

LPIHS SCIENCE- ORIENTED SECTION ALUMNI TRACER STUDY: A BASIS FOR IMPROVEMENT IN CURRICULUM ELECTIVES

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Available Online: May 2023
 Revised: April 2023
 Accepted: February 2022
 Received: January 2022

Volume I Issue 2 (2023)
 DOI: 10.5281/zenodo.8019334
 E-ISSN: 2984-7184
 P-ISSN: 2984-7176
<https://guildofeducatorstesolinternational.com/research/>

Abstract

This study aimed to improve the curriculum electives of the Science-Enhanced Program using a tracer of Science-Oriented Section alumni from 2004 to 2015. It assessed the Science-Enhanced Program's strengths and weaknesses as viewed by alumni, collected their recommendations to improve the Science-Enhanced Curriculum in connection with current field demands, and constructed a SEP learner's packet. This study used a mixed-methods strategy. A total of 238 respondents were purposefully selected via quota sampling. The alumni's demographic profile based on their sex, civil status, educational attainment, employment information, as well as two extra questions, were collected using a tracer form. The first question focused on alumni perceptions of the science-enhanced program's strengths and weaknesses, and the second question focused on their suggestions for improving the science-enhanced curriculum with respect to current field demands. After gathering the data and assessing the results, it has been concluded that the strengths of the science-enhanced program are the following: elective subjects offered, teaching quality, interdisciplinary learning, and student workload. Meanwhile, the learning environment, the research capacity, and the facilities provided were listed as the weaknesses of the said program. The respondents concurred that the curriculum should include courses in robotics, programming, and other IT-related topics. The alumni also agreed that students should be exposed to more real-world scenarios in the curriculum. Hence, it has been validated that it can be used as a guide in crafting the competencies in formulating the SEP Learners' Packet.

Keywords: *Curriculum Electives, Science-Enhanced Program, Alumni, Learners' Packet*

INTRODUCTION

Science instruction begins in the third grade, and science is a required subject throughout compulsory education. The science curriculum consists of three parts: overall objectives for the level (primary, lower secondary, or upper secondary), objectives and content for each grade or section, and syllabus design. All schools must address all aspects of science instruction by developing an overall science plan that includes descriptions of the following: objectives and content; qualities, abilities, and attitudes to be cultivated; learning activities; teaching methodology and framework; and learning evaluation. According to Mullis, I. V. S., Martin, M. O., Goh, S., & Cotter, K. (Eds.) (2016), the international Science Curriculum for primary, lower secondary, and upper secondary education standards, objectives, and content are presented in the Courses of Study based on TIMSS.

Here in the Philippines, secondary school principals, both public and private, are advised to begin orienting their high school students on the various career pathways to pursue after high school as early as First Year, in accordance with

the mandate of secondary education to prepare students for lifelong learning and the world of work. Early exposure to the numerous professional options available in the curriculum will motivate children to learn and complete their basic education. Students can learn about their abilities, follow their passions, and develop their multiple intelligences through the many curricular programs. These are the special curricular programs that can be offered by schools: Special Program in the Arts (SPA); Special Program in Sports (SPS); Engineering and Science Education Program (ESEP) and Science and Technology (S & T); Special Program in Journalism (SPJ); Special Program in Foreign Language (SPFL); and Technical-Vocational (Tech-Voc) Education including the newly designed Career Pathways in Technology and Livelihood Education (CP-TLE).

As part of the K to 12 Basic Education Program, corresponding revisions have been made to the curriculum of the following Special Programs: Science and Technology, Arts, Sports, Journalism, Foreign Language, and Technical-Vocational Education. The implementation of the Special Curricular Programs shall be done progressively starting in School Year 2012-2013 following the DepEd Order No. 46, s.2012 entitled "Policy Guidelines on the Implementation of the Special Curricular Programs at the Secondary Level". In line with these are the sets of suggested elective subjects stated in the DepEd Order No. 55, s.2010 entitled "Policies and Guidelines on Strengthening Science and Mathematics Education at the Secondary Level" to strengthen the STEM education in the Philippines.

In response to market demands for the Science and Technology Education (STE) career pathway in support of the national development goals, Luis Palad Integrated High School, formerly known as Luis Palad National High School, aims to improve its quality education to the youth as the first ISO 9001:2015 certified public school in Quezon Province and the third in Calabarzon. As one of its specialized curricula, it has offered the Science-Oriented Program since 2000 and produced its first batch of graduates in 2004.

