

Transforming Education: Integrating Continuous Quality Improvement for Enhanced Learning Outcomes

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I. INTRODUCTION

For the past decades, the traditional way of education is embraced by numerous educational systems all over the world. The teacher-centered approach has dominated the learning process of the students in the academe, where teachers became the primary source of information and the sole authority within the classroom setup. In this model, the teachers deliver lectures and may include memorization of notes to instill the information to the students. This traditional approach rise concerns as learning in this model became one-way and there is no other avenue for new knowledge other than the teacher and the materials presented (Spooner, 2015 p.23). Although it undeniably produced graduates equipped with knowledge, the industries demands after the skills of graduates that makes them more competitive and efficient in actual industry settings. To address these demands, educational systems have been considered the emergence of Continuous Quality Improvement (CQI) to further enhance outcomes and propel institutional effectiveness.

The Outcome Based Education (OBE) is a framework that accentuates the concrete objectives and align the educational practices to attain the desired outcomes. Through the use of the assessment forms which are the OBE Syllabus, Individual Course Assessment Matrix, Individual Course Assessment Datasheet, Course Assessment Summary, Table of Specification, and Class record along with direct and indirect surveys, faculty can check whether students have attained the Course Learning Outcomes (CLOs) and Program Learning Outcomes (PLOs) for alumni. Concurrently, the Continuous Quality Improvement (CQI) serves as a methodology for continuous assessment and improvement of several educational practices to achieve quality outcomes using the data-driven decision making. Implementing the CQI process will require inputs and cooperation from the faculty, students, alumni, and employers deemed appropriate by the College of Electronics Engineering.

II. OBJECTIVES

- 1.) To develop an auto fetch feature to easily accomplish the assessment forms needed for Continuous Quality Improvement.
- 2.) To determine the Course Learning Outcomes attainment of the students through direct and indirect assessments.

III. BACKGROUND OF THE PROBLEM

In higher education, the implementation of Outcome-Based Education (OBE) aims to enhance the quality of teaching and learning within education programs through the Continuous Quality Improvement (CQI) process. The critical aspect of this approach involves monitoring and assessing whether students are meeting the Course Learning Outcomes (CLOs).

However, the existing assessment methods pose challenges, particularly in the use of Word files for faculty to evaluate student performance. This reliance on traditional paperwork has proven demanding for faculty members, leading to delayed assessments and potentially hindering the timely attainment of students' semester objectives. The assessment methods directly impact teaching strategies and the overall learning experience for students. In light of these challenges, there is a need to explore more efficient assessment approaches. Integrating technology or adopting streamlined tools can alleviate the burden on faculty, ensuring a more timely and effective CQI process. Additionally, modernizing the assessment methods aligns with the broader goals of enhancing educational quality and aligning with established standards.

IV. REVIEW OF RELATED LITERATURE

Outcome-based education (OBE) is a method known for its emphasis on the development of pragmatic skill sets and focuses on the performance of students to develop cutting-edge tertiary-level curricula. A continuous improvement of the curriculum, teaching and learning

strategies, and assessment tools are done to ensure that students can attain the expected learning experiences. This learning process is reflected in the OBE Framework implemented in the programs under the College of Engineering.

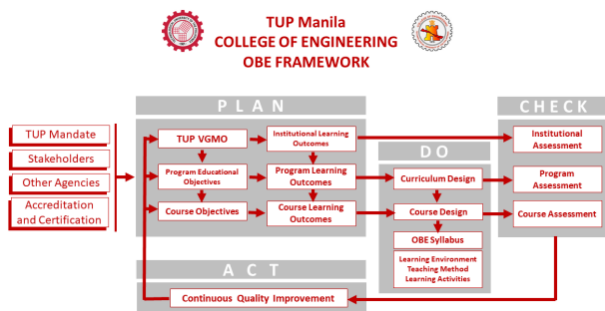


Figure 1: Proposed OBE-CQI TUP Framework

The learning process of OBE implementation at the University is stated into four steps, namely: the Plan, Do, Check, and Act. In the Planning process, goals and how they can be achieved are established and specified. The two basic components of a Plan are outcome or goal statements and action statements. Under the outcome or goal statements are the targets and outcomes that are expected to attain which include the set of Institutional Learning Outcomes (TUP Graduate Attributes) for the institutional level, the Program Learning Outcomes (PLO) at the program level, and the Course Learning Outcomes (CLO) at the course level. On the other hand, the action statements include the TUP Mission, Vision, Goals, and Objectives (TUP VMGO), the Program Objectives (PO), and the Course Objectives (CO). The Do block involves the program and course implementation through the curriculum map and the OBE syllabus. The Check block assesses whether the definition and revision of the Program Educational Objectives (PEOs) are necessary. This is initiated by the OBE CQI Committee and discussed at the department level with the involvement of the faculty members and members of the program advisory board. The students are also required to be involved in discussing issues related to PEO. Assessments of the attainment of PEOs should be done every 3 years. The factors that will be considered for such assessment come from different instruments such as advisory board meeting, focus group survey, employers' survey, and alumni survey. Meeting with the stakeholders is done at the Act block. Once a year, the program advisory board meets to address matters concerning the improvement of the programs.

Rani (2020) distinguished the Outcome-Based Education from the traditional education system that is existing for decades. The conventional strategy is nearly defined as learning happens within a vacuum wherein the teacher is the only source of knowledge that is being imparted to the students. On the other hand, the outcome-based education is characterized by a pre-defined set of course objectives that must be obtained by student at the end of the semester while pre-defined program objectives that should be attained after finishing the degree program. The regular assessment of these outcomes will be used to compare and contrast each batch for the institution to have a Continuous

Quality Improvement (CQI). However the evaluation process both to the students and graduates have a significant workload in return to the faculty members as they are required to fill out the OBE syllabus, the four (4) assessment forms, and the class records.

Abdulah et al. (2020) designed a mobile application to perform the OBE approach known as the i-MOBE in Higher Learning Institutions (HLI). This includes interfaces such as- academic, student, assessment, and database agents that are used by the academicians in monitoring and evaluating their students from time to time. The i-MOBE is only focused on evaluating the students and do not include whether program objectives are achieved by graduates after 3 to 5 years of completing the program.

Ertz et al. (2021) study suggests that the utilization of word scraping will simplify the entire process of the OBE-CQI. Since some of the required information to fill in are also present with other forms, some of the inputs are repetitive and will consume much of the time by retyping them. Instead of doing so, Ertz et al. introduced a technique which uses a keywords-based data searching approach, thus the next time that the web application requires a similar information present in other forms, auto fetching of data from the database will then occur and automatically fill in the information.

Bienkowski et al. (2012) stated that visual data analytics help human to appreciate the importance of the collated data. K - 12 institutions are now adopting those level of analysis to effectively detect areas for improvement and measuring results. This is similar to the CQI web application as the proponents include report generation where graphs and tables are displayed for ease of comparing and contrasting the attainment of students and graduates to the pre-defined objectives of each course and program per batch.

V. METHODOLOGY

In this research, the auto-fetch feature was integrated into the CQI system to simplify the CQI process and lessen the redundancy of answering the forms. The OBE Syllabus must be accomplished first to store the data. Upon submitting the forms, data for similar fields are fetched to the succeeding forms. The script used for this functionality is Python language and a unique ID for each input was assigned to avoid conflicts with other elements and make it more reliable and maintainable. This IDs are also used to generate the reports for the assessment forms. The class record from the assessment forms is used to assess the CLO attainment of a student. The CLOs for a particular subject were divided into three: CLO1 for the Prelim period, CLO2 for the Midterm Period, and CLO3 for the Final Period. CLO attainment can be determined by dividing the score obtained by the student by the total of the Major exam. The graphical interface for these forms was developed and available in the system.

