Innovations

Retrospective Evaluation of the Senior High School Science, Technology, Engineering, and Mathematics Strand

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Abstract

The study employs a descriptive cross-sectional research design in determining the retrospective evaluation of Senior High School – Science, Technology, Engineering, and Mathematics (SHS-STEM) graduates of the K to 12 Curriculum Courses in terms of perceived adequacy and relevance. A total of 280 STEM graduates of the University of the Cordilleras participated in the study. The study showed that the majority of STEM graduates pursued college degrees that are aligned with STEM.The study also revealed that the university is making a significant contribution to its graduates by providing very adequate faculty competence, library services, and laboratory facilities for the graduates to utilize in their higher education studies. It revealed further that UC SHS STEM graduates consider the core subjects and applied relevant and very relevant. It is interesting to note that they see all specialized subjects as very relevant to their college degrees.There are significant differences in the relevance of the SHS STEM subjects when the respondents are grouped according to the degree they took. For core subjects, the difference is in 21st Century Literature, Contemporary Philippine Arts, General Mathematics, Statistics and Probability, and UCSP. For specialized subjects, the difference is seen in all subjects. For applied subjects, the difference is in Practical Research 1, Practical Research 2, Empowerment Technology, and Entrepreneurship. Teachers need to revisit the delivery of applied subjects in terms of their contextualization of the strand. For specialized subject teachers, they may need to explore the transfer of learning of their subject.For future researchers, other strands in the senior high school and other exits of the SHS may be considered. Also, factors in choosing college degrees may be explored further.

Keywords: *1.Retrospective Evaluation 2. Senior High School 3. STEM 4. K-12 Curriculum 5. Review*

Introduction

Republic Act No. 10533 which is known as the 'Enhanced Basic Education Act of 2013' was signed into law and implemented in the Philippines to improve the quality of high school graduates by meeting the demands of global education. From 10 years of basic education, the Philippine Basic Education system strengthened its curriculum and implemented a mandatory kindergarten and the addition of two years in the senior high school – K to 12 Curriculum.

The Senior High School (SHS) program is envisioned to allow students extra years to learn abilities to develop and master the essential knowledge, skills, and attitudes for lifelong learning (Padios et al., 2021). Previously, high school education is designed to prepare students academically for tertiary education. Currently, one of its major thrusts, aside for higher education, is to help students develops skills that will help them enter the labor market (Palafox et al., 2018).

The K to 12 curriculum is designed with four exits—higher education, middle-level skills development, entrepreneurship, and employment. SHS graduates now have the optionsfor growth and productivity in the country. Also, graduates have broader opportunities and choices thanin the previous curriculum (Padios et al., 2021). Senior high school students geared towards employment, entrepreneurship, and middle-skills development exits undergo the same set of core courses as those in academic strands together with specialized subjects and applied courses under their chosen strand (Palafox et al., 2018).

In response to the different exits of the K to 12 curriculum, different tracks and strands were established in the senior high school. First is the Academic Track which is mainly designed to prepare students for higher education. Under the Academic Track are different strands—the Science, Technology, Engineering, and Mathematics (STEM) strand; Accountancy, Business, and Management (ABM) strand; Humanities and Social Sciences (HUMSS) strand; and the General Academic (GA) strand. Second is the Technical-Vocational-Livelihood (TVL) Track which is intended for the employment, entrepreneurship, and middle skills development exits. Third and fourth are the Sports Track (ST) and Arts and Design Track (ADT) for students with special skills and interests. Generally, however, the SHS program can prepare students for higher education since most general education courses of tertiary education were transferred to senior high school (Palafox et al., 2018).

This study focuses on the STEM strand which is intended for students with strong interests in science and math and other related subjects. As a transition between high school and college, the subjects offered in senior high school are designed to prepare them for college. These subjects are grouped into three: core subjects, applied subjects, and specialized subjects.

Core subjects are subjects that are taken by all senior high school students regardless of track or strand. This is comparable to the 'general education' subjects in college. These subjects include Oral Communication, Reading and Writing, Komunikasyon at Pananaliksik, Pagbasa at Pagsulat, 21st Century Literature, Contemporary Philippine Arts, Media and Information Literacy, General Mathematics, Statistics and Probability, Earth and Life Science, Physical Science, Personal Development, Understanding Culture Society and Politics, Introduction to Philosophy of the Human Person, and Health Optimizing Physical Education. These subjects will prepare the students for their college studies regardless of the nature of their degrees.

