "*I believe that to use an equation in a problem, I need to know more than just what of word in the equation means*" with a mean score *(M=3.23, SD=0.61)* and was also remarked as Strongly Agree. On the other hand, the statement "*I give up and leave a word problem if I failed to solve it within 10 minutes*" received the lowest mean score of responses with *(M=2.40, SD=0.94)* yet was also remarked Moderately Agree.

The level of contributing factors to student's content knowledge as to study habits attained a weighted mean score of 2.91 and a standard deviation of 0.78 and was High among the respondents. It was found out on the study of Mbonyiryivuze et. Al (2021) that even if students are aware of the importance of physics and shows interest of the subject matter, a considerable number of participants have claimed that learning physics is not fun. This lack of interest may affect student's effort to study Physics and result in decline of performance and heightened negative attitude towards the subject matter.

Table 14. Level of contributing factors to student's content knowledge as to teacher factor

STATEMENTS	MEAN	SD	REMARKS
I believe that physics teachers have a great influence on the extent of how I learn physics.	3.52	0.58	Strongly Agree
I can comfortably ask my teacher for further explanation on unclear concepts since my teachers always try to understand the needs and interest of the students.	3.17	0.67	Agree
I do not feel that teachers are too strict and "know-it-all" in dealing with students.	3.17	0.67	Agree
I think that our teachers makes concepts interesting and meaningful to me.	3.41	0.54	Strongly Agree
I think that our teachers give enough explanation of the concepts they are trying to teach in such a way that it can be easily learned, and clearly explain the words that I difficult to understand.	3.30	0.57	Strongly Agree
I feel that teachers try to give the same amount of attention and help to their students.	3.32	0.62	Strongly Agree
I think that our physics teacher usually promptly marks and returns the practical work done before the next one.	3.18	0.55	Agree
I think that our physics teacher provides learning activities, experiments, drills and exercises to help us apply concepts better.	3.36	0.58	Strongly Agree
I feel that there must be a visual aid (e.g. charts, models, simulations) that is simultaneously used with the discussion to help me understand physics better.	3.54	0.58	Strongly Agree
I believe that discussion is enough for me to learn concepts and solve Physics problems.	2.60	0.87	Agree
Weighted Mean	3.26		
SD	0.68		
Verbal Interpretation	Very High		

Table 14 illustrates the level of contributing factors to student's content knowledge as to teacher factor.

From the statements above, "*I feel that there must be a visual aid (e.g. charts, models, simulations) that is simultaneously used with the discussion to help me understand physics better*" yielded the highest mean score *(M=3.54, SD=0.58)* and was remarked as Strongly Agree. This is followed by "*I believe that physics teachers have a great influence on the extent of how I learn physics*" with a mean score *(M=3.52, SD=0.58)* and was also remarked as Strongly Agree. On the other hand, the statement "*I believe that discussion is enough for me to learn concepts and solve Physics problems*" received the lowest mean score of responses with *(M=2.60, SD=0.87)* yet was also remarked Agree.

The level of contributing factors to student's content knowledge as to teacher factor attained a weighted mean score of 3.26 and a standard deviation of 0.68 and was Very High among the respondents.

Table 15. Relationship between the teacher's profile and teacher's self-evaluation on the extent of content knowledge in Physics

		Content Knowledge Mastery	**Pedagogical Content Knowledge**	**Technological Content Knowledge**
Age	*r - value*	-0.278	-0.179	-0.359
	p - value	0.101	0.296	0.031
	Degree of Correlation	Weak (Negative)	Very Weak (Negative)	Weak (Negative)
	Analysis	Not significant	Not significant	Significant
Sex	*r - value*	0.012	0.159	-0.076
	p - value	0.943	0.034	0.660
	Degree of Correlation	Very Weak	Very Weak (Negative)	Very Weak (Negative)
	Analysis	Not significant	Significant	Not significant
Undergraduate Specialization	*r - value*	-0.003	-0.111	-0.141
	p - value	0.049	0.052	0.041
	Degree of Correlation	Very Weak (Negative)	Very Weak (Negative)	Very Weak (Negative)
	Analysis	Significant	Significant	Significant
Years in Service	*r - value*	-0.105	-0.045	-0.255
	p - value	0.054	0.037	0.013
	Degree of Correlation	Very Weak (Negative)	Very Weak (Negative)	Very Weak (Negative)
	Analysis	Significant	Significant	Significant
Years in Teaching Physics	*r - value*	0.200	0.196	0.039
	p - value	0.242	0.252	0.821
	Degree of Correlation	Very Weak (Negative)	Very Weak (Negative)	Very Weak (Negative)
	Analysis	Not significant	Not significant	Not significant

Legend:

±0.80 - ±1.00	*Very Strong*
±0.60 - ±0.79	*Strong*
±0.40 - ±0.59	*Moderate*
±0.20 - ±0.39	*Weak*
±0.00 - ±0.19	*Very Weak*

Table 15 presents the relationship between the teacher's profile and teacher's self-evaluation on the extent of content knowledge in Physics.