To further offer quality science education, the researchers would like to gauge the impact that the Science-Oriented curriculum has imparted to its alumni by determining the careers taken by them and examining the current demands on the different fields to improve the curriculum of elective subjects of Luis Palad Integrated High School. The researchers will focus on the Science-Oriented Section Alumni of Luis Palad Integrated High School from 2004 to 2015 to improve the set of subjects that can be useful to the students. The proponents believed that the curriculum design must evolve as new learning designs and technologies are developed and implemented to ensure that these methods remain based on effective learning practices.

In the Philippines and around the world, people are talking about a science and technology-based world and a knowledge-based economy. Given the expectations and skills required to live successfully in such an environment and the varied problems of science education in the country, there is a need to rethink what the vision of science education is. The current direction of curriculum development in many countries is towards scientific literacy, where the science education needs of all students are differentiated from those who have an interest in scientific careers.

According to Brawner (2011), the Science-Enhanced Curriculum is useful because of its links to technology and industry, which, from a national perspective, are areas of high priority for development. It develops students' scientific inquiry skills, values, and attitudes, such as objectivity, curiosity, honesty, and habits of mind, including critical thinking. All these are useful to the individual student for his personal development, future career, and life. These skills, values, attitudes, and dispositions are useful to the community that an individual student belongs to and is further useful to the country he lives in.

The Department of Education recognized the important role of school science education in supporting the development of scientific literacy in all students as well as motivating them to pursue careers in science, technology, and engineering. The STEM Curriculum for Junior High School was further established and formalized in the DepEd Order No. 149, s.2011, entitled "Career Pathways for High School Students". This program initiated by the department will prepare students for lifelong learning and the world of work. The school heads of secondary schools, both public and private, are advised to orient their high school students as early as First Year on the various career pathways to pursue after high school. Early orientation on the many career opportunities provided in the curriculum will strongly encourage them to learn and complete their basic education.

According to Molloy (2021), when it comes to schooling, most students regard core classes to be the foundation of a high school education. Elective classes, on the other hand, help students who wish to break free from the confines of academia, which force everyone to follow a predetermined career route.

While some students prefer topics like Science or English, most of them think that electives are their favorite classes. Elective courses are appealing because they give students several possibilities to have fun while learning. Elective courses allow students to select a course that motivates them to learn. It also allows students to explore their interests and potential career paths. Besides this, there are other benefits of having elective topics in high school.

First, elective subjects can open a learner's eyes to a plethora of fascinating employment possibilities. Engineering, math, and medical science are all popular these days. From music to sociology to psychology to health care, business, and astronomy to health care and entrepreneurship, there is something for everyone.

Second, there is no doubt that a high-grade point average is important when applying for a prestigious college. Colleges, on the other hand, are looking for a well-rounded student, not just good marks. Electives assist students in developing a solid resume that demonstrates their desire and curiosity to officials and future employers.

Third, many students complain about having to take the core subjects alone. Taking an elective subject allows them to take a break from the primary subjects and experiment with new talents.

Fourth, employers favor students who have a wide range of educational experiences. Many high school electives give learners hands-on experience that will benefit them in the future. Some students find part-time work that allows them to apply their talents in a real-world setting. Learners can better match the required qualifications of a position by developing their skills and gaining experience.

Fifth, electives expose students to real-world situations that do not necessitate academic papers or research. They not only learn to work alone, but they also develop self-motivation, discipline, and confidence in order to accomplish their objectives.

Sixth, educators must ensure that students' welfare and well-being are not put at risk due to stress and anxiety while taking the electives. Proper scheduling and providing the best effort will make them feel at ease while learning.

Lastly, elective subjects are used for a lot more than just filling up the gaps in a student's high school diploma requirements. It allows them to try out new hobbies and explore new possibilities. It also allows them to learn more about the subject they are enthusiastic about. They give students the abilities they need to boost their creativity that they might not find in the classroom.

The educational system has a key role to play in ensuring that opportunities are provided for all individuals to develop their skills continually in a lifelong learning perspective, enabling them to adapt to the rapidly changing requirements and conditions of the world. Researchers and education policymakers work hand in hand in designing the configuration

of education in accordance with the current needs of society. One of the tools that can help them in their goal is the use of tracer studies. Tracer studies provide information to educators and curriculum makers in crafting policies, training, and curricula in education. It also helps individuals decide on their educational paths, respectively.