Applied subjects, on the other hand, are also taken by all students regardless of strand but are taught in the contextualized application of the subject the strand, or track. These subjects include English for Academic and Professional Purposes, Filipino sa Piling Larangan Empowerment Technologies, Entrepreneurship, Practical Research 1, Practical Research 2, and Inquiries, Investigations and Immersion.

STEM strand deals with advanced concepts and topics in science and mathematics compared to other strands. Specifically, STEM specialized courses include General Biology I and II, General Chemistry I and II, General Physics I and II, Precalculus, Basic Calculus, Capstone/Research Project. These subjects aim to prepare the students forSTEM-relateddegrees since they are expected to become pilots, architects, physicists, biologists, chemists, engineers, dentists, nutritionists, nurses, doctors, among others (De Guzman &Rogayan, 2020).

As a new program in Philippine education, limited tracer studies and curriculum evaluation have been conducted on senior high school curriculum specifically on the adequacy, relevance, and effectiveness of the program. There also seems to be a paucity ofresearch on the perceptions of students of senior high school students of the curriculum after graduation. This establishes the grounds for this study as an effort to bridge the research gap.

Literature Review

There are numerous tracer studies conducted by institutions, usually by higher education institutions, to get information on their graduates. Kalaw (2019) states that the general aim of tracer studies is to evaluate the medium to long-term impact of education programs. Rogayan (2019) adds that higher education institutions worldwide conduct tracer studies to obtain first-hand information from their graduates regarding the adequacy, acceptability, relevance, and effectiveness of curricular programs. Schomburg (2013), as cited by Rogayan (2019), also supplements that tracer studies are valuable sources of information for evaluating the results and effectiveness of the instruction, education, and training of a specific institution.

Osei et al. (2015) also mention that tracer studies and evaluation provide appropriate responses which can be used to review curriculum contents in order to produce graduates fitting for the job markets. Kalaw (2019) emphasized that tracer studies, aside from improving the education and training content and study conditions, improve the transition of their graduates from education to the labor market, and to better match the supply of skills with the demand for them.Tracer studies are means of maintaining curriculum relevance and providing targeted benefits to graduates to enhance the marketability of educational programs.

Since evaluations by graduates of an institution provide accurate feedback and highly useful insights regarding the effectiveness of an educational institution's curriculum (Rogayan, 2019), it can be used as grounds for course and program revisions and improvements. In as much as most tracer studies are conducted by higher education institutions to align their programs to the changing educational landscapes and industrial era, this study is conducted for graduates of the senior high school program and will focus on the alignment of their SHS training to their higher education. This is done using retrospective evaluations.

Retrospective evaluations provide feedback to an institution on the competencies and insufficiencies of a program and its alignment with the demands of related industries. It aims to effectively help institutions determine specific areas for growth and development considering as viewed by the graduates their relevant preparations and training provided by the institution (Rogayan, 2019). Thus, this study determines the graduates' retrospective evaluation of the STEM program in terms of its adequacy, relevance, and effectiveness towards higher education.

Importance of the Study

SHS graduates' evaluations of the SHS programs are an area that is lacking in existing literature because it is a young program in education. The SHS evaluations will provide accurate and highly useful perceptions of the adequacy, relevance, and effectiveness of the SHS STEM program by the University of the Cordilleras. These retrospective evaluations and tracer studies can assist teachers and administrators in revisions and improvements of program areas and curricular programs that are research-based, relevant, and responsive.

Limitations of the Study

The study focuses only on the adequacy of program areas and the relevance of the SHS STEM program areas as perceived by the graduates. The adequacy and effectiveness of the SHS program may be recommended for future researchers.

While it is tempting and more interesting to make a study so comprehensive that it involves all strands and all batches of graduates, the researcher decided to limit it to the STEM strand. Other factors like

factors affecting the choice of graduates' degree may also be considered for further studies. Also, other than the higher education exit, other exits may also be considered like middle level skills development, employment, and entrepreneurship.