Research Locale

The web application was hosted and deployed for the Electronics Engineering Department only of the

Technological University of the Philippines- Manila. Data were obtained from the students and faculty of the said department.

Software Development

The web application for the system was developed using the Laravel framework. PHP, JavaScript, and Python were employed as the primary programming languages. Python was utilized for scripting auto-fetch functionalities, while PHP and JavaScript were leveraged for developing the graphical interface and handling events for various features. MySQL served as the chosen database management system for storing and managing data within the application. An API was used to generate the document file of the reports wherein the report format was based on the CQI assessment forms.

Computation for CLO Attainment

To evaluate student achievement regarding Course Learning Outcomes (CLOs), a proposed class record has been formulated. Each period within a semester corresponds to a specific CLO. The class standing and major exam for a given period collectively contribute to 100% of the evaluation. The faculty retains the autonomy to distribute this 100% between Class Standing (CS) and Major Exam (ME). For CS, a maximum of 3 quizzes were allowed.

To determine the CLO attainment for each period:

CLO1 = Preliminary Exam Score / Total Score for Preliminary Exam

CLO2 = Midterm Exam Score / Total Score for Midterm Exam

CLO3 = Final Exam Score / Total Score for Final Exam

If the calculated percentage for any CLO exceeds or equals 60%, the CLO is deemed attained. Conversely, if the calculated CLO percentage falls below 59%, it is considered not attained.

During the Midterm period, students are evaluated to determine if intervention is necessary. This assessment is based on the CQI, calculated as follows:

$CQI = \text{Prelim Grade} + \text{Midterm Grade}$

A CQI percentage value equal to or exceeding 80% indicates that a student does not require intervention. A percentage value below 79% signifies the need for intervention.

VI. RESULTS

The Indirect Assessment survey that the proponents have collected from the 1st year to 4th year ECE students per semester provides valuable insight and feedback from students on evaluating the effectiveness of the instructional methods, course materials, and overall curriculum alignment with the intended learning outcomes.

1st Year, 1st Semester End of Semester Survey

I. Demographic Profile of the Students

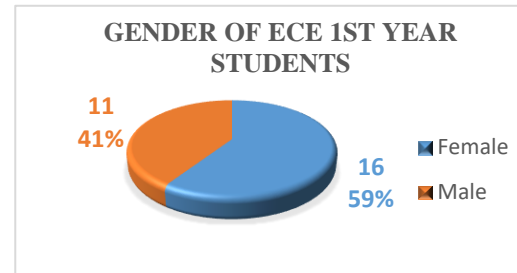


Figure 1: 1st Year ECE Students' Gender

There were 27 responses collected from first-year ECE students in the first semester for the end-of-semester survey. The population comprises sixteen female students (59%) and eleven male students (41%).

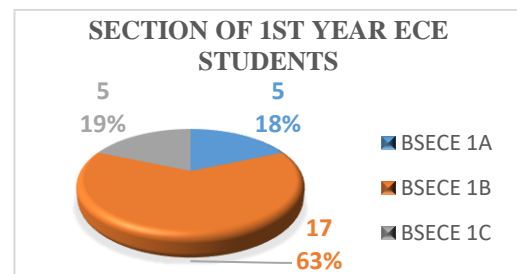


Figure 2: 1st Year ECE Students' Section

Figure 2 illustrates that 63% of the respondents, or seventeen students, are from BSECE 1B. The remaining 37% of the respondents are equally divided between BSECE 1A and BSECE 1C, with five students from each class.

II. Comparison of Students' Response Based on Gender

a.) Chemistry for Engineers (Lec and Lab)

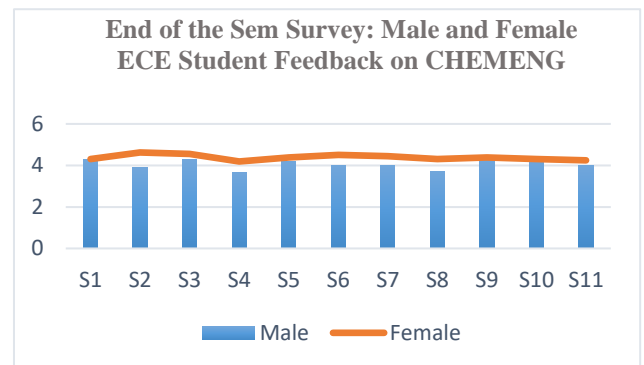


Figure 3: Comparative Response of Male and Female on CHEMENG

Table 1. Average Response for CHEMENG (Male)

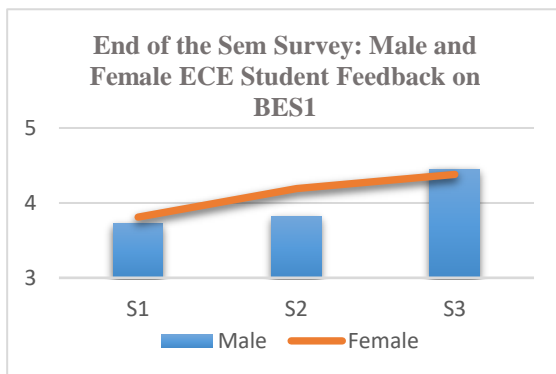
	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)	Average	Equivalent
S1	35	28	6	0	0	4.31	5
S2	50	24	0	0	0	4.625	5
S3	45	28	0	0	0	4.56	5
S4	35	20	12	0	0	4.19	4
S5	40	24	6	0	0	4.38	5
S6	45	24	3	0	0	4.5	5
S7	40	28	3	0	0	4.44	5
S8	45	12	12	0	0	4.31	5
S9	45	16	9	0	0	4.38	5
S10	35	28	6	0	0	4.31	5
S11	25	40	3	0	0	4.25	5

Table 2. Average Response for CHEMENG (Female)

	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)	Average	Equivalent
S1	25	16	6	0	0	4.27	5
S2	15	20	6	2	0	3.9	4
S3	20	24	3	0	0	4.27	5
S4	15	16	3	6	0	3.64	4
S5	25	16	3	2	0	4.18	4
S6	25	12	3	4	0	4	4
S7	25	12	3	4	0	4	4
S8	15	12	12	2	0	3.72	4
S9	25	20	3	0	0	4.36	5
S10	30	16	3	0	0	4.45	5
S11	20	16	6	2	0	4	4

The table above shows that the average responses from female students are remarkably higher than those acquired by male ECE students. Of all the eleven (11) statements, the S10 has the average that surpassed the female's response average. This suggests that female students are confident about the learning outcomes in their Chemistry for Engineers subject.