According to Impact, T. & Training, O. (2017), tracer studies use a structured survey to conduct a retrospective analysis of graduates. Graduate surveys, alumni surveys, and graduate tracking are all terms used to describe them. Its main purpose is to assess the medium- to long-term impacts of educational programs and curricula. Improving the content and study circumstances of education and training, improving the transition of graduates from school to the job market, and better matching the supply of skills with the demand for them are some of the more concrete goals. Questions about study progress, the transition to work, work admission, career, utilization of learned competencies, present occupation, and connections to the educational institution are common subjects in tracer study questionnaires.

According to Kashem (2016), curriculum assessment should ideally take place in all stages of the curriculum development for quality education. The qualitative research identifies when and how it will be done. At this level students' attitudes towards learning experience have been evaluated in the evaluation process. Liking/disliking of the students of the curriculum may be evaluated to provide data for its improvement. Apparently, the self-assessment process identifies the areas of improvement for making the education qualitative and competitive in the education market.

Based on the study conducted by the Education on Scotland (2009), it has been established that technology and future market need are the two main determinants of curriculum development. Basically, the curriculum has been benchmarked against international curricula and is based on a solid evidence base, including the implications of the curriculum for learning, pedagogy, and what is effective in professional practice. The objectives of the curriculum should be to develop learners' skills and knowledge, which eventually feature successful learners in the job market and enriched confidence, become responsible citizens, and become effective contributors.

Objectives

This research sought to improve the curriculum electives of the Science-Enhanced Program through a tracer of the Science-Oriented Section Alumni for School Year 2004-2015.

Specifically, this study aimed to answer the following questions:

1. What is the demographic profile of the alumni based on their:
 1. 1 Sex
 1. 2 Civil status
 1. 3 Educational attainments
 - 1.4 Employment information
2. What are the strengths and weaknesses of the Science-Enhanced Program as perceived by the alumni?
3. What recommendations do the alumni offer for the improvement of the Science- Enhanced Curriculum in relation to the current demands of the field?

4. What competencies must be included in the Science-Enhanced Curriculum Electives as part of the SEP Learner's Packet?

METHODS

Research Design

The study employed mixed methods; the quantitative approach was used to determine the demographic profile of the alumni and it was also utilized in collecting their perceptions of the Science-Enhanced Program's strengths and weaknesses. Meanwhile, the researchers used thematic analysis to investigate the respondents' recommendations for improving the science-enhanced curriculum in relation to the field's current demands.

Population and Sampling

The participants of this research were the alumni of Luis Palad Integrated High School (formerly known as Luis Palad National High School) from the school year 2004 to the school year 2015. From a total of 620 alumni, the researchers trimmed the number of respondents to 238 using Slovin's formula. The chosen respondents were part of the Science-Oriented Program and were not covered by the K–12 curriculum. The respondents were chosen since they have enough work experience and were already exposed to the field.

The researchers also used quota sampling after obtaining the exact number of respondents from each batch from the school year 2004 to 2015. The gathering of data immediately stopped when the target of 238 participants answered the tracer form.

Instrumentation

For the data collection tool, a tracer form consisting of the demographic profile of the alumni based on their sex, civil status, educational attainment, employment information, and two other questions were prepared. The first question focused on the perception of the alumni on the strengths and weaknesses of the Science-Enhanced Program, and the second question centered on their recommendations for the improvement of the Science-Enhanced Curriculum in relation to the current demands of the field. The said form was subjected to face and content validation by experts before it was utilized.

Data Collection

The researcher carried out the tracing to collect the necessary data for this study. Following the administration of the tracer form, the data were analyzed, collated, tabulated, statistically treated, and presented to the elective teachers in charge of developing the learners' packet or the elective curriculum guide.

Data Analysis

Weighted mean was used in collecting the demographic profile and the perception of the alumni regarding the strengths and weaknesses of the Science-Enhanced Program. Further, thematic analysis was utilized in processing the

respondents' recommendations for the improvement of the science-enhanced curriculum in relation to the field's current demands. After analyzing and evaluating, the results of this study became the basis of the new learners' packet in Luis Palad Integrated High School.