Objectives of the Study

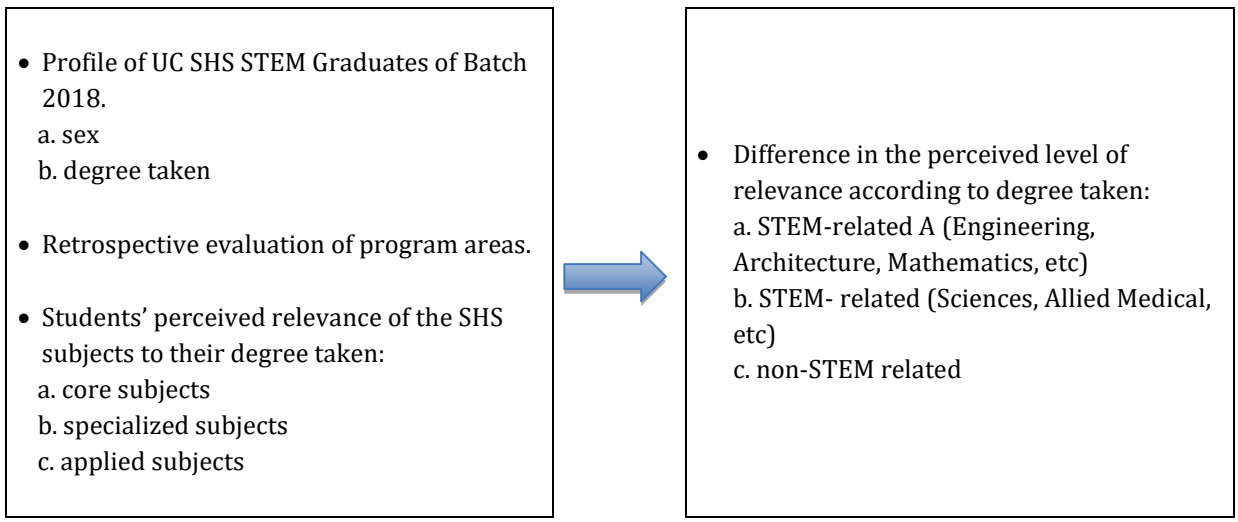
The study aims to trace the graduates of the SHS STEM and to document their retrospections of the SHS program. Specifically, it aims to answer the following:

1. What is the profile of UC SHS STEM graduates in terms of the following:
    a. sex
    b. degree taken
2. What are the students' retrospective evaluations of the program areas?
3. What are the students' perceived relevance of the SHS subjects to their degree taken:
    a. core subjects
    b. specialized subjects
    c. applied subjects
4. Is there a significant difference in the perceived relevance of SHS subjects to their degree taken in terms of their current degree?
    Null Hypothesis: There is no significant difference in the perceived relevance of SHS subjects to their degree taken.
    Alternative Hypothesis: There is a significant difference in the perceived relevance of SHS subjects to their degree taken.

Methodology

Research Design

This study employs a descriptive cross-sectional study research design. The data collected contain information about the SHS graduates as well as their retrospections.



Selection and Study Site

Participants in this study are the first batch of senior high school graduates at the University of the Cordilleras Senior High School. The school year 2016-2017 saw the first implementation of the K to 12 Basic Education Program which produced the first batch of graduates in 2018. Specifically, graduates of the STEM strand were considered.

A total of 944 finished their SHS last 2018 under STEMin the regular school year. A considerable number of students who finished after taking remediation were not considered in the population of the study. Using Raosoft, Inc, 274 was determined as the sample size.

Instrumentation and Data Collection

A survey questionnaire was used to collect the information from the respondents which was sent via Facebook, Messenger, and e-mail.The participants accomplished the survey using a Google Form. To verify, the respondents' school ID number was collected.

The survey questionnaire consisted of three main parts: a) personal information b.) retrospective evaluation of program areas c.) perceived relevance of core subjects to their current degree d.) perceived relevance of specialized subjects to their current degree e.) perceived relevance of applied subjects to their current degree.

The first part which is on personal data collects the participants' information such as sex and degree taken. Option in the degree taken includes a.) STEM-Related -Engineering and Architecture Degrees b.) STEM-Related -Allied and Medical Degrees c.) non-STEM-Related. The options are considered to determine the difference in the relevance of the SHS subjects in terms of their chosen degrees.

The second part of the questionnaire is on the retrospective evaluation of the SHS program areas. The tool was adapted from Rogayan (2019) which is established to have content validity and internal consistency (α=0.977). Specifically on the program areas with 10 items, it obtained a reliability index of α=0.857. Thus, the questionnaire is fitting to meet the aims of the study.

The third to the fifth part is adapted and modified from the CHED Graduate Tracer Study and Research and Statistics Center. The subjects presented are modified as it is presented in the SHS curriculum. Since it is a standard tool, it was assumed to be valid and reliable (Dotong et al., 2016).