b.) Computer Aided Drafting

**Figure 4:** Comparative Response of Male and Female on BES 1**Table 1.** Average Response for BES1 (Male)

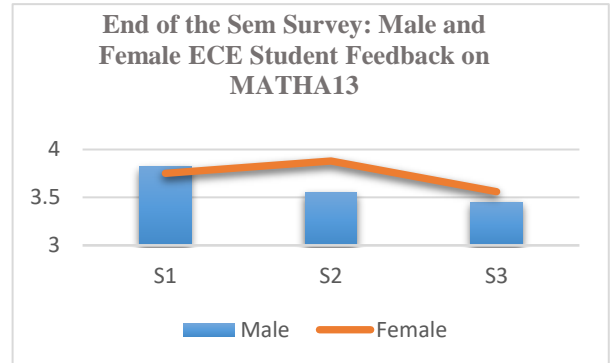
	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)	Average	Equivalent
S1	15	20	3	2	1	3.73	4
S2	15	20	6	0	1	3.82	4
S3	30	16	3	0	0	4.45	5

Table 2. Average Response for BES1 (Female)

	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)	Average	Equivalent
S1	25	12	24	0	0	3.81	4
S2	30	28	9	0	0	4.19	4
S3	40	24	6	0	0	4.38	5

The tables illustrate the numerical comparison of respondents' averages on male and female students. However, as shown in the graph above, it suggests that female students have a more favorable response towards the learning experience, dominating the S1 and S2 in the subject of Computer Aided Drafting.

c.) Differential Calculus

**Figure 5:** Comparative Response of Male and Female on MATHA13**Table 3.** Average Response for MATHA13 (Male)

	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)	Average	Equivalent
S1	15	20	6	0	1	3.82	4
S2	10	20	6	2	1	3.55	4
S3	10	16	9	2	1	3.45	4

Table 4. Average Response for MATHA13 (Female)

	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)	Average	Equivalent
S1	30	8	18	4	0	3.75	4
S2	30	12	18	2	0	3.88	4
S3	25	8	18	6	0	3.56	4

In differential calculus, the responses for the first statement are dominated by male ECE students with an average of 3.82. The female response is prevalent in the remaining two statements, with an average of 3.88 and 3.56, equivalent to a four-point mark on the Likert scale. This suggests that female or male students can perform well in some areas.

d.) Fundamentals of ECE

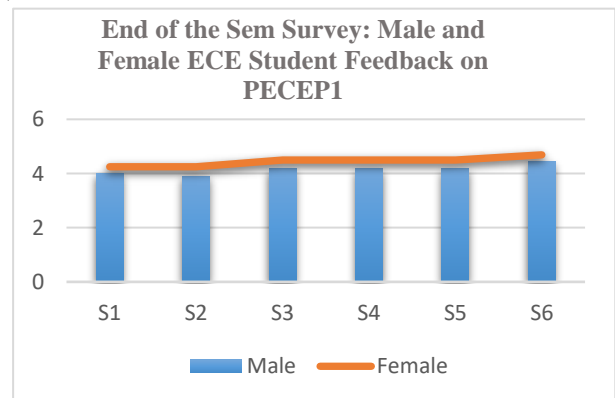
**Figure 6:** Comparative Response of Male and Female on PECEP1

Table 3. Average Response for PECEP1 (Male)

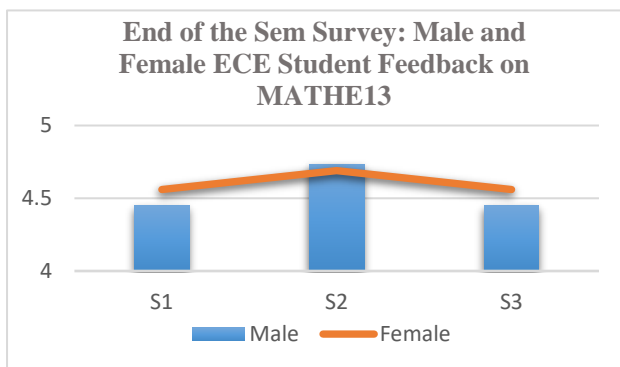
	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)	Average	Equivalent
S1	20	16	6	2	0	4	4
S2	25	12	3	2	1	3.9	4
S3	25	20	0	0	1	4.18	4
S4	20	24	0	2	0	4.18	4
S5	25	20	0	0	1	4.18	4
S6	25	24	0	0	0	4.45	5

Table 4. Average Response for PECEP1 (Female)

	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)	Average	Equivalent
S1	30	32	6	0	0	4.25	5
S2	25	40	3	0	0	4.25	5
S3	45	24	3	0	0	4.5	5
S4	40	32	0	0	0	4.5	5
S5	45	24	3	0	0	4.5	5
S6	60	12	3	0	0	4.69	5

The direct assessment for the Fundamentals of ECE subject comprises six statements and can be rated using the five-point likert scale. From the figure above, the illustration suggests that the average of responses acquired by female ECE students is beyond the average obtained by the responses of male students.

e.) Engineering Data Analysis

**Figure 7:** Comparative Response of Male and Female on MATHE13**Table 7.** Average Response for MATHE13 (Male)

	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)	Average	Equivalent
S1	50	20	3	0	0	4.56	5
S2	60	12	3	0	0	4.69	5
S3	50	20	3	0	0	4.56	5

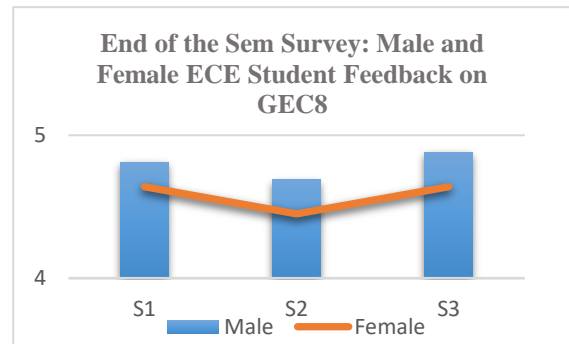
Table 8. Average Response for MATHE13 (Female)

	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)	Average	Equivalent
S1	30	16	3	0	0	4.45	5
S2	40	12	0	0	0	4.73	5
S3	30	16	3	0	0	4.45	5

The Engineering Data Analysis end of the Semester Survey comprises three questions. The graph above suggests that the male and female responses fluctuate perfectly from those statements, forming an arrow-like line pointing upward and a bar graph with equal height on each side. However, the

average of the responses for both males and females indicates students' positive perceptions towards the subject.

f.) Ethics

**Figure 8:** Comparative Response of Male and Female on GEC8**Table 5.** Average Responses for GEC8 (Male)

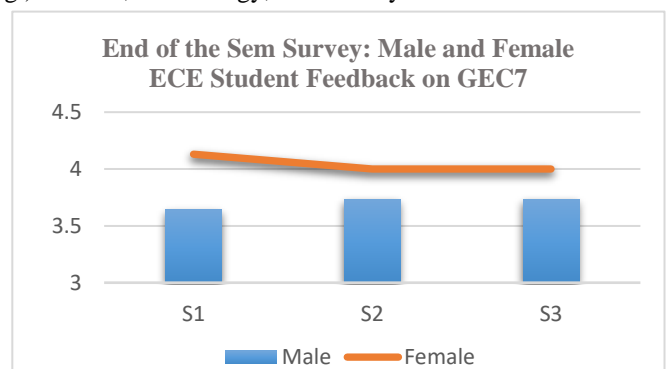
	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)	Average	Equivalent
S1	65	12	0	0	0	4.81	5
S2	60	12	3	0	0	4.69	5
S3	70	8	0	0	0	4.88	5

Table 6. Average Responses for GEC8 (Female)

	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)	Average	Equivalent
S1	35	16	0	0	0	4.64	5
S2	30	16	3	0	0	4.45	5
S3	35	16	0	0	0	4.64	5

