Industry Preparedness of ECE Graduating Students of Columban College on Satellite Communication: *Basis for the Improvement of ECE Curriculum*

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Abstract— **In line with the myriad efforts of the government through PTC and CHED to emphasize the promotion of engineering education and assimilate international standards, this study was carried out from an aggressive intern opportunity of the proponent and the ECE graduating class of Columban College at the sole satellite operator in the Philippines, the Asia Broadcast Satellite (ABS), to investigate the gap between industry requirements and the academe. The implementation of OBE curriculum in all engineering courses as stated in CMO 37 Series of 2012 had given a positive implication to measure quality education not only through effectiveness, efficiency and sustainability but also by relevance. Relevance in education would mean addressing the needs of the students and employers of today and providing the future graduates a curriculum of global comparability. This is a big enigma to the higher education institutions offering engineering programs including the 235 HEI offering Electronics Engineering. Moreover SBMA is anticipated as the most competitive international service and logistics center in the Southeast region. Since quality is the central mystery, this study explored the preparedness of the ECE graduating students of Columban College for future professional career in the field of Satellite Communication after graduation. Certain issues like their degree of preparation technically and emotionally were established. Furthermore, this study pursued the success indicators and competencies required for effective action in a satellite company. The study unveiled the relevance of the engineering education imparted to the ECE graduates employed in ABS by the ECE department in the perspective of satellite industry. Deficiencies were identified through the different satellite careers of the 10 ECE graduates of Columban College currently employed in ABS and observation of the proponent. Since elective subjects in the ECE curriculum can be geared towards the need of the industry in close proximity to the academic institution specifically Columban College, modification is herewith recommended. Preventive measures and intervention are suggested and must be integrated in the academic coursework.**

Keywords: satellite communication, engineering education, electronics engineering, satellite careers, technical assistance center, satellite operations, spacecraft engineering, ground support system, MCR

I. INTRODUCTION

In the light of SBMA's strategic location, vast employment opportunities emanates constantly and entails development intervention in line with the academic institutions producing graduates who are expected to be globally competitive in terms of technical skills needed by the industries. Advancements in technology have revolutionized electronics engineering in the areas of communication systems and information technology and the convergent fields. Convergence in technology, protocol and industry is inevitable. As noticed from the acquisition of Mabuhay Satellite Corporation by Asia Broadcast Satellite (ABS) in 2010, industrial convergence redefines the global exposure of the knowledge-capital economy provided by educational institutions in the proximity.

ABS is one of the fastest growing premium global satellite operators in the world. With diverse IP transit through its Asian, African, European and the Middle East internet gateways, ABS offers a complete range of tailored solutions including broadcasting, cellular backhaul, VSAT and Internet backbone services. ABS' satellite fleet includes five satellites (ABS-1, ABS-1A, ABS-2i, ABS-3 and ABS-7) with its sixth satellite (ABS-2) scheduled to launch in January 2014. The ABS-2 satellite will be located in geostationary orbit at 75˚East and fitted with up to 89 active C, Ku, and Ka-band transponders. It will provide optimized direct TV broadcast, multimedia applications, telecommunications and data transmission services for Asia Pacific, Africa, Middle East, Europe and Russia/CIS countries. ABS has also ordered two new Boeing 720SP satellites with the options to add more satellites over the next 2 to 3 years to its growing satellite fleet.

Columban College is a Christ-centered Catholic educational institution owned by the Diocese of Iba and guided by the motto: "We are Christ's and not our own." The College is dedicated to serve the needs of Olongapo City and towns of Zambales and its neighboring provinces. The main campus is located at Barangay Asinan and the other campuses are in Barrio Barretto and Barangay Naulo, Sta. Cruz, Zambales. The Engineering Department is located in the Barretto campus offering Civil Engineering, Electronics

Engineering, Electrical Engineering, Industrial Engineering and Computer Engineering programs. The Electronics Engineering (ECE) program started since 1998 and has been adding new Electronics Engineers to the larger pool of ECE professionals since 2003.

The findings of the study can present feedback to educators and administrators as to how the program outcomes can be realized. This paper is a quest to find the requirements of engineering education from an aggressive intern opportunity towards integrating the industrial and academic perspective.