Data Gathering Procedure

First, the researcher informed the University of the Cordilleras Senior High School office of the conduct of the study which may also be used as input for curriculum review and development. Then the number of STEM graduates of batch 2018 was requested to the same office. Since there is no official directory of the list of graduates, a class list during the school year was used in cross-checking the respondents.

Second, the researcher reached out to the graduates via social media since there was also no official school email of the students during that time. The survey questionnaire via Google form was sent to the students via Messenger, posted in the student's Facebook groups and pages, and sent through group chats. Students were also requested to send to their batchmates who cannot be reached using their Facebook names. To address ethical concerns, informed consent is contained in the first part of the survey. The informed consent discussed the anonymity of the respondents and described the nature of the data to be collected, data storage, and data disposal.

Third, the Google Form data was exported and downloaded as Excel. Since the form does not allow unanswered items, the data doesn't require cleaning. The data were further analyzed and processed.

Analysis of Data

There were a total of 280 responses collected from the SHS STEM graduates of 2018. All of the data were enumerated and processed using statistical software.

Frequency counts and percentage calculations were employed to answer objective number one. This provides descriptive statistics on the sex and nature of the degree taken by senior high school graduates.

To answer objectives two and three, descriptive data analysis was also used to determine the median. To arrive at the verbal description of each item, the arbitrary numerical guide was followed: (a) Retrospective Evaluation of Program Areas – (5) Very Adequate, (4) Adequate, (3) Moderately Adequate, (2) Slightly Adequate, (1) Not Adequate; and for (b) Level of Relevance of SHS Subjects – (5) Very Relevant, (4) Relevant, (3) Moderately Relevant, (2) Slightly Relevant, and (1) Not Relevant.

Finally, for the fourth objective, to determine the difference in the perceived relevance of the SHS subjects to the student's chosen degree, Kruskal-Wallis was used. Post hoc analysis using Tukey's Test was used to further determinethe significant differences in the groups.

Results and Discussion

Table 1.1. Frequency Distribution of Sex

Sex	N	%
Male	126	45%
Female	154	55%

The first table shows the profile of the UC SHS STEM graduates of Batch 2018. It presents that 45% of the respondents were male and 55% of the respondents were females.

Table 1.2. Frequency distribution of Current Degree Taken

Current Degree Taken	N	%
STEM-related (Engineering and Mathematics)	137	48.9%
STEM-related (Allied Medical)	103	36.8%
Non STEM related	40	14.3%

It can be gleaned from the table that 48.9% (N=126) of the graduates took STEM-related degrees in engineering and mathematics. These degrees include but are not limited to architecture, various engineering degrees, mathematics, computer science, and information technology. On the other hand, 36.8% (N=103) of the graduate enrolled in STEM-related degrees in allied medical degrees. These degrees include nursing, medical laboratory science, biology, and pharmacy, among others. Meanwhile, a considerable 14.3% (N=40) of the graduates took non-STEM-related degrees like criminology and accountancy.

The number of graduates who took degrees not-related to their strand is considerably low compared to Padios, et al. (2021) where almost 50% of the SHS graduates took degrees not aligned to their SHS strand. The number is also good compared to Santos, et. Al (2019) where 80.67% of graduates took degrees not aligned with their course.

With a combined number of 85.7% of graduates taking degrees related to STEM, it implies that the majority of the students were guided in taking a strand aligned to their degree in college which is the aim of the senior high school program. The training and foundational knowledge provided to them in SHS were hoped to have guided them in their college degree. There are different factors to consider in the alignment of the SHS strand to a college degree such as policies and guidelines of the admitting college, family income, availability of the course, and others. These factors were not included in the present study and are recommended for future researchers.

Table 2. Retrospective Evaluation of Program Areas

Area	Median	Description
Vision, Mission, Goals and Objectives	4.00	Adequate
Faculty Competence	5.00	Very Adequate
Curriculum and Instruction	4.00	Adequate
Support to Students	4.00	Adequate
Research and Development	4.00	Adequate
Extension and Community Involvement	4.00	Adequate
Library Services	5.00	Very Adequate
Physical Plant and Facilities	4.00	Adequate
Laboratories	5.00	Very Adequate
Administration and Management	4.00	Adequate

Results reveal that the graduates' collective evaluation of the program areas is adequate and very adequate to their higher education and especially to their chosen degree. The Faculty Competence (m=5.00), Library Services (m=5.00), and Laboratories (m=5.00) obtained the highest ratings which are classified as very adequate. This implies that teachers in the senior high school are very competent in delivering the curriculum to the senior high school students and training them for higher education. A very adequate library service also means that the university was able to cater to the resources needed by the students in their study from books to digital resources. Graduates also evaluate laboratories in the university as very adequate. This implies that as STEM students who are expected to take STEM-related degrees, they are equipped with laboratory skills, and they are competent in laboratory courses.