The graph shows that male students' responses acquired more positive reactions than female ones. The three (3) statements are dominated by male students who have gained 4.81, 4.69, and 4.88 average, respectively. This suggests that male students may have achieved the expected ethical learning outcomes.

g.) Science, Technology, and Society

**Figure 9:** Comparative Response of Male and Female GEC7**Table 9.** Average Responses for GEC7 (Male)

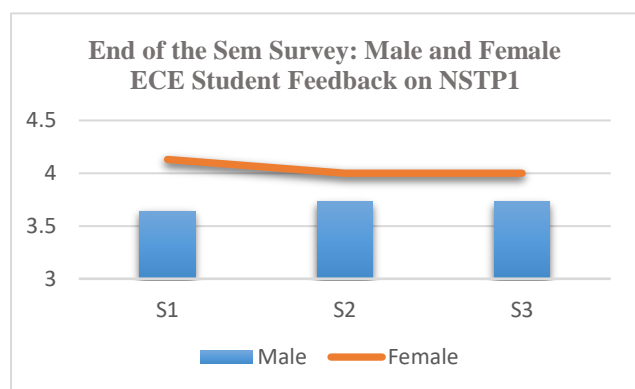
	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)	Average	Equivalent
S1	20	8	12	0	0	3.64	4
S2	20	12	9	0	0	3.73	4
S3	20	8	12	0	1	3.73	4

Table 10. Average Responses for GEC7 (Female)

	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)	Average	Equivalent
S1	30	28	6	2	0	4.13	4
S2	30	24	6	4	0	4	4
S3	25	28	9	2	0	4	4

In the graph presented above, the line representing the female group of students surpassed the average gained by male students. The average of the two different cohorts being studied materializes their difference. This suggests that female students are more confident with their learning experience while undertaking Science, Technology, and Society subjects. At the same time, various improvements should be implemented to compensate for other areas that are found to be poor.

h.) National Service Training Program 1 (NSTP1)

**Figure 10:** Comparative Response of Male and Female on NSTP1**Table 11.** Average Responses for NSTP1 (Male)

	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)	Average	Equivalent
S1	20	24	3	0	0	4.27	4
S2	20	20	6	0	0	4.18	4
S3	15	28	3	0	0	4.18	4

Table 12. Average Responses for GEC7 (Female)

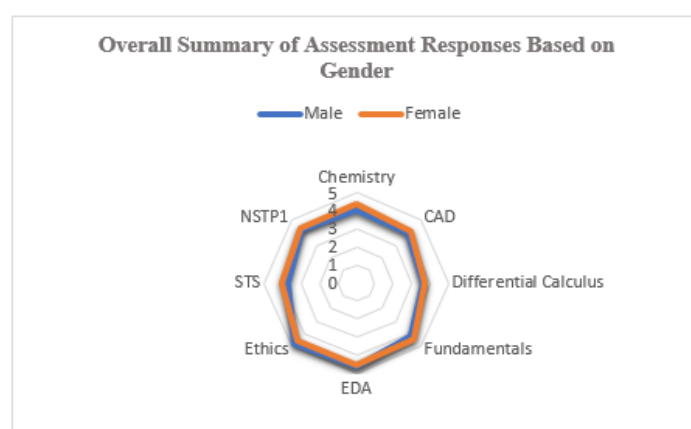
	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)	Average	Equivalent
S1	35	28	6	0	0	4.31	5
S2	35	28	6	0	0	4.31	5
S3	35	28	6	0	0	4.31	5

The NSTP subject also comprises a three-question indirect assessment for the end-of-semester survey. For male students, the total average for each statement is as follows: 4.27, 4.18, and 4.18, while the average of responses for female students is 4.31 for statements 1 to 3. From the average of both groups, it can be concluded that there is no negative feedback, while minimal, neutral responses can be further improved.

Table 13. Average Responses of Male and Female per Subject

Subjects	Male	Female
Chemistry	4.07	4.39
CAD	4	4.13
Differential Calculus	3.61	3.73
Fundamentals	4.15	4.45
EDA	4.6	4.54
Ethics	4.79	4.58
STS	3.7	4.04
NSTP1	4.21	4.31

As shown above, the tabulated data illustrates the overall average of responses in each question per subject. The average is also classified based on students' gender to conclude whether gender is one of the factors affecting the attainment of Course Learning Outcomes (CLOs).

**Figure 11:** Summary of Indirect Assessment Responses Based on Gender

Upon calculating the mean or average of responses between male and female ECE students, the following data has been collected: in Chemistry for Engineers, Computer Aided Drafting, Differential Calculus, Fundamentals of ECE, Science, Technology, and Society, and the NSTP1, the group of female students have obtained the highest average compared to male students. On the other hand, in subjects such as Engineering Data Analysis and Ethics, male students outperformed their counterpart gender.

However, even though the data suggests that female students have gained significantly high averages, a final inference cannot be made due to a minimal sample size that may cause potential bias in results. Additionally, indirect assessment alone cannot be concluded if the learning outcomes have been achieved.

3rd Year, 1st Semester End of Semester Survey

I. Demographic Profile of Students

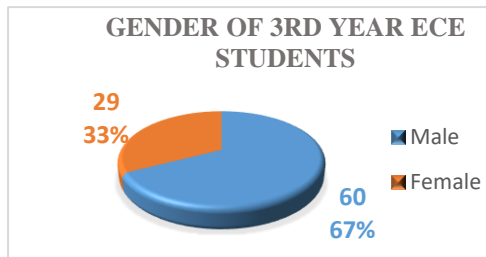


Figure 12: 3rd Year ECE Students' Gender

The acquired sample from the 3rd Year ECE students totaled 89, consisting of twenty-nine (33%) female and sixty (67%) male students, suggesting that male students are more prevalent within this sample. However, as this is a sample size, it may not fully represent the overall gender distribution of the entire 3rd-year ECE student population. If this pattern is consistent for the whole cohort, more research with a bigger sample size would be required.

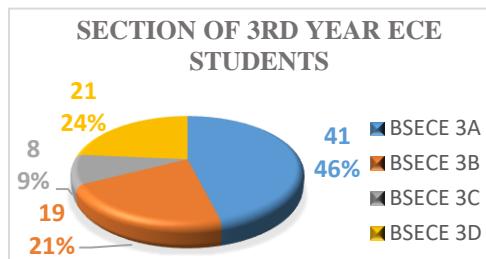


Figure 13: 3rd Year ECE Students' Section

The 3rd year ECE Students are divided into four sections, and these are their respective distribution: forty-one (46%) of respondents are from BSECE 3A, nineteen (21%) from BSECE 3B, eight (9%) are from BSECE 3C, while the remaining twenty-one (24%) are BSECE 3D students.