II. PRACTICUM PROJECT

Equipping electronics engineering students with the skills and knowledge required to be successful in the industry near the academic institution must be a major thrust of the Electronics Engineering Department of Columban College. Today, ABS employs ten ECE graduates of Columban College. The congruence of skills required in their career in satellite and their undergraduate study should be evaluated, not only through tracer studies that assess the graduate employability but also through immersion in the very exciting company in satellite industry that they belong. The investigation regarding the demands of professional practice in a satellite industry promoted reflection-for-action from the perspective of an educator. As the engineering education curricula are facing a number of challenges including a rapid growth in what is perceived by the technical community to be necessary foundation of knowledge, the gap between the academe and the industry is more apparent. Herewith deficiencies must be identified and interventions must be integrated in the academic coursework.

As the international standards and the goals of engineering education reiterates the fundamental purpose of engineering education to build a knowledge base and attributes to enable the graduate to continue learning and to proceed to formative development that will develop the competencies required for independent practice, benchmarking in the sole satellite operator in the Philippines leverage the research pursuit from a global community minding the competitiveness of its graduates because in Asia Broadcast Satellite the world is flat.

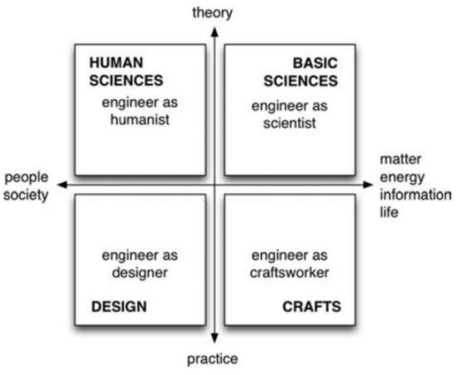

Figure 1. The Four Dimensions of an Engineer [1]

Figueiredo (2008) models a whole engineer as the combination of the four dimensions of the engineering profession namely a strategist, a scientist, a businessman and a doer. Moreover, the graduate attribute profile of an engineer as reflected from the program or student education outcomes of the engineering program from ABET Criteria 2000 include technical understanding, technical engineering capabilities, community responsibility and personal capabilities. This classification shows that the technical understanding and engineering capabilities namely knowledge, analysis, design, investigation and tool use are related to technical engineering knowledge and its applications. The seven other attributes are related to community responsibility and personal capabilities specifically society, environment, ethics, individual and team collaboration, communications and life-long learning are related to broad knowledge skills, capabilities and attributes that are considered to be essential for an engineer to be able to perform in the 21st century.

As these qualities are essential attributes that must be possessed by each graduate completing the program, it follows that they must be subjected to assessment. This study pursued the competencies required for effective action in a satellite company. Furthermore, this study is an assessment of the ECE department's performance in the perspective of Satellite Communications.

A. *Respondents of the Study*

There were 20 respondents covered by this study broken down as follows:

1. 10 ECE graduating students of Columban College
2. 10 ECE graduates of Columban College employed in ABS

TABLE I. ECE GRADUATES OF COLUMBAN COLLEGE AND THEIR SATELLITE CAREER

Satellite Career	**Number of ECE Graduates of Columban College Employed in ABS**				
	Year Graduated				
	2003	***2009***	***2010***	***2011***	***2012***
NOC/TAC			1		1
Satellite Systems Engineering		1			
Satellite Operations	1		1		1
MCR			1	1	1
GSS			1		

Table 1 shows the distribution of the ECE graduates of Columban College employed in ABS and their corresponding satellite career.

B. *Methodology*

This academia-industry interaction is a quest to establish the level of competence of the ECE graduating students in their pursuit of a satellite career after graduation. Success indicators in a satellite industry were incorporated in the Course Experience Questionnaire authored by the proponent. A four-part written pre-test technical examination was conducted. After a two week industrial immersion, the same examination was administered as a post-test. Deficiencies and corresponding interventions were identified through the different satellite careers of the ECE graduates of Columban College currently employed in ABS and observation of the proponent.

C. Data Processing

Data gathering consisted of a pre-test technical examination administered to the ECE graduating class before the industrial immersion. In collaboration with a spacecraft engineer and flight dynamics/mission analyst engineer, a two-part technical exam was authored by the researcher incorporating the common terminologies encountered in the operations room and the calculation for delta velocity where strategies for adjustment in the orbital position done in maneuvering are derived. An OJT program was devised by the TAC 2 supervisor and approved by the manager from UK. An introduction to antenna, baseband and RF systems were provided during the first week. Overview of data services, video broadcast services through satellite and link budget analysis was done in the second week. Through the on-the-job training of the ECE graduating class exceptional experiences were gained through exposing their mind in a real situation. They obtained the basic principles from the academic point and then eventually through this program they apply it to an industry situation where they are mentored by practicing engineers. It does not only give the students experiential knowledge but also give a new sense of living. It can help the students prepare more in facing their job and to build a harmonize relationship with workmates in the near future.