Lower median, but with adequate evaluation, were obtained in VMGO, Curriculum and Instruction, Support to Students, Research, and Development, Extension and Community Involvement, Physical Plant and Facilities, and Administration and Management. This shows program areas that the university needs to take a closer look into as to how can it be improved to better cater to the students. As cited by Rogayan (2019), tracer studies such as this study shall be a basis of informed and evidence-based decisions about the potential improvement of an institution'sservices Nevertheless, the adequate and very adequate evaluation of the graduates of the ten program areas are indicative that the senior high school in the university is effective in training senior high school students to prepare them for higher education.

Table 3.1. Relevance of Core Subjects to Current Degree

Core Subjects	Median	Description
Oral Communication	5.00	Very Relevant
Reading and Writing	5.00	Very Relevant
Komunikasyon at Pananaliksik…	4.00	Relevant
Pagbasa at Pagsusuri ng Iba'tIbangTeksto	4.00	Relevant
21st Century Literature…	4.00	Relevant
Contemporary Philippine Arts from the Regions	4.00	Relevant
Media and Information Literacy	4.00	Very Relevant
General Mathematics	5.00	Very Relevant
Statistics and Probability	5.00	Very Relevant
Earth Science	4.00	Relevant
Disaster Readiness and Risk Reduction	5.00	Very Relevant
Personal Development	5.00	Very Relevant
Understanding Culture , Society and Politics	4.00	Relevant
Introduction to the Philosophy…	4.00	Relevant
Physical Education and Health	4.00	Relevant

Table 3.1. presents the relevance of SHS core subjects to the current degree. It shows that Oral Communication, Reading and Writing, General Mathematics, Statistics and Probability, Disaster Readiness and Risk Reduction, and Personal Development are rated as very relevant to the graduates. Lower median, but still evaluated as relevant, includes Komunikasyon at Pananaliksik, Pagbasa, 21st Century Literature, Contemporary Philippine Arts from the Regions, Media and Information Literacy, Earth Science, Understanding Culture, Society and Politics, Philosophy, and Physical Education and Health. Having relevant and very relevant evaluations in the fifteen core subjects is congruent with the aims of the Department of Education to prepare senior high school students for higher education regardless of the strand. This calls, however, a review of the specific topics in the subjects tagged as relevant.

Table 3.2.Relevance of Specialized Subjects to Current Degree

Specialized Subjects	Median	Description
Pre-Calculus	5.00	Very Relevant
Basic Calculus	5.00	Very Relevant
General Biology 1	5.00	Very Relevant
General Biology 2	5.00	Very Relevant
General Chemistry 1	5.00	Very Relevant
General Chemistry 2	5.00	Very Relevant
General Physics 1	5.00	Very Relevant
General Physics 2	5.00	Very Relevant
Capstone Project/ Research Project	5.00	Very Relevant

Table 3.2. presents the relevance of SHS STEM specialized subjects to the current degree of the graduates. It shows that all specialized subjects in the STEM program are relevant to the graduates' current degree from Precalculus, Basic calculus, General Biology 1, General Biology 2, General Chemistry 1, General Chemistry 2, General Physics 1, General Physics 2, and Capstone Project. This implies that all knowledge and skills obtained from these subjects are utilized by the students in their chosen degrees. This also supports the goal of the STEM strand which is to prepare SHS students forSTEM-related degrees in college. This shows that there has been a careful curation of specialized subjects for STEM students.