II. Comparison of Students' Response based on their Gender

a.) Signals, Spectra, and Signal Processing

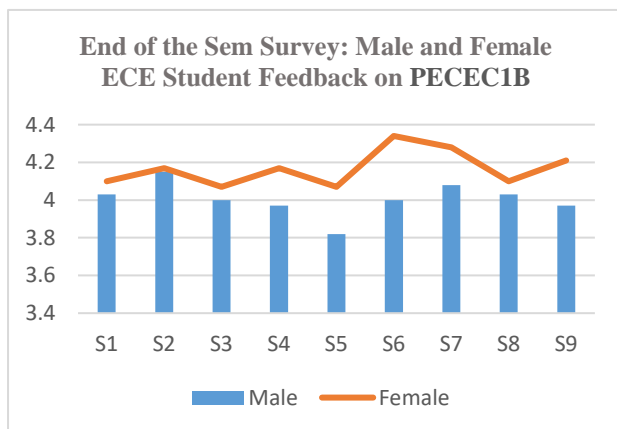


Figure 14: Comparative Response of Male and Female on PECEC1B

Table 14. Average Responses for PECEC1B (Male)

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Average	Equivalent
S1	50	48	21	0	0	4.1	4
S2	55	48	18	0	0	4.17	4
S3	45	52	21	0	0	4.07	4
S4	50	56	15	0	0	4.17	4
S5	55	36	27	0	0	4.07	4
S6	70	44	12	0	0	4.34	5
S7	65	44	15	0	0	4.28	5
S8	50	48	21	0	0	4.1	4
S9	65	36	21	0	0	4.21	5

Table 16. Average Responses for PECEC1B (Female)

	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)	Average	Equivalent
S1	75	128	39	0	0	4.03	4
S2	115	92	42	0	0	4.15	4
S3	95	96	48	0	1	4	4
S4	75	112	51	0	0	3.97	4
S5	60	116	51	1	1	3.82	4
S6	105	84	45	6	0	4	4
S7	115	80	48	2	0	4.08	4
S8	100	100	36	6	0	4.03	4

The subject of Signals, Spectra and Signal Processing includes nine questions students answered using a five-point Likert scale. The average answers male and female students provided for each question are shown in Figure 14. The numerical data presented in the table indicates that female students have surpassed the average responses of male students. From the provided information, we can infer that female students, on average, responded more positively or with higher agreement to the questions on the subject of Signals, Spectra, and Signal Processing than male students. This suggests that female students might better understand the material, have greater satisfaction with the course, or have higher engagement in the subject.

b.) Electronics 3: Electronic Systems and Design

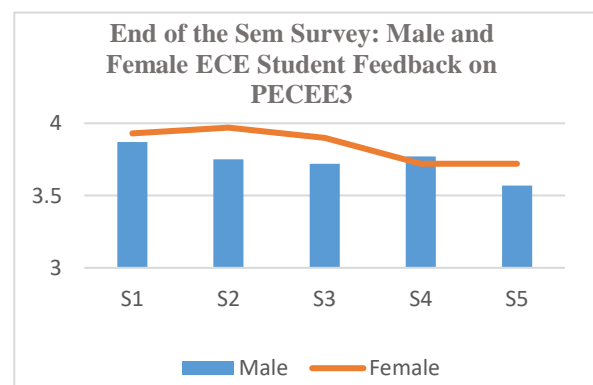


Figure 15: Comparative Response of Male and Female on PECEE3

Table 15. Average Responses for PECEE3 (Male)

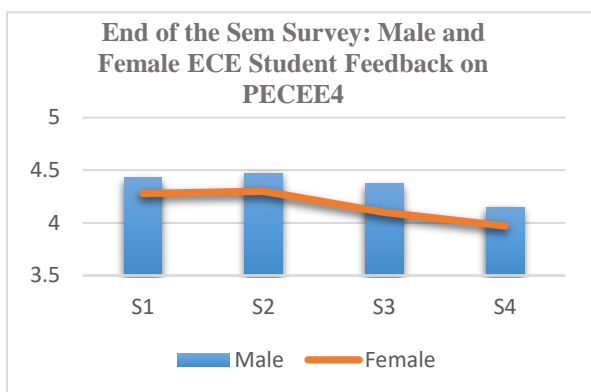
	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)	Average	Equivalent
S1	85	96	42	8	1	3.87	4
S2	60	108	48	8	1	3.75	4
S3	65	100	48	8	2	3.72	4
S4	55	128	33	8	2	3.77	4
S5	45	108	51	6	4	3.57	4

Table 17. Average Responses for PECEE3 (Female)

	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)	Average	Equivalent
S1	40	48	24	2	0	3.93	4
S2	45	48	21	0	1	3.97	4
S3	30	56	27	0	0	3.9	4
S4	35	36	36	0	1	3.72	4
S5	40	28	39	0	1	3.72	4

In the Electronics 3 subject, it can be concluded that female students generally performed better on most of the questions compared to male students. Specifically, female students scored higher on questions S1, S2, S3, and S5, indicating a stronger understanding or greater confidence in these areas. Conversely, male students performed better on question S4.

c.) Digital Electronics 1: Logic Circuits and Switching Theory

**Figure 16:** Comparative Response of Male and Female on PECEE4**Table 19.** Average Responses for PECEE4 (Male)

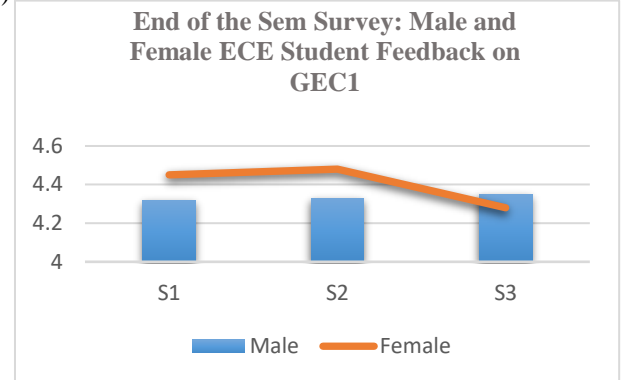
	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)	Average	Equivalent
S1	165	88	12	0	1	4.43	5
S2	180	72	15	0	1	4.47	5
S3	165	72	24	0	1	4.37	4
S4	120	96	30	2	1	4.15	4

Table 20. Average Responses for PECEE4 (Female)

	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)	Average	Equivalent
S1	65	44	15	0	0	4.28	5
S2	70	40	15	0	0	4.3	5
S3	55	44	18	2	0	4.1	4
S4	45	44	24	2	0	3.97	4

From Figure 16 above, which presents the summary of responses from 3rd year ECE male and female students, it is evident that male students have outperformed female students in all questions related to the Digital Electronics subject. This suggests that male students may have a stronger grasp or better understanding of the material in this particular subject area compared to their female counterparts.

d.) Understanding the Self

**Figure 17:** Comparative Response of Male and Female on GEC1**Table 18.** Average Responses for GEC1 (Male)

	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)	Average	Equivalent
S1	130	108	21	0	0	4.32	5
S2	130	112	18	0	0	4.33	5
S3	135	108	18	0	0	4.35	5

Table 21. Average Responses for GEC1 (Female)

	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)	Average	Equivalent
S1	50	64	15	0	0	4.45	5
S2	55	60	15	0	0	4.48	5
S3	60	52	12	0	0	4.28	5

In Understanding the Self subject, female students have achieved higher average scores on questions 1 and 2, indicating greater engagement or understanding in these areas. Conversely, male students have slightly outperformed female students on question 3, with an average score of 4.35 compared to 4.28 for female students. This suggests that while female students generally excel in this subject, there are specific aspects, as highlighted by question 3, where male students demonstrate a stronger performance. This variation could be attributed to differences in interests, strengths, or interpretations of the material covered in question 3.