RESULTS and DISCUSSION

Table 1. Demographic Profile of the Science- Enhanced Program Alumni

| Demographics | | Responses | | | | | | | |
|------------------------|--|---|--------|---|--------|----------------------|---------|-------|---------|
| Sex | | Male | | Female | | Total | | | |
| | | N | % | N | % | N | % | | |
| | | 99 | 41.60% | 139 | 58.40% | 238 | 100.00% | | |
| Civil status | | Single | | Married | | Total | | | |
| | | N | % | N | % | N | % | | |
| | | 212 | 89.08% | 26 | 10.92% | 238 | 100.00% | | |
| Educational attainment | | Vocational/College degree related to STEM | | Vocational/College degree unrelated to STEM | | Total | | | |
| | | N | % | N | % | N | % | | |
| | | 191 | 80.25% | 47 | 19.75% | 238 | 100.00% | | |
| Educational attainment | | Pursued Master's/Doctor's Degree | | Did not Pursue Master's/Doctor's Degree | | Total | | | |
| | | N | % | N | % | N | % | | |
| | | 33 | 13.87% | 205 | 86.13% | 238 | 100.00% | | |
| Employment information | | Employed to STEM related Job | | Employed to non-STEM related Job | | Presently Unemployed | | Total | |
| | | N | % | N | % | N | % | N | % |
| | | 157 | 65.97% | 81 | 34.03% | 36 | 15.13% | 238 | 100.00% |

Table 1 shows the demographic profile of the Science-Enhanced Program alumni. Based on the table above, 99 (41.60%) of the respondents were male while 139 (58.40%) were female. It was determined that 212 (89.08%) of

the alumni were single and 26 (10.92%) were married. There were 191 (80.25%) alumni who pursued a STEM-related vocational/college degree, and 47 (19.75%) who pursued a STEM-unrelated vocational/college degree. It was discovered that 157 (65.97%) of the respondents worked in STEM-related jobs, while the remaining 36 (15.31%) did not.

Table 2. Strengths and Weaknesses of the Science-Enhanced Program as Perceived by the Alumni

| Indicators | Strength | | Weakness | | Does Not Apply | | Total | |
|----------------------------|----------|--------|----------|--------|----------------|-------|-------|---------|
| | N | % | N | % | N | % | N | % |
| Elective Subjects Offered | 231 | 97.06% | 0 | 0.00% | 7 | 2.94% | 238 | 100.00% |
| Teaching quality | 228 | 95.80% | 8 | 3.36% | 2 | 0.84% | 238 | 100.00% |
| Interdisciplinary learning | 217 | 91.18% | 15 | 6.30% | 6 | 2.52% | 238 | 100.00% |
| Student Workload | 183 | 76.89% | 39 | 16.39% | 16 | 6.72% | 238 | 100.00% |
| Learning Environment | 176 | 73.95% | 50 | 21.01% | 12 | 5.04% | 238 | 100.00% |
| Research Capacity | 161 | 67.65% | 67 | 28.15% | 10 | 4.20% | 238 | 100.00% |
| Facilities | 102 | 42.86% | 123 | 51.68% | 13 | 5.46% | 238 | 100.00% |

The strengths and weaknesses of the Science-Enhanced Program (SEP) as perceived by alumni were shown in Table 2. According to the chart above, in terms of the elective subjects offered, 231 (97.06%) of the graduates believed that the offered elective subjects were beneficial. In terms of teaching quality, 228 respondents (95.80%) thought it was one of the SEP's strengths, whereas 8 (3.36%) saw some faults in this area. In relation to interdisciplinary learning, 217 (91.18%) saw it as a strength, whereas 15 (6.30%) saw it as a weakness. To continue, 183 alumni (76.89%) answered that the student workload is one of the program's strengths, while 39 (16.39%) saw it as a weakness. In terms of the Learning Environment, 176 (73.95%) stated it is one of the SEP's strengths, while 50 (21.01%) said it is one of its flaws. There were 161 (67.65%) respondents who agreed that the program's research capacity is effective, while 67 (28.15%) thought it is weak in certain ways. Consequently, 102 (42.86%) believed in the SEP's strength in terms of its current facilities. On the other hand, 123 (51.68%) said that one of the program's weaknesses is the facilities.

As shared by one of the alumni, "There were too many subjects!" During our time, we were the earliest in school yet we were the last one to leave. We still have calculus until 6pm, also, we have the shortest time for breaks plus we still have to practice for non-curricular activities." Others have unanimously agreed that programming, robotics, and other IT related subjects should be included in the curriculum. On the other hand, some said that the SEP elective subjects geared them toward their holistic development. Further, some alumni believed that the facilities available are not enough such as lab facilities and testing grounds for their science investigatory projects.