Table 3.3 Relevance of Applied Subjects to Current Degree

Applied Subjects	Median	Description
English for Academic and Professional Purposes	4.00	Relevant
Filipino sa Piling Larangan – Akademik	4.00	Relevant
Practical Research 1	5.00	Very Relevant
Practical Research 2	5.00	Very Relevant
Empowerment Technology	4.00	Relevant
Entrepreneurship	4.00	Relevant
Inquiries, Investigations and Immersion	5.00	Very Relevant

Table 3.3. presents the relevance of the SHS STEM applied subjects to the graduates' chosen degree. It reveals that Practical Research 1, Practical Research 2, and Inquiries, Investigations, and Immersion subjects are evaluated as very relevant by the graduates. This is interesting since all these subjects are research subjects in nature. Thus, it implies that research knowledge and skills obtained from these subjects are important for students as they pursue higher education. Lower median, but still evaluated as relevant, includes English for Academic and Professional services, Filipino sa Piling Larangan, Empowerment Technology, and Entrepreneurship. A review for the content of these subjects as aligned to college courses may be considered.

Table 4.1a Difference in the Relevance of Core Subject According to Current Degree

Core Subjects	F	p
Oral Communication	0.777	0.678
Reading and Writing	3.704	0.157
Komunikasyon at Pananaliksik…	4.727	0.094
Pagbasa at Pagsusuri ng Iba'tIbangTeksto	5.557	0.062
21st Century Literature…	7.366	0.025
Contemporary Philippine Arts from the Regions	7.921	0.019
Media and Information Literacy	2.414	0.299
General Mathematics	35.826	0.000
Statistics and Probability	17.553	0.000
Earth Science	6.369	0.041
Disaster Readiness and Risk Reduction	2.026	0.363
Personal Development	1.994	0.369
Understanding Culture , Society and Politics	6.036	0.049
Introduction to the Philosophy…	2.323	0.313
Physical Education and Health	0.004	0.998

Kruskal-Wallis was used to compare the relevance of the core subjects in terms of the graduates' current degree taken—STEM related (engineering and mathematics), STEM related (allied medical), and non STEM related. There is a significant difference according to degree taken in the relevance of 21st Century Literature (F= 7.366, p=0.025), Contemporary Philippine Arts (F= 7.921, p=0.019), General Mathematics (F= 35.826, p=0.000), Statistics and Probability (F= 17.553, p=0.000), Earth Science (F= 6.369, p=0.041), and Understanding Culture, Society and Politics (F= 6.036, p=0.049).

As core subjects, these subjects are delivered to all SHS regardless of track or strand with the wisdom also that it prepares them for any exit path and any degree in higher education. These subjects replace the supposed general education subjects in college before the implementation of the K12 Curriculum. Thus, there should be no differences in the subjects' relevance according to degree taken. There are different factors to consider, however, that contributes to the difference such as the nature of the subjects as pre-requisite or foundational subject to the degree taken.

Table 4.1b Pairwise Analysis of Core Subject with Significant Difference

					Pairwise Analysis	
		n	mean	SD	Engineering & Math	Allied Medical
21st Century Literature	Engineering & Math	137	3.686	1.116		
	Allied Medical	103	3.412	1.233	0.334	
	non STEM	40	3.975	1.143	0.333	0.024
Contemporary Philippine Arts	Engineering & Math	137	3.686	1.180		
	Allied Medical	103	3.350	1.273	0.126	
	non STEM	40	3.900	1.257	0.028	0.671
General Mathematics	Engineering & Math	137	4.701	0.623		
	Allied Medical	103	4.087	1.001	0.00	
	non STEM	40	4.125	0.882	0.00	1.000

Statistics and Probability	Engineering & Math	137	4.693	0.613		
	Allied Medical	103	4.281	0.923	0.001	
	non STEM	40	4.225	1.025	0.009	1.000
Earth Science	Engineering & Math	137	4.175	0.977		
	Allied Medical	103	3.941	1.178	0.612	
	non STEM	40	3.600	1.336	0.041	0.407
UCSP	Engineering & Math	137	4.001	1.068		
	Allied Medical	103	3.806	1.164	0.577	
	non STEM	40	4.325	0.859	0.347	0.045

Further, post-hoc analysis reveals that there is a significant difference mainly involving students who pursued non STEM degrees. It shows that in 21st Century literature, students who chose non-STEM degrees (x=3.975) significantly view its relevance (p=0.024) compared to Allied Medical students. In Contemporary Philippine Arts, students who chose non-STEM degrees (x=3.900) significantly views its relevance (p=0.028) over Engineering and Math and non-STEM degrees students. Further, for General Mathematics, Engineering and Math degree students (x=4.701) significantly views its relevance compared to Allied Medical degree students (x=4.087, p=0.000) and non-STEM degree students (x=4.125, p=0.000). This is the same in Statistics and Probability where Engineering and Math degree students (x=4.693) significantly views its relevance compared to Allied Medical degree students (x=4.281, p=0.001) and non-STEM degree students (x=4.225, p=0.009). For Earth Science, Engineering and Math degree students (x=4.175) view its relevance (p=0.041)compared to non-STEM degree students (x=3.600). Lastly, for UCSP, non-STEM degree students (x=4.325) statistically view its relevance (p=0.045) compared to Allied Medical degree students (x=3.806).