e.) Readings in Philippine History

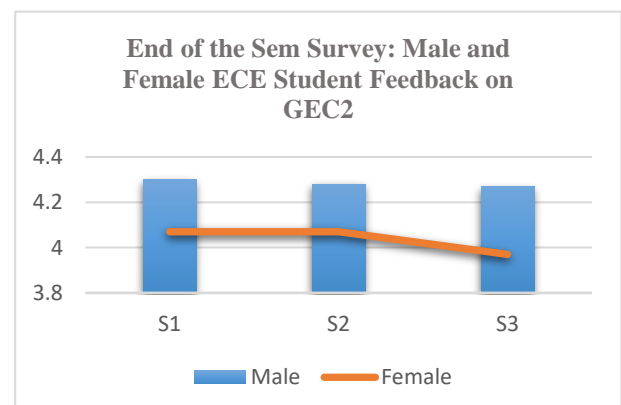
**Figure 18:** Comparative Response of Male and Female on GEC2

Table 22. Average of Responses for GEC2 (Male)

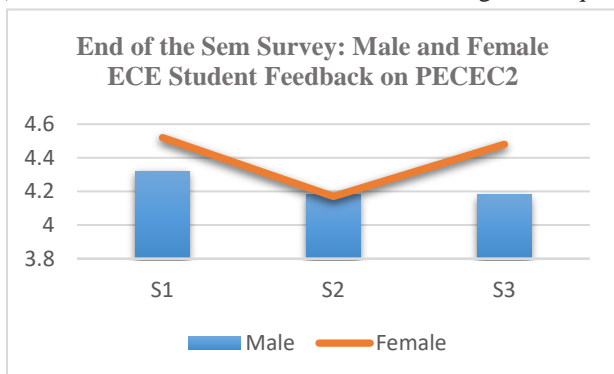
	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)	Average	Equivalent
S1	140	92	24	2	0	4.3	5
S2	140	92	21	4	0	4.28	5
S3	135	96	21	4	0	4.27	5

Table 23. Average Responses for GEC2 (Female)

	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)	Average	Equivalent
S1	50	48	18	2	0	4.07	4
S2	45	52	21	0	0	4.07	4
S3	40	56	18	0	1	3.97	4

Readings in Philippine History subject is composed of three questions by which the average of responses are dominated by male students. The results of the average from S1 to S3 of male students have shown a large difference compared with that of the female group. The significant difference in average scores between male and female students suggests that male students may have a deeper understanding or stronger engagement with the material covered in this subject. This difference could stem from various factors such as personal interest, prior knowledge, or learning styles.

f.) Communications 2: Modulation and Coding Techniques

**Figure 19:** Comparative Response of Male and Female on PECEC2**Table 24.** Average of Responses for PECEC2 (Male)

	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)	Average	Equivalent
S1	120	132	6	0	1	4.32	5
S2	80	164	6	0	1	4.18	4
S3	100	132	18	0	1	4.18	4

Table 25. Average of Responses for PECEC2 (Female)

	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)	Average	Equivalent
S1	80	48	3	0	0	4.52	5
S2	55	48	18	0	0	4.17	4
S3	75	52	3	0	0	4.48	4

The figure above depicts the comparative graph of male and female in terms of their responses in questions about the communications 2 subject. The graph illustrates that among the three questions, female has dominated the S1 and S2 while male have dominated the S3. This suggests that female students may have a stronger understanding or higher level of engagement in the topics covered by questions S1 and S2. In contrast, male students may excel in the content of question S3.

Table 26. Average of Responses per Subject and Gender

SUBJECTS	Male	Female
Signals	4.01	4.17
Electronics 3	3.736	3.848
Digital Electronics 1	4.36	4.163
Understanding the Self	4.33	4.4
Readings in Philippine History	4.28	4.04
Communications 2	4.23	4.39

As shown above, the tabulated data illustrates the overall average of responses in each question per subject. The average is also classified based on students' gender to conclude whether gender is one factor affecting the attainment of Course Learning Outcomes (CLOs).

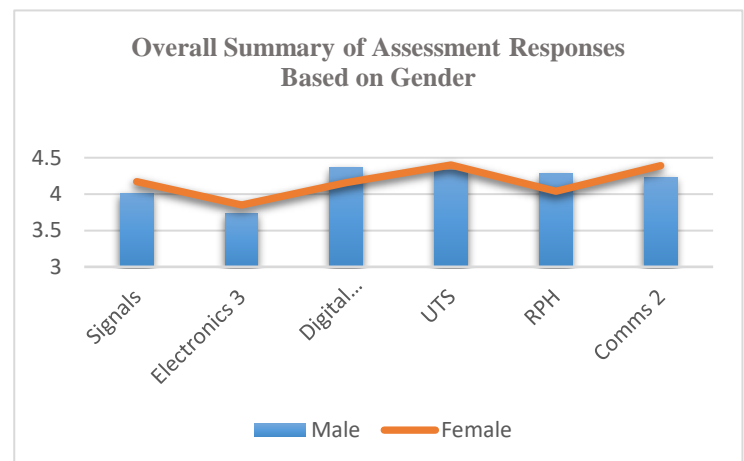
**Figure 20:** Summary of Indirect Assessment Responses Based on Gender

Figure 20 summarizes the overall average of the responses from the students. From the data collected, the male group of students obtained the highest points in Digital Electronics 1 and Readings on Philippine History with an average of 4.36 and 4.28, respectively. However, the female students have dominated the Signals, Electronics 3, Understanding the self, and Communications 2 subjects.

It cannot be inferred that female students are inherently better than male students in the subjects mentioned. This is primarily because there are variations in the sample sizes between the two groups being studied. The differences observed in performance could be influenced by various factors such as the number of male and female students enrolled in each subject, individual strengths and weaknesses, teaching methods, and even random chance. To draw more accurate conclusions about gender differences in

academic performance, conducting more rigorous analysis, possibly considering factors like prior academic background, study habits, and socioeconomic status, while ensuring a balanced and representative sample size from both male and female student groups would be necessary.

Alumni Survey

To measure the Program Educational Attainment of the BSECE Graduates of TUP-M, the proponents have collected survey form responses that will provide a comprehensive understanding of their academic achievements, skills acquired, and overall satisfaction with the program. These survey responses are essential for assessing the effectiveness of the curriculum and identifying areas where enhancements could be made to better prepare graduates for their careers in engineering.

I. Demographic Profile of the Alumni

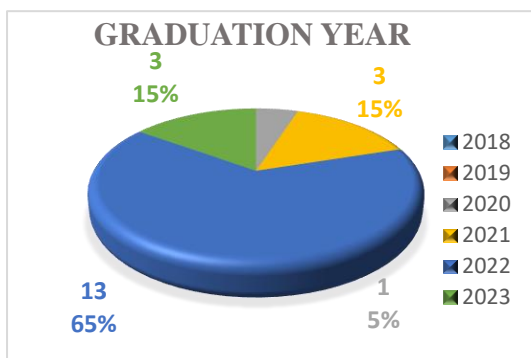


Figure 21: Alumni's Graduation Year

The proponents have accumulated 20 responses from TUP-Manila's ECE alumni, spanning batches from 2018 to 2023. The distribution of responses are as follows: 1 alumnus from the batch of 2020, 3 alumni from the batch of 2021, 13 alumni from the batch of 2022, and 3 alumni from the batch of 2023.