A post-test technical examination was administered along with the Course Experience Questionnaire (CEQ) authored by the proponent. The survey incorporated 50 questions with 5-point Likert scale response options and an invitation to include free-form comments. The first 11 questions of the CEQ survey are the program or student education outcomes of the Electronics Engineering program from ABET Criteria 2000 that specify what students are expected to know and be able to do by the time of graduation. These relate to the skill, knowledge and behaviors that the students acquire as they go through the program. In order to verify salient competencies required in ABS, survey questions 12 to 45 are devised to indicate the level of agreement of the respondent relative to the acquisition of key competencies necessary to be transferred to real-life situations in the context of Satellite Communications. Lack of this ability prevents highly knowledgeable students from becoming competent in this field. Survey question 46 measures the readiness of the student to be involved in a 24/7 operation combatting its hardships and affliction. Survey questions 47 to 50 evaluate Columban College in developing a job-ready graduate.

Interview questions for ECE graduates from Columban College and managers are devised to investigate on salient points further. The experts by experience were involved to assess students' readiness in their professional practice as well as in the mobilization of the pursuit made by the academe to eliminate the disconnection of the classroom setup from the broad cross-section of the engineering community. The informal encounters with managers from different countries conveyed the steps pursued by the academic institution and the Philippines in general. Comparison with the educational system and industry sandwich programs enables the proponent to rethink reform of the ECE curriculum in the Philippines relative to the standard of other advanced countries. This preliminary step will serve as a guide for the next batch of ECE learner.

III. RESULTS AND DISCUSSION

This section unveils the assessment result to the ECE graduating class of Columban College and the ECE graduates of Columban College currently employed in ABS.

A. Assessment Result of the ECE Graduating Students

This study investigated how well Electronics Engineering graduating students and Electronics Engineering graduates employed in Asia Broadcast Satellite perceive they were prepared for work in a satellite communication industry. Based on the observation, qualitative analysis of the Course Experience Questionnaire and interview, graduates and the graduating students felt that overall, they were not prepared for work in the satellite industry.

Little is known about how well prepared final-year Electronics Engineering students perceive themselves to enter the satellite career. The amount of student learning and personal development associated with any educational program is directly proportional to the quality and quantity of student involvement in that program.

To realize student learning and personal development associated with the Electronics Engineering program, a four-part written pre-test technical examination was conducted. After a two-week industrial immersion, the same examination was administered as a post-test. Table II summarizes the measured learning outcome of the multiple choice examination under the technical ability examination on Satellite Communication and the result of the pretest and posttest administered to the 10 ECE graduating students of Columban College.

TABLE II. MEASURED LEARNING OUTCOME OF THE MULTIPLE CHOICE TECHNICAL EXAMINATION ON SATELLITE COMMUNICATION AND NUMBER OF STUDENTS WITH CORRECT ANSWERS

Item	**Measured Learning Outcome**	**Number of Students Correct out of 10**	
		Pretest	***Posttest***
1	Ability to rekindle the history of satellite communication by identifying among options Sputnik 1 as the first satellite launched by the Soviet Union in October of 1957 just to prove they could. Four months later, the U.S. responded with Explorer 1.	6	10
2	Ability to rekindle the history of satellite communication by identifying among options Sputnik 1 the first satellite launched by the Soviet Union that ushered in new political, military, technological, and scientific developments.	4	10
3	Ability to recognize among options why a carrier is used and why it is modulated	7	10
4	Ability to identify the wrong statement regarding satellite communication and Wired Communications	5	5