The undergraduate specialization and years in service of Teachers Profile were observed to have a significant relationship to the teacher's self-evaluation on the extent of content knowledge in Physics. This is based on the computed r values obtained from the tests with very weak to weak relationship. Furthermore, the p-values obtained were less than the significance alpha 0.05, hence there is a significance.

The analysis of effects of age, sex, undergraduate specialization, and years of service has been discussed in the former parts of the discussion. The learning experiences of a teacher is expected to increase with age, as long as the teacher continues to seek updating his/her mastery of the content. However, age has been found to have a negative weak relationship to the mastery of content knowledge. This may be attributed to having less exposure to learning experiences such as updating of knowledge and research as an individual ages. Unexpectedly, sex has been found to have significant relationship with the extent of pedagogical content knowledge of teachers based on their self-evaluation. This may be due to dominance of female in the teaching profession and has contributed to the image that teaching profession is a "woman's work" (Bongco and Ancho, 2020). The undergraduate specialization has been found to contribute to the extent of content knowledge in Physics. Without understanding of basic concepts in physics, the teacher will not be able to relate the subject matter to other fields and discipline. Lastly, the proficiency of teachers is associated with their years of service. Research suggested that varying number of years in teaching may be classified as beginning teachers, transitioning, and experienced teachers differ in the following dimensions: emotional support, classroom organization, and instructional support (Cologon and Pianta, 2020). This suggest that targeted support for each teacher category must be considered by governing agencies and school administrators.

While the age, sex, and years in teaching physics of Teachers Profile was not observed to have any significant relationship to the teacher's self-evaluation on the extent of content knowledge in Physics. Furthermore, the p-values obtained were greater than the significance alpha 0.05, hence there is absence of significance.

From the findings above, we can infer that at 0.05 level of significance, the null hypothesis "*There is no significant relationship between the teacher's profile and teacher's self-evaluation on the extent of content knowledge in Physics*" is rejected. Thus, the alternative should be accepted which incites that there is a partial significant relationship between them in terms of undergraduate specialization and years in service of teachers.

Table 16. **Relationship between the contributing factors and teachers' self-evaluation on the extent of content knowledge in physics**

		Content Knowledge Mastery	Pedagogical Content Knowledge	Technological Content Knowledge
Availability of resources	*r - value*	0.625	0.568	0.488
	p - value	0.042	0.000	0.003
	Degree of Correlation	Strong	Moderate	Moderate
	Analysis	Significant	Significant	Significant
Attendance to trainings and seminars	*r - value*	0.565	0.469	0.413
	p - value	0.0003	0.004	0.012
	Degree of Correlation	Moderate	Moderate	Moderate
	Analysis	Significant	Significant	Significant

Technological fluency	*r - value*	0.629	0.549	0.632
	p - value	3.974	0.001	0.043
	Degree of Correlation	Strong	Moderate	Strong
	Analysis	Not significant	Significant	Significant
Research engagement in Physics-related Studies	*r - value*	0.730	0.583	0.697
	p - value	0.005	0.000	2.377
	Degree of Correlation	Strong	Moderate	Strong
	Analysis	Significant	Significant	Not significant
Peer observation and coaching	*r - value*	0.198	0.078	0.497
	p - value	0.024	0.036	0.002
	Degree of Correlation	Very Weak	Very Weak	Moderate
	Analysis	Significant	Significant	Significant

Legend:
±0.80 - ±1.00 *Very Strong*
±0.60 - ±0.79 *Strong*
±0.40 - ±0.59 *Moderate*
±0.20 - ±0.39 *Weak*
±0.00 - ±0.19 *Very Weak*

Table 16 presents the significant relationship between the contributing factors and teachers' self-evaluation on the extent of content knowledge in physics

The availability of resources, attendance to trainings and seminars, technological fluency, research engagement in physics related studies, and peer observation and coaching of Contributing Factors were observed to have a significant relationship to the teacher's self-evaluation on the extent of content knowledge in Physics. This is based on the computed r values obtained from the tests with very weak to weak relationship. Furthermore, the p-values obtained were less than the significance alpha 0.05, hence there is a significance.

With regards to the execution of planned activities and effective delivery of the lesson, the availability of resources have a huge impact on how the teachers will implement the planned activities. Lack or absence of the essential resources such as laboratory equipment, textbooks, learning materials, and teaching guides may add up to the challenges faced by the teachers in the teaching and learning process. Also, students will not be able to gain exposure to practical work whenever laboratory equipment is unavailable or malfunctioning, unless the teacher innovates.