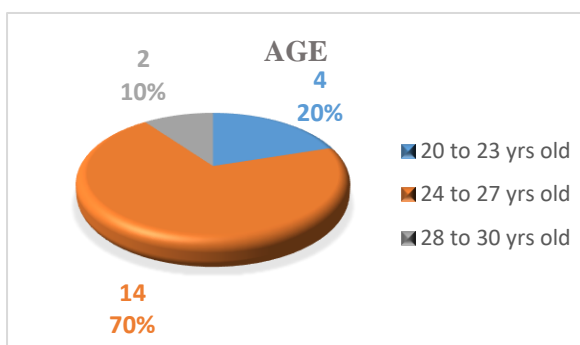


Figure 22: Age Distribution

Regarding age, the respondents fall into three brackets: 4 individuals are between 21-23 years old, 14 are between 24-27 years old, and two are between 28-30 years old. This indicates that the majority of respondents are in their mid-20s.

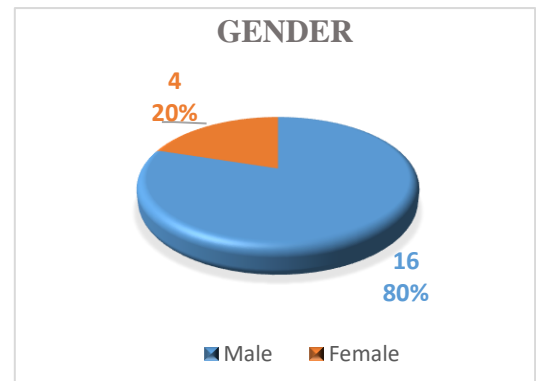


Figure 23: Gender Distribution

In Figure 23, predominant gender of the respondents is male, with 16 individuals, while the remaining four are female. This reflects a gender imbalance among the ECE alumni respondents.

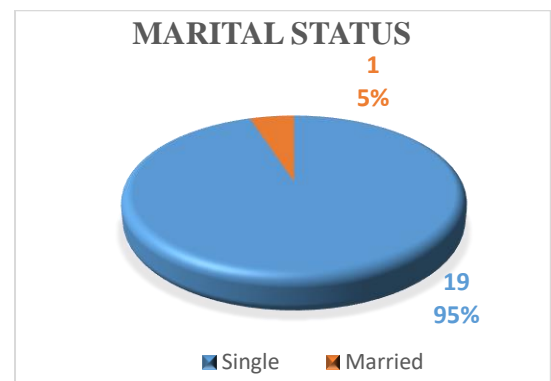


Figure 24: Marital Status Distribution

According to the respondents' marital status, 19 out of the respondents are single, and only one respondent is married. This suggests that most respondents are at a stage in life where they are not yet married.

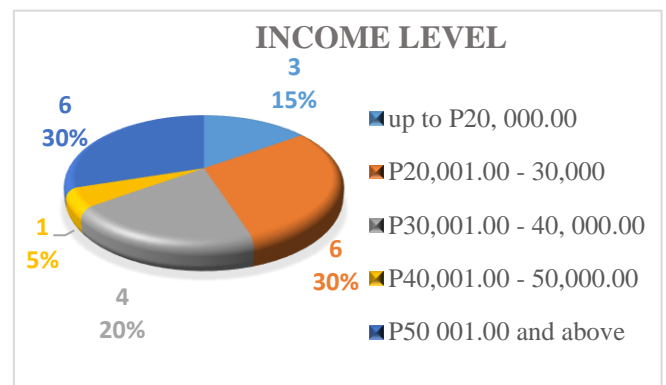


Figure 25: Income Levels Distribution

As for income levels, the respondents' earnings are distributed as follows: 3 individuals earn up to Php20,000, six earn between Php20,001-30,000, four earn between Php30,001-40,000, one earns between Php40,001-50,000, and 6 earn Php50,001 and above. This range of income levels provides insight into the economic status of the alumni shortly after graduation.

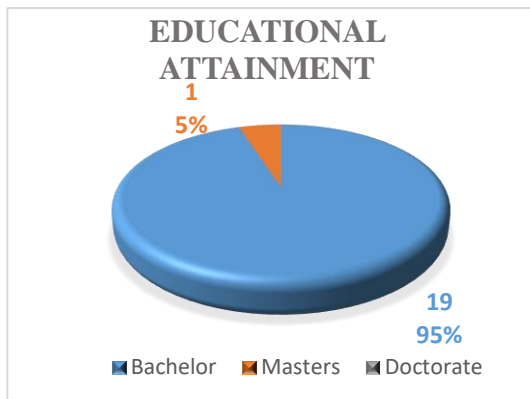


Figure 26: Educational Attainment Distribution

In terms of education, out of the 20 ECE alumni, 19 have completed their bachelor's degree, and one is pursuing a master's degree. This indicates a high level of academic achievement among the respondents, with a small number continuing further studies.

II. Transition to the World of Work

a.) License

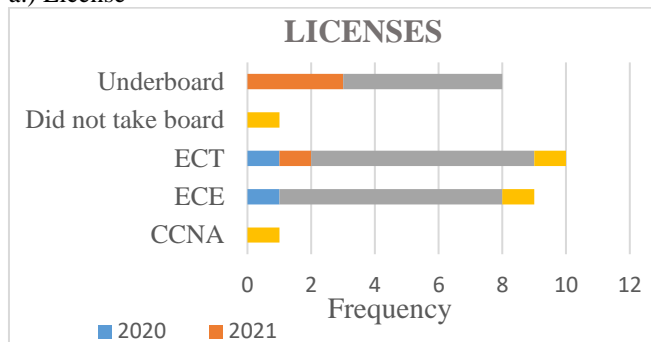


Figure 27: License Distribution

The ECE Alumni respondents from batches 2018 to 2023 were asked about acquiring their licenses after finishing their program studies. The summary of results is as follows: the alumnus from 2020 acquired both the ECE and ECT licenses; among the three respondents from 2021, one obtained an ECT license, while three are on board for the ECE licensure examination. However, in 2022, seven obtained both ECE and ECT licenses, and five are under board. Out of the three respondents from 2023, one has both ECE and ECT licenses, one did not take the board exam, and the other has a CCNA license.

This data suggests no consistent trend across the years, which indicates a clear link between the length of time since finishing the degree program and the acquisition of licenses. However, more studies with a larger sample size are required to prove this. It may suggest that the duration could signify that an alumnus would pursue a master's degree.

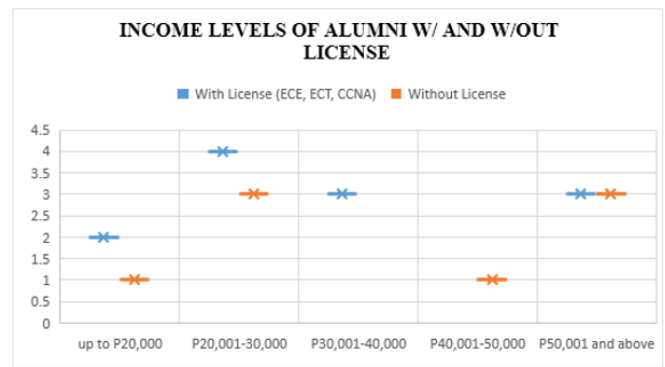


Figure 28: Income Level of Alumni With and Without License

Moreover, upon dissecting the data regarding income levels from the demographic profiles of the respondents and correlating it with the acquisition of licenses, it can be inferred that there is no discernible connection between the two variables. Of the 14 individuals with licenses, two are earning up to Php20,000, four are earning Php20,001-30,000, three are earning Php30,001-40,000, and three are earning Php50,000 and above. Of the eight individuals without a license, one is earning up to Php20,000; three are earning Php20,001-30,000; one is earning Php40,001-50,000; the remaining three are earning Php50,000. The data presented above indicates that they can earn a decent income regardless of whether the respondents have obtained a license.