CONTINUATION OF TABLE II

Item	Measured Learning Outcome	Number of Students Correct out of 10	
		Pretest	*Posttest*
5	Ability to identify among options the many interesting alternatives and tradeoffs in the design of a satellite communications system	1	9
6	Ability to identify among options LEO satellites that orbit from 160-2000km above the earth. LEOsatellites take approximately 1.5 hrs for a full orbit and only cover a portion of the earth's surface, therefore requiring a network or constellation of satellites to provide global, continual coverage	2	9
7	Ability to identify among options LEO satellites which have a lower latency and require less amplification for transmission	2	10
8	Ability to identify among options latency as the time between the moment a packet is transmitted and the moment it reaches its destination	2	10
9	Ability to identify among options MEO satellites that are located above LEO and below GEO satellites and typically travel in an elliptical orbit over the North and South Pole or in an equatorial orbit	4	5
10	Ability to identify among options MEO satellites that are used for GPS navigation systems and are sometimes used for voice and data communications	1	3
11	Ability to identify among options MEO satellites that require a constellation of satellites to provide continuous coverage	2	7
12	Ability to identify among options GEO satellites that orbit at 35,786 km (22,282 mi) above the equator in the same direction and speed as the earth rotates on its axis	2	6
13	Ability to identify among options HEO satellites which is at about 20,000 km and is above the second Van Allen belt but below GEO	6	7
14	Ability to identify among options the appropriate orbit constraints	7	10
15	Ability to identify the characteristics and properties C band among options	5	9
16	Ability to identify the characteristics and properties X band among options	3	0
17	Ability to identify the characteristics and properties of Ku band among options	4	9
18	Ability to identify the characteristics and properties of Ka band among options	4	4
19	Ability to identify among options TDMA as the multiple satellite access technique suitable only for digital transmission	4	0
20	Ability to identify among options CDMA as the multiple satellite access technique suitable for communication satellites with military application	1	0
21	Ability to identify among options the correct statement relating to transponder capacity utilization in case of TDMA and FDMA techniques	2	5
22	Ability to identify among options the correct statement relating to the use of code division multiple access technique	4	5

CONTINUATION OF TABLE II

Item	Measured Learning Outcome	Number of Students Correct	
		Pretest	*Posttest*
23	Ability to identify among options the correct statement relating to frequency reuse	0	0
24	Ability to identify the characteristics and properties ofTDMA	4	10
25	Ability to identify the spelled outmeaning of DAMA	0	10
26	Ability to identify the characteristics and properties ofCDMA	2	0
27	Ability to identify the time duration between the transmission of traffic bursts in TDMA	1	0
28	Ability to identify the signaling channels	8	10
29	Ability to identify among options DAMA attributed to the near far effect	2	5
30	Ability to identify among options FDMA attributed to intermodulation distortion	1	5

Range of scores in the pre-test examination reveals 5 out of 30 as the lowest score and 21 out of 30 as the highest score. After a two week industrial immersion, the same examination was administered as a post-test. An improvement in the result was noticed as reflected in Figure 2 but 21 out 30 remains the highest score.

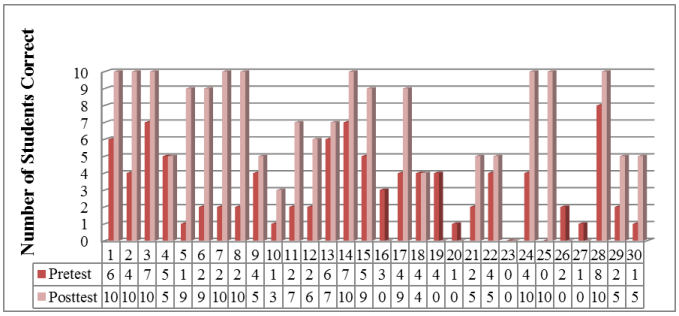

Figure 2. Multiple Choice Examination Result

The first part consists of 30 multiple choice tests focusing on the origin of satellite communication, satellite frequency allocation and band spectrum, types of satellite, design of satellite communication system and multiple satellite access techniques. Since communications satellite system is an extension of line of sight (LOS) microwave technology, it is necessary to gauge the understanding of ECE graduating students in basic concepts of Wireless Communication through this board exam type questions. As Wireless Communication is incorporated in first semester of the fifth year subjects, students are expected to acquire the competencies of the course. Wireless Communication as part of the Communication Track Elective includes the concepts of signal transmission modes, spread spectrum modulation system, terrestrial microwave, satellite systems, satellite multiple access techniques, terrestrial and satellite systems path calculations and link budgets. These satellite communication concepts are compressed in the two chapter allocation in Wireless Communication as suggested by CMO