The attendance to training and seminars is also essential in enhancing the content knowledge of teachers. Trainings and seminars that targets least learned competencies in Physics and workshops to update the teacher's utilization of laboratory equipment is recommended. Similarly, these trainings and seminars may also enhance technology fluency of the teachers as they are expected to know how to use digital and traditional tools for teaching with ease. In terms of research engagement in physics-related studies, the participation and involvement in conducting or reading research will benefit the teaching and learning process by learning how and which interventions would work and simply, for professional development of teachers. Having *peer observation and coaching* of Contributing Factors help teachers to become more aware of how they perform and reflect and share strategies with peers.

From the findings above, we can infer that at 0.05 level of significance, the null hypothesis "*There is no significant relationship between the contributing factors and teachers' self-evaluation on the extent of content knowledge in physics*" is rejected. Thus, the alternative should be accepted which incites that there is a significant relationship between them.

Table 17. **Relationship between the student's test scores and the contributing factors affecting their extent of content knowledge in physics**

Contributing Factors		Availability of resources	Exposure to Practical Work	Study Habits	Teacher Factor
	r - value	0.173	0.046	0.227	0.061
	p - value	0.016	0.037	0.036	0.026
Test Scores	*Degree of Correlation*	Very Weak	Very Weak	Weak	Very Weak
	Analysis	Significant	Significant	Significant	Significant

Legend:
±0.80 - ±1.00 *Very Strong*
±0.60 - ±0.79 *Strong*
±0.40 - ±0.59 *Moderate*
±0.20 - ±0.39 *Weak*
±0.00 - ±0.19 *Very Weak*

Table 17 presents the significant relationship between the student's test scores and the contributing factors affecting their extent of content knowledge in physics

The *Availability of Resources, Exposure to Practical Work, Study Habits, and Teacher Factor* of Contributing Factors was observed to have a significant relationship to the test scores. This is based on the computed r values obtained from the tests with very weak to weak relationship. Furthermore, the p-values obtained were less than the significance alpha 0.05, hence there is a significance.

From the findings above, we can infer that at 0.05 level of significance, the null hypothesis "*There is no significant relationship between the student's test scores and the contributing factors affecting their extent of content knowledge in physics*" is rejected. Thus, the alternative should be accepted which incites that there is a significant relationship between them. With regards to availability of resources to the academic performance of students, Abas and Marasigan (2020) emphasized the importance of having a conducive laboratory in their study as the utilization of laboratory exposes the learners closer to the real-life application of Physics concepts. The research of Mbonyiryivuze et al (2021) supports the interconnectedness of student behaviors (e.g. study habits) and cognitive abilities (academic performance) of learners. The attitude and intrinsic motivation of students towards physics allows them to be mentally prepared and willing to absorb and understand concepts. And lastly, the teachers play a vital role in facilitating learning and mastery of content knowledge as they are the one to design the lessons with integration of experiential learning and inquisitive methods, prepare which activities and teaching strategies is necessary and is appropriate to the learner, and most importantly, they implement and execute the lesson plan.

CONCLUSION

The content knowledge of teachers based on their self-evaluation was found to be high and of remarkable level while the content knowledge of students based on their test scores has a descriptive equivalent of Satisfactory and verbally interpreted as Average. It was also found out that teachers are in need of support in the following aspects as it contributes to their level of content knowledge namely availability of resources, attendance to trainings and seminars, technological fluency, and research engagement in physics related studies. On the other hand, students' academic performance may be enhanced by considering that the following factors are met and enhanced: the availability of resources, exposure to practical work, study habits, and teacher factor.

RECOMMENDATIONS

Based on the self-evaluation of the teachers and students, it is recommended to conduct targeted seminar or training in least learned competencies in Physics for various proficiency levels of teachers. There are a lot of trainings implemented on the teaching strategies but only none to few focuses on the mastery of subject content. There should be short-term workshops and trainings on the use of laboratory apparatus and equipment to improve teacher's technological fluency. There is a need to upgrade laboratory facilities with upgraded equipment with manuals on how to operate and incorporation of ICT in the classroom to assist learning. And thus, the teacher will be able to utilize available learning resources and laboratory to cater students' need of exposure to practical work. The education sector should focus on provision of credible and comprehensive learning materials (online or printed) that are aligned with the national standard, appropriate to the level of knowledge of the learners, supplements student learning, and is easy to understand.

To bridge learning gaps, it is also recommended to conduct remediation or intervention on expected learning outcome in Physics. Bridging programs in Mathematics and English as it has an impact on conceptual understanding of Physics is recommended for students.

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