As supported by the study of the Education on Scotland (2009), it has been established that technology and future market need are the two main determinants of curriculum development. Basically, the curriculum has been benchmarked against international curricula and is based on a solid evidence base, including the implications of the curriculum for learning, pedagogy, and what is effective in professional practice. The objectives of the curriculum should be to develop learners' skills and knowledge, which eventually feature successful learners in the job market and enriched confidence, become responsible citizens, and become effective contributors.

Table 3. Recommendations of the Alumni towards the Improvement of the Science-Enhanced Curriculum

| Indicators | Recommendations and Feedback |
|--|---|
| FACULTY DEVELOPMENT | <ul style="list-style-type: none"> • Coordination is very important among educators especially the elective teachers to ensure better delivery of the service. • The teachers need improvement to continue and thrive for excellence every year. • The teachers should focus on building teamwork and camaraderie among students. |
| CAREER OPPORTUNITY | <ul style="list-style-type: none"> • Being part of a science-enhanced program makes you more prepared for the future. • The Science Enhanced Program at Luis Palad Integrated High School is an opportunity to grow and enhance our skills and knowledge to be ahead of other students in our batch. |
| SUBJECT OFFERING | <ul style="list-style-type: none"> • Much better if a subject related to Data Analysis was offered. • I liked how we had elective subjects because they were helpful especially when I went to university. • Continue the implementation of SIP to train our students to research as their preparation for their thesis during Senior HS and College. |
| 21ST CENTURY SKILLS DEVELOPMENT | <ul style="list-style-type: none"> • The program equipped me with valuable so-called "soft skills" which I think was essential in nurturing my personal artistry. • During my time, I just hope that there are more specialized programs designed to cater for individuals who relatively have a higher level of intelligence but excels in a more niche field. • Enhance oral skills. |
| ALIGNMENT OF SKILLS | <ul style="list-style-type: none"> • Prior to choosing a science-oriented section, a student must have already decided that she will pursue Science related courses. • Previously they are choosing those who are academic performers only not considering their own personal interest and believing that choosing this section is the best choice. |

| | |
|---|---|
| FACILITIES IMPROVEMENT | <ul style="list-style-type: none"> • More facilities and equipment in which students can perform hands on activities related to subject being discussed (related to science, engineering, ICT) |
| LEARNING ENVIRONMENT IMPROVEMENT | <ul style="list-style-type: none"> • Teach them to study for the learning - being able to think for themselves and not to study because of the fear of failing or being demoted to the next section. I believe that having elective subjects during high school was one of the advantages in college. Personally, I learned not only in academics, but also perseverance, hard work, and passion. • The students in the science academic program should have more exposure to real life experience of making experiments in the laboratory. The theoretical portion of science is well taught in LPHNS but there is a need to enhance the practical capability of the students. |
| | <ul style="list-style-type: none"> • One downside that I experienced from the program was the student workload. Most of the time, we were given projects and activities from multiple subjects all at the same time. I still find it manageable, though it would be better if the workload were lessened for the students to achieve a balance between school and social life. |

As a result of the data analysis, the responses of the respondents were categorized based on the similarities of their suggestions.

Faculty Development

The educational system has a key role to play in ensuring that opportunities are provided for all individuals to develop their skills continually in a lifelong learning perspective, enabling them to adapt to rapidly changing requirements and conditions of the world. Researchers and education policymakers work hand in hand in designing the configuration of education in accordance with the current needs of society (Molloy, 2021).

Based on the expressions of the learners, it was revealed that the respondents unanimously agreed that coordination among elective teachers is vital to ensure better delivery of the service, and they also need improvement to continue and thrive for excellence every year.

As stated by one of the learners: "The teachers should focus on building teamwork and camaraderie among students."

Career Opportunity

Here in the Philippines, secondary school principals, both public and private, are advised to begin orienting their high school students on the various career pathways to pursue after high school as early as First Year, in accordance with the mandate of secondary education to prepare students for lifelong learning and the world of work. Early exposure to the numerous career options available in the curriculum will motivate children to learn and complete their basic education. Students can learn about their abilities, follow their passions, and develop their multiple intelligences through the many curricular programs (Mullis, I. V. S., Martin, M. O., Goh, S., & Cotter, K. (Eds.) (2016).

Based on the statements of the learners, it was revealed that the respondents unanimously agreed that the Science Enhanced Program at Luis Palad Integrated High School is an opportunity to grow and enhance their skills and knowledge to be ahead of other students.