24 Series of 2008 Annex III. This examination also revealed the preparation of the ECE graduating class to possible board exam question. It can be interpreted that the result is a consequence of the Communications 4 subject because most of the shortfall is in the altitude classifications for satellite orbits as can be seen in entries 9 to 13 and multiple access schemes as can be seen in 19 to 23, 26 to 27 and 29 to 30.One of the course competencies of Satellite Communication concepts should include the specification of modern satellite system design, multiple access, modulation and coding schemes as part of critical network requirement. In ABS as their satellite transponders have C, Ku and Ka band beams, the ability to identify the characteristics, properties and attribute the aforementioned to the design of the link is a primary competency. As reflected in entry 18 of Table II, students were not able to improve in the measured learning outcome of ability to identify the characteristics and properties of Ka band among options. The Ka band is primarily used for two-way consumer broadband and military networks. Dishes can be much smaller and typically range from 60cm-1.2m (2' to 4') in diameter. Transmission power is much greater compared to the other band beams. Due to the higher frequencies of this band, it can be more vulnerable to signal quality problems caused by rain fade. Two significant nuances between traditional satellite using X, C, Ku, Ka bands and HTS-band satellite using Ku and Ka are spot beam architecture and Ka-band frequency. As High Throughput Satellite (HTS) services will be the emerging environment for high-value networks, knowledge of the contemporary issues should be assessed.

The second part of the technical ability examination is comprised of 21 definition problems authored by a spacecraft engineer. It focused on the orbital aspects, basic terminologies in Satellite Communication and mission analysis of satellite communication such as the satellite roll, pitch, yaw, inclination, longitude, latitude and eccentricity. Frequency distribution of the number of students with correct definition in the pretest and posttest are depicted in Figure 3. Most of the students were not able to define any entry as depicted in Figure 3 and a 4 out 21 was the highest score. This satellite engineering terminologies are prerequisite. On the other hand students were not able to define even basic keyword such as demodulator which was defined correctly by 2 out 10 students in the pre-test.

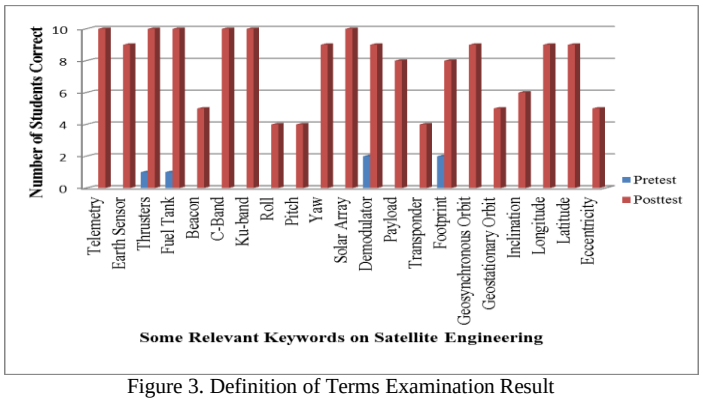

Figure 3. Definition of Terms Examination Result

After a two-week industrial immersion, as part of the post-test, a tremendous increase of correct responses was clearly shown in Figure 3. A student was able to define 21 out of 21 relevant keywords in satellite engineering.

The third part involves identification of 60 basic terminologies used in the day-to-day activities of the Network Operations Center. Frequency distribution of the number of students with correct keywords in the pretest and posttest of Part III are depicted in Figure 4 and 5. Most of the students were not able to identify any entry and a 9 out 60 was the highest score. After the industrial immersion, a student was able to identify 20 out of 60 basic terminologies used in the operations room.