b.) Assessment of College Performance, Start of Seeking a Job, and Duration of Job Search

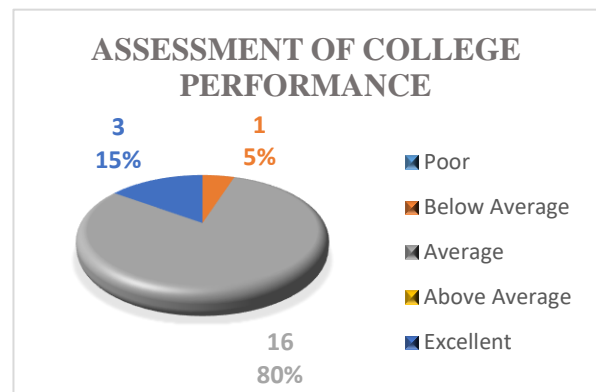


Figure 29: College Performance

The alumni are surveyed to classify their performance levels during their studies. It turns out that sixteen classified themselves as average students, three as excellent, and one as below average. The ECE alumni from 2020 to 2023 had varied plans during their studies, as well as before and after graduation.

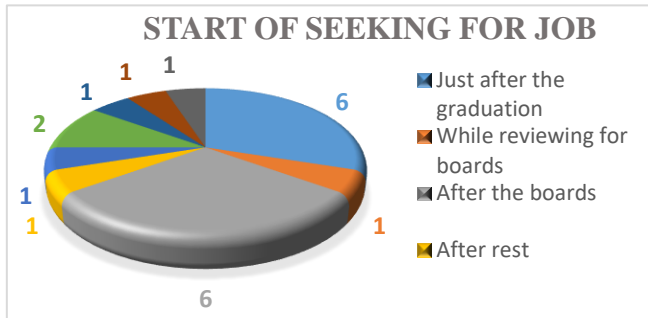


Figure 30: Job Seeking Period

The survey shows that three were working students, two sought jobs before graduation, six sought jobs after graduation, one sought a job after obtaining a certification, one sought a job during the review for the board examination, six sought jobs after the board examination, and one sought a job after taking a rest. Regarding the duration of the job search, nineteen alumni were employed within six months after graduation, while one was employed within six to eleven months.

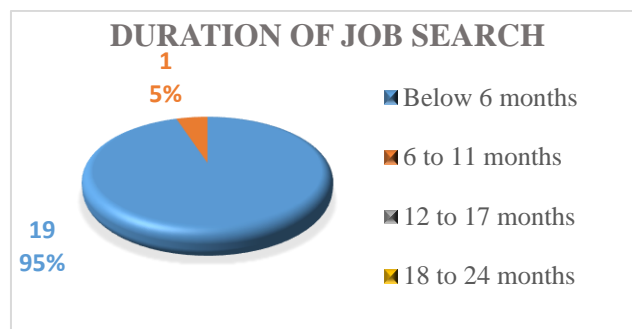


Figure 31: Duration of Job Search

Regarding the duration of the job search, nineteen alumni were employed within six months after graduation, while one was employed within six to eleven months. The data indicates no strong correlation between self-assessed academic performance and the success or timing of job hunting among ECE alumni from 2020 to 2023. Sixteen alumni considered themselves average students, three considered excellent, and one below average. Despite these varied self-assessments, nineteen out of twenty alumni secured employment within six months of graduation, demonstrating that academic performance did not significantly impact job-hunting outcomes. The alumni employed diverse job search strategies, such as working during studies, seeking jobs before graduation, and pursuing certifications, contributing to their quick employment.

c.) Level of Importance of Specific Requirements and Factors Affecting Acquisition of First Job

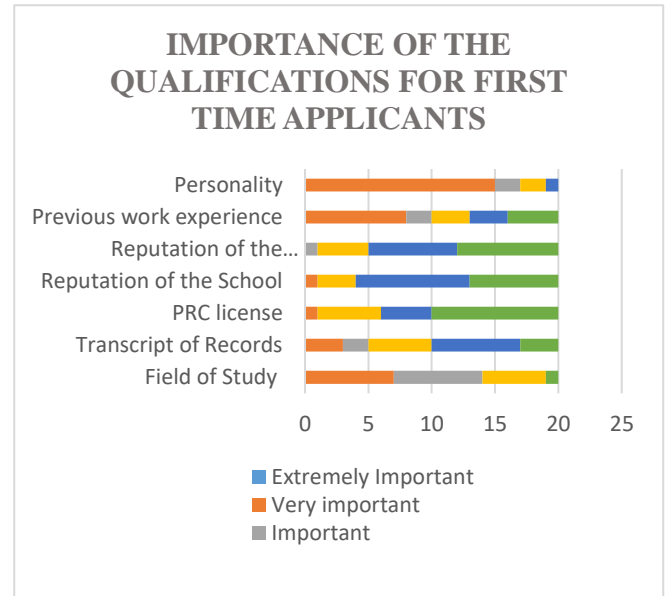


Figure 32: Qualifications for First Time Applicants

The graph illustrated above concludes that personality is deemed extremely important among the seven qualifications, followed by the field of study, which is ranked as very important. Previous work experience, however, is placed as important, while the PRC license, reputation of the school, department, and engineers are deemed somewhat important.

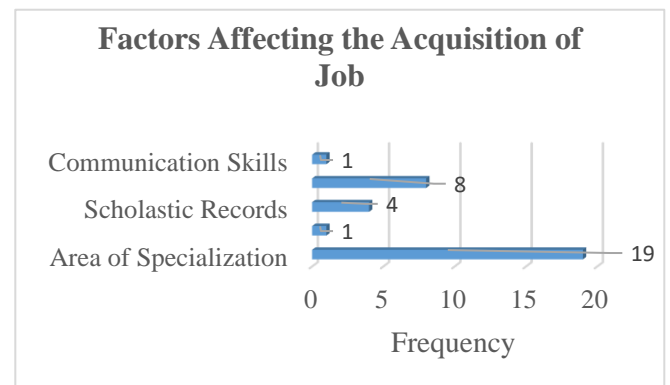


Figure 33: Factors Affecting Acquisition of First Job

The graph above depicts that the area of specialization is the topmost factor that affects the job application of the graduates. It is followed by personality factors, academic records, and lastly, the communication skills and reputation of the university.

Understanding the factors and skills that influence the acquisition of the first job among alumni is crucial for Continuous Quality Improvement (CQI) in educational institutions. By identifying these factors, institutions can enhance their career services and guidance for students, tailoring support to prepare them for the job market better. Insights into job acquisition factors also inform curriculum enhancements, ensuring educational programs align with industry needs and enhance graduates' employability.

VII. CONCLUSION

The web application was able to collect the basic information of the students through the register feature wherein this information is necessary for the alumni tracing. Under the curriculum tools are the forms needed for the CQI process. The CLO attainment was determined through direct and indirect assessment. Hence, the graphical representation of the CLO and PLO attainment for the key courses of the curriculum was generated. The system was able to collect responses from the students and alumni for the end of semester and alumni survey. Through this, a comparative analysis was formulated to determine the CLO attainment between the students. Overall, the system was evaluated using the ISO 25010 standard and the web app functions well.

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