As stated by one of the learners: "Being part of a science-enhanced program makes you more prepared for the future."

Subject Offering

According to Molloy (2021), elective classes help students who wish to break free from the confines of academia, which force everyone to follow a predetermined career route. The elective subjects can open a learner's eyes to a plethora of fascinating employment possibilities. They are used for a lot more than just filling up the gaps in a student's high school diploma requirements. It allows them to try out new hobbies and explore new possibilities. It also allows them to learn more about the subject they are enthusiastic about. They give students the abilities they need to boost their creativity that they might not find in the classroom.

Based on the expressions of the learners, they liked how they had elective subjects because they were helpful, especially when they went to university. While some wish some ICT-related subjects to be included in the elective subjects.

One of the alumni expressed his support for the inclusion of research in the curriculum, "The continued implementation of SIP is beneficial to students' higher education."

21st Century Skills Development

According to Molloy (2021), electives expose students to real-world situations that do not necessitate academic papers or research. They not only learn to work alone, but they also develop self-motivation, discipline, oral skills, and confidence in order to accomplish their objectives.

As shared by one of the students: "The program equipped me with valuable so-called "soft skills" which I think was essential in nurturing not only my knowledge but also my personal artistry."

Based on the responses of the alumni, most of them agreed that the elective subjects not only developed their knowledge but also developed their soft skills and other communication skills.

Alignment of skills

According to Brawner (2011), Science-Enhanced Curriculum is useful because of its links to technology and industry, which, from a national perspective, are areas of high priority for development. It develops students' scientific inquiry skills, values, and attitudes, such as objectivity, curiosity, honesty, and habits of mind, including critical thinking. All these are useful to the individual student for his personal development, future career, and life. These skills, values, attitudes, and dispositions are useful to the community that an individual student belongs to and are further useful to the country he lives in.

When it comes to the alignment of the skills, most of the alumni took STEM related courses, and they can honestly state that their high school experience helped them a lot in their chosen path. As one of them shared, "Prior to choosing a science-oriented section, a student must have already decided that she will pursue Science related courses in the future."

Facilities Improvement

In the Philippines and around the world, people are talking about a science and technology-based world and a knowledge-based economy. Given the expectations and skills required to live successfully in such an environment and the varied problems of science education in the country, there is a need to rethink what the vision of science education is including the facilities to cater to the needs of the learners. The current direction of curriculum development in many countries is towards scientific literacy, where the science education needs of all students are differentiated from those who have an interest in scientific careers.

Majority of the alumni shared that more facilities and equipment must be provided for the learners for them to reach their full potential. One of them stated that, "More facilities and equipment in which students can perform hands-on activities related to subjects being discussed (related to science, engineering, ICT) is needed."

Learning Environment Improvement

Many high school electives give learners hands-on experience that will benefit them in the future. Learners can better match the required qualifications of a position by developing their skills and gaining experience. Students complain about having to take the core subjects alone. Taking an elective subject allows them to take a break from the primary subjects and experiment with new talents. In addition, educators must ensure that students' welfare and well-being are not put at risk due to stress and anxiety while taking the electives. Proper scheduling and providing the best effort will make them feel at ease while learning.

Based on the statements of the learners, it was revealed that the respondents unanimously agreed that the students in the science-enhanced program should have more exposure to real life experience of making experiments in the laboratory. The theoretical portion of science is well-taught in LPHNS but there is a need to enhance the practical capability of the students. They also commented on the student workload which they think is quite compacted.

As stated by one of the learners: "One downside that I experienced from the program was the student workload. Most of the time, we were given projects and activities from multiple subjects all at the same time. I still find it manageable, though it would be better if the workload were lessened for the students to achieve a balance between school and social life."