Based on the results, it is interesting that for these core subjects, non-STEM degree students significantly view the relevance of the non-STEM subject. This may be because their current degrees have post requisite of the core subjects like 21st Century Literature, Contemporary Philippine Arts, and UCSP. On the other hand, for the mathematics core subjects of General Mathematics and Statistics and Probability, Engineering and Math degree students view its relevance compared to the other groups. This may be because of the nature of the subjects as foundation of higher math subjects and tertiary education. Lastly, for Earth science, Allied Medical degree students views significantly its relevance compared to the other groups. This may also be attributed to the nature of the subject.

Table 4.2a Difference in the Relevance of Specialized Subject According to Current Degree

Specialized Subjects	f	p
Pre-Calculus	101.031	0.000
Basic Calculus	99.804	0.000
General Biology 1	78.269	0.000
General Biology 2	77.989	0.000
General Chemistry 1	57.701	0.000
General Chemistry 2	57.167	0.000
General Physics 1	79.322	0.000
General Physics 2	80.516	0.000
Capstone Project/ Research Project	36.340	0.000

Kruskal-Wallis was used to compare the relevance of the SHS STEM specialized subjects in terms of the graduates' current degree taken—STEM related (engineering and mathematics), STEM related (allied medical), and non STEM related. There is a significant difference in the relevance of the specialized

subjects according to degree taken in all the specialized subjects: Precalculus (F= 101.031, p=0.000), Basic Calculus (F= 99.804, p=0.000), General Biology 1 (F= 78.269, p=0.000), General Biology 2 (F= 77.989, p=0.000), General Chemistry 1 (F= 57.701, p=0.000), General Chemistry 2 (F= 57.167, p=0.000), General Physics 1 (F= 79.322, p=0.000), General Physics 2 (F= 80.516, p=0.000), and Capstone Project (F= 36.340, p=0.000).

Table 4.2b Pairwise Analysis of Specialized Subject with Significant Difference

					Pairwise Analysis	
		n	mean	SD	Engineering & Math	Allied Medical
Precalculus	Engineering & Math	137	4.737	0.645		
	Allied Medical	103	3.350	1.412	0.000	
	non STEM	40	2.950	1.327	0.000	0.242
Basic Calculus	Engineering & Math	137	4.752	0.628		
	Allied Medical	103	3.398	1.403	0.000	
	non STEM	40	2.950	1.339	0.000	0.179
General Biology 1	Engineering & Math	137	3.788	1.363		
	Allied Medical	103	4.728	0.660	0.000	
	non STEM	40	2.750	1.256	0.000	0.000
General Biology 2	Engineering & Math	137	3.781	1.360		
	Allied Medical	103	4.718	0.663	0.000	
	non STEM	40	2.725	1.261	0.000	0.000
General Chemistry 1	Engineering & Math	137	4.314	1.020		
	Allied Medical	103	4.621	0.805	0.000	
	non STEM	40	2.925	1.384	0.000	0.000
General Chemistry 2	Engineering & Math	137	4.307	1.026		
	Allied Medical	103	4.612	0.795	0.052	
	non STEM	40	2.900	1.373	0.000	0.000
General Physics 1	Engineering & Math	137	4.708	0.632		
	Allied Medical	103	4.001	1.240	0.000	
	non STEM	40	2.700	1.343	0.000	0.000
General Physics 2	Engineering & Math	137	4.715	0.629		
	Allied Medical	103	4.010	1.241	0.000	
	non STEM	40	2.700	1.343	0.000	0.000
Capstone Project	Engineering & Math	137	4.547	0.757		
	Allied Medical	103	4.418	0.945	1.000	
	non STEM	40	3.325	1.327	0.000	0.000

Further, post hoc analysis reveals that students who took non-STEM degrees did not significantly find the relevance of the specialized subjects to their current degree compared to those who took Engineering and Math degrees and Allied Medical degrees. This was expected especially if their degree is completely different and far from STEM. Differences may also be seen between Engineering and Math and Allied Medical.