Table 4. Competencies to be Included in the Learner’s Packet of the Science- Enhanced Curriculum Electives

| Grade | Elective | Competencies |
|-------|-------------------|--|
| 7 | Research I | <p data-bbox="475 333 578 359">Quarter 1</p> <ul style="list-style-type: none"> <li data-bbox="526 380 1399 447">● Explain how the study habits contribute to the development of knowledge and perceptual capacities in Research. <li data-bbox="526 468 1230 493">● Explain scientific literacy and its importance in modern society. <li data-bbox="526 514 943 539">● Describe the two types of research. <li data-bbox="526 560 1399 627">● Explicate the importance of acquiring basic process skills in conducting research. <li data-bbox="526 648 1399 716">● Expound the importance of acquiring thinking skills in conducting research study. <li data-bbox="526 737 1268 762">● Explain and apply the steps of scientific method in research study. <li data-bbox="526 783 1273 808">● Apply the uses of the laboratory apparatus in the experimentation. <p data-bbox="475 842 578 867">Quarter 2</p> <ul style="list-style-type: none"> <li data-bbox="526 888 1057 913">● Describe the variables, constants, and groups. <li data-bbox="526 934 1029 959">● Enumerate the parts of the research paper. <li data-bbox="526 980 1187 1005">● Explain on how to write the parts of Chapter I in Research <p data-bbox="475 1039 578 1064">Quarter 3</p> <ul style="list-style-type: none"> <li data-bbox="526 1085 1078 1110">● Describe experimentation in a research method. <li data-bbox="526 1131 1370 1157">● Distinguish the possible causes of human mistakes and experimental errors. <li data-bbox="526 1178 1399 1203">● Explain how to present the research data through tabular and graphical format. <li data-bbox="526 1224 1127 1249">● Describe the referencing, citation, and paraphrasing. <li data-bbox="526 1270 1170 1295">● Explain how to write the parts of Chapter II in Research. <p data-bbox="475 1329 578 1354">Quarter 4</p> <ul style="list-style-type: none"> <li data-bbox="526 1375 1052 1400">● Identify ethical issues in conducting research. <li data-bbox="526 1421 1399 1488">● Discuss the Science Research Evaluation Committee (SRC), Institutional Regulatory Board (IRB) and Institutional Biological Safety Committee (IBC). <li data-bbox="526 1509 1179 1535">● Explain how to write the parts of Chapter III in Research. |

8

Research II

Quarter 1

- Explain the parts of a research proposal/ project plan.
- Write a research proposal/ project plan.
- Develop linkages and communication in research.
- Identify the types of library resources.
- Describe the different types of online resources.
- Identify the types of personal communication skills used in research.
- Prepare for a research title proposal.

Quarter 2

- Differentiate research problems and research objectives.
- Write an effective research introduction and purpose of the study.
- Write scope and limitations of a study.
- Write a good significance of the study.
- Define and interpret a conceptual framework.
- Describe a research paradigm.

Quarter 3

- Differentiate related studies and related literature.
- Evaluate significance of the study using available reviews and abstract.
- Evaluate significance of the study using MAARIE Framework.
- Write and develop related literature and studies.
- Cite authorities and references using different writing styles.
- Describe references/ bibliographies in different writing styles.

Quarter 4

- Describe the different kinds of research methods.
- Differentiate the kinds of research design.
- Explain technical specifications.
- Differentiate qualitative and quantitative research.
- Create an experimental flowchart.
- Cite the roles SRC-IBC-IRB in research.
- Prepare for a pre-oral defense.

Programming I Quarter 1

- Familiarize yourself with Python as a programming language, including its history, development, and application.
 - Explain the process of the proper installation of Python and text editor in the devices (desktop/ laptop/ cellphone).
 - Explain the different Data Types and Variables used in Python.
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- Determine what are strings in Python.
- Identify what Numbers and Booleans are in Python.
- Create a program that can perform basic calculations in solving mathematical problems.

Quarter 2

- Create a program that can ask Input from the user.
- Determine the different types of Operators used in Python.
- Explain what are the different Arithmetic and Assignment Operators.
- Explain what are the different Comparison and Logical Operators.
- Determine the basics of conditional execution that involves the different types of Python Operators.
- Create a program that can perform conversions of numbers and units.

Quarter 3

- Determine the different types of Data Structures in Python.
- Explain what Lists are in Python.
- Explain what are Tuples and Sets in Python.
- Explain what dictionaries are in Python.
- Identify the steps and methods on how to handle errors while typing codes and programs in Python.
- Create a program that can record your personal scores and grades from different subjects.

Quarter 4

- Explain how to create If - else Statements in Python.
- Explain how to create codes involving "for loops" in Python.
- Explain how to create codes involving "while loops" in Python.
- Explain how to create codes involving "functions" in Python.
- Create a "Number GuessingGame" using Python Codes and Programs.

9

Research III

Quarter 1

- Explain how Control Flow works in Python.
- Explain how If- and If-Else statements work.
- Explain how Nested If-Else statements work.
- Explain how iteration and Looping works in Python.
- Capstone Project #1

Quarter 2

- Describe While Loop and how it works.
- Explain how Nested While Loop works.
- Explain how For Loop works.
- Explain how Nested for Loops work.
- Capstone Project # 2

Quarter 3

- Identify the different Functions and Methods used in Python.
- Identify the other useful built-in methods in Python.
- Explain how Functions work in Python.
- Identify the different built-in Functions in Python including different parameters and arguments.
- Capstone Project # 3

Quarter 4

- Explain how Recursion works in Python.

- Explain how Object- Oriented Programming works.
- Explain how Classes work.

| | | | |
|----|-----------------------|-----------|---|
| | Programming II | Quarter 1 | <ul style="list-style-type: none"> • Explain the parts of the research proposal/ project plan. • Explain the importance of testing in research. • Describe study population, sample size and statistical power. • Describe the positive and negative studies in research. • Differentiate qualitative from quantitative research data. • Differentiate statistically significant from biologically significant. • Determine the mean, median, mode, decile and percentile for a given set of data. |
| | | Quarter 2 | <ul style="list-style-type: none"> • Explain the importance of rejecting or accepting hypothesis. • Calculate data/problems using z-test. • Calculate data/problems using t-test. • Calculate data/problems using One-Way ANOVA. • Calculate data/problems using Two-Way ANOVA. • Write the elements of Chapter II of the chosen topic in research. |
| | | Quarter 3 | <ul style="list-style-type: none"> • Calculate data/problems using post Hoc test. • Calculate data/problems using Pearson Correlation Coefficient(r). • Calculate data/problems using Spearman rho. • Calculate data/problems using chi-square. • Explain the different ways of presenting the results of the study. • Write the elements of Chapter III of the chosen topic in research. |
| | | Quarter 4 | <ul style="list-style-type: none"> • Explain ways of interpreting data. • Explain ways of accepting results using clinical, statistical, and sensory acceptability. • Explain ways of making conclusions and recommendations. • Explain ways of making Lay out of Project Display. • Explain ways of preparing for the oral defense and making PowerPoint presentation. • Present the new project proposal consisting of Chapters 1 to 3. |
| 10 | Research IV | Quarter 1 | <ul style="list-style-type: none"> • Understand the concept of IMRaD Format. • Explain how to write research using the IMRaD format. • Understand the guidelines for publishing research papers. • Creating your own Class • Final Capstone Project |

Quarter 2

- Understand the concept of assessing research for the continuation of the study.
- Understand the concept of re-evaluation process of the previous research study.

Quarter 3

- Explain the steps in re-evaluation of the previous research.
- Describe the independent research writing.
- Understand the concept of writing Independent Research writing.
- Explain the way of peer critiquing.

Quarter 4

- Chapters 1 to 5

Robotics

Quarter 1

- Identify the basic aspect of Robotics.
- Determine the other features of Robotics.
- Understand the importance of teaching Robotics.
- Develop basic skills using a breadboard.
- Apply Basic Skills in DIY Projects Using Breadboard.

Quarter 2

- BASIC (Beginners' All-purpose Symbolic Instruction Code) Programming
- Fundamentals of Programming in Python
- Coding using Python.
- Explore on Python Programming

Quarter 3

- Understanding the role of mBot in Robotics.
- Graphical Programming Skills, Electronics and Robotics.
- Exploring on mBot.

Quarter 4

- Choosing a Robotic Platform.
- Recommended Robot Application.
- Make the robot work.
- Present the finished product.

Table 4 shows the elective subjects to be taken by the SEP students from Grade 7 to Grade 10. This was crafted from the result of the tracer study. Based on the table above, Research I to IV will be taken by the SEP students starting from Grade 7. Other subjects such as Advanced Chemistry, Programming I, Programming II, and Robotics will be taken from Grade 7 to Grade 10 respectively.

CONCLUSIONS

Based on the findings, the following conclusions were drawn:

1. Majority of the SEP Alumni from 2004-2015 took a science-related course.
2. The strengths of the Science-Enhanced Program are the following: Elective subjects offered, Teaching quality, Interdisciplinary learning, and Student workload. Meanwhile, the Learning environment, the Research capacity, and the Facilities provided were listed as the weaknesses of the said program.
3. Unanimously, the respondents agreed that programming, robotics, and other IT-related subjects should be included in the curriculum. Also, the alumni concurred that the curriculum should provide students with more exposure to real-world situations.

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