Table 4.3.Difference in the Relevance of Applied Subject According to Current Degree

Applied Subjects	f	p
English for Academic and Professional Purposes	2.142	0.343
Filipino sa Piling Larangan – Akademik	5.047	0.080
Practical Research 1	30.097	0.000
Practical Research 2	30.250	0.000
Empowerment Technology	20.169	0.000
Entrepreneurship	23.983	0.000
Inquiries, Investigations and Immersion	4.927	0.085

Kruskal-Wallis was used to compare the relevance of the applied subjects in terms of the graduates' current degree taken—STEM related (engineering and mathematics), STEM related (allied medical), and non-STEM related. There is a significant difference in the relevance of the applied subjects according to degree taken in Practical Research 1 (F= 30.097, p=0.000), Practical Research 2 (F= 30.250, p=0.000), Empowerment Technology (F= 20.169, p=0.000), and Entrepreneurship (F= 23.938, p=0.000).

Table 4.2b Pairwise Analysis of Specialized Subject with Significant Difference

					Pairwise Analysis	
		n	mean	SD	Engineering & Math	Allied Medical
Practical Research 1	Engineering & Math	137	4.642	0.735		
	Allied Medical	103	4.670	0.600	1.000	
	non STEM	40	3.950	0.986	0.000	0.000
Practical Research 2	Engineering & Math	137	4.650	0.723		
	Allied Medical	103	4.670	0.584	1.000	
	non STEM	40	3.950	0.986	0.000	0.000
Empowerment Technology	Engineering & Math	137	4.387	0.885		
	Allied Medical	103	3.816	1.127	0.000	
	non STEM	40	4.125	0.822	0.119	0.788
Entrepreneurship	Engineering & Math	137	4.182	0.994		
	Allied Medical	103	3.427	1.288	0.000	
	non STEM	40	3.675	1.141	0.031	1.000

Further, post hoc analysis reveals that for Practical Research 1, students who took Engineering and Math degrees (x=4.642) and Allied Medical Degrees (x=4.670) found it significantly relevant (p=0.000) compared to students who took non-STEM degrees (x=3.950). The same for Practical Research 2, students who took Engineering and Math degrees (x=4.650) and Allied Medical Degrees (x=4.670) found it significantly relevant (p=0.000) compared to students who took non-STEM degrees (x=3.950). For empowerment technology, the significant difference in relevance (p=0.000) is between students who took Allied Medical degrees (x=3.816) and Engineering and Math degrees (x=4.387). Lastly, for Entrepreneurship, students with Engineering and Math degrees (x=4.182) views its relevance compared to students with Allied Medical degrees (x=3.427, p=0.000) and non-STEM degrees.

Conclusion

This tracer study has provided the researcher an opportunity to obtain the necessary feedback from UC SHS STEM graduates.

1. 85.7% of the UC SHS STEM graduates of batch 2018 pursued college degrees that are aligned to STEM. It is recommended to observe the importance of orienting the students in the degrees they take in college.
2. The study revealed that UC SHS STEM is making significant contribution to its graduates by providing very adequate faculty competence, library services, and laboratory facilities for the graduates utilize in their higher education studies. There may be a need to improve the quality and adequacy of the different program areas like Vision, Mission, Goals and Objectives, Curriculum and Instruction, Support to Students, Research and Development, Extension and Community Involvement, Physical Plant and Facilities, and Administration and Management.
3. UC SHS STEM graduates consider the core subjects and applied relevant and very relevant. It is interesting to note that they see all specialized subjects as very relevant to their college degrees.
4. There are significant differences in the relevance of the SHS STEM subjects when the respondents are grouped according to the degree they took. For core subjects, the difference is in 21st Century Literature, Contemporary Philippine Arts, General Mathematics, Statistics and Probability, and UCSP. For specialized subjects, the difference is seen in all subjects. For applied subjects, the difference is in Practical Research 1, Practical Research 2, Empowerment Technology, and Entrepreneurship. Teachers need to revisit the delivery of applied subjects in term of its contextualization to the strand. For specialized subject teachers, they may need to explore on the far transfer of their subject.

Based on the findings of this study, it is recommended that UC SHS use the graduates' feedback as contained in the study to review existing program areas and program outcomes. For future researchers, other strands in the senior high school and other exits of the SHS may be considered. Also, factors in choosing college degrees may be explored further.

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