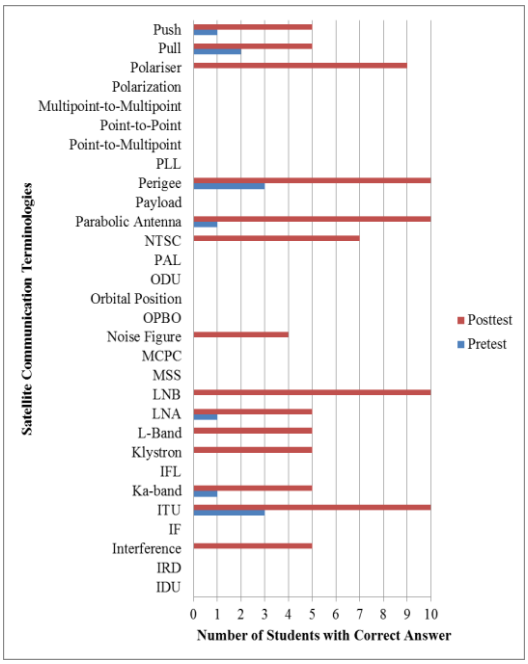

Figure 4. Identification of Terms Examination Result for Item 1 to 30

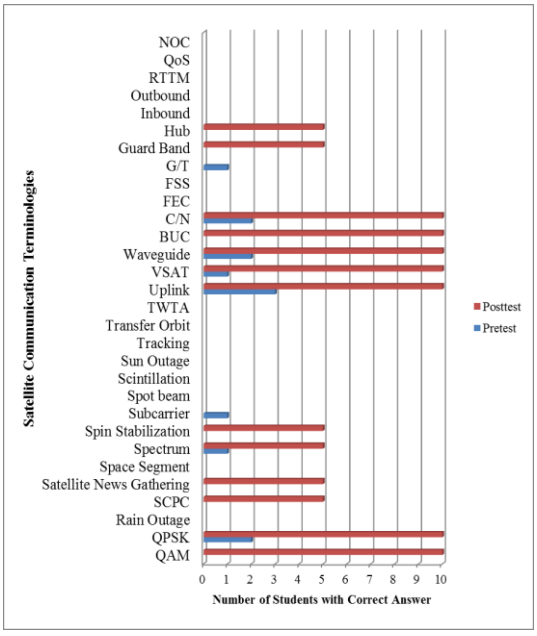

Figure 5. Identification of Terms Examination Result for Item 31 to 60

As part of the two-chapter allocation of satellite communication in the subject Wireless Communication, students should understand Very Small Aperture Terminals (VSAT). As mobile operators are upgrading from 3G and planned 4G networks to remote and rural areas, VSAT growth is expected to be increasingly significant part of the Electronics Engineering profession. In satellite communication as a ubiquitous technology, VSAT should be attributed to business perspective. Terminologies included starts with VSAT terminal major components, satellite application and the some of the important terminologies in the workplace.

Part IV investigates the inclination of satellites. ABS 3 is already inclined and this will allow ABS to sell OCB equipment for tracking. Inclined orbit is a condition that occurs when a satellite is no longer corrected in velocity along the north-south direction. Many satellite orbits are inclined by accident because it is not easy to launch satellites into their pre-determined orbits. A satellite operator might also want an inclined orbit as what is done in ABS3. The students were not able to give one reason why this is intended as illustrated in Figure 6. On the contrary, inclined orbit was thoroughly explained by every student during the posttest.

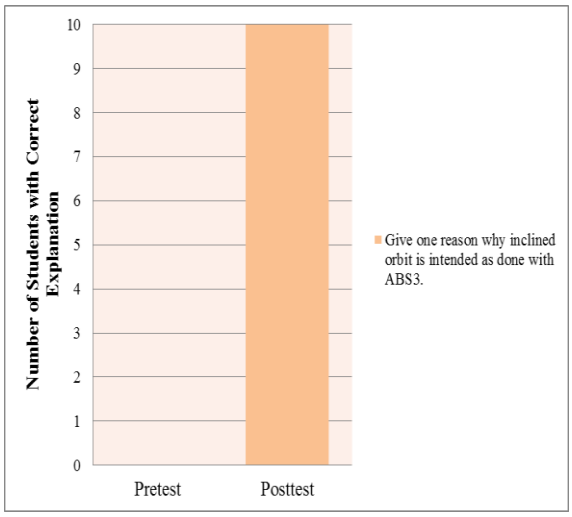

Figure 6. Part IV Examination Result

Part V was authored by a mission analyst and flight dynamics engineer. The first problem asks the students to calculate the velocity of a geostationary satellite given the earth constants for earth's central gravity and earth's rotation rate. The second problem relays the main job of the mission analyst that is to maintain the orbit of the satellite. In line with this, the students were not able to exhibit problem solving skill in this aspect. After the industrial immersion, 5 out of 10 students were able to derive the velocity of a geostationary satellite as illustrated in Figure 7.

As relayed by the spacecraft engineer and the mission analyst flight dynamics engineer during the industrial immersion, station keeping is done using thrusters which of course, produce a thrust that affects the elements of the orbit. This thrust is generally measured and known in the Satellite Industry as Delta Velocity, Delta V or ΔV, measured in m/s. The effects of these maneuvers depend on where the thrusters are positioned relative to the satellite. The thrust is a relatively important capacity of a satellite since it is through the understanding of its strategies that orbit transfers, relocations, de-orbit or decommissioning, collocations and all other adjustments are made. The students are asked to calculate for the changes in semi-major axis "a", drift rate "D" and eccentricity "e" for a Delta V of 1 m/s taking into account that a maneuver in the direction of the satellite motion is positive delta V and typically introduced by thrusters on the west-face of the satellite. Since calculation entails tedious computation, the students were not able to answer this question during the pretest and posttest as shown in Figure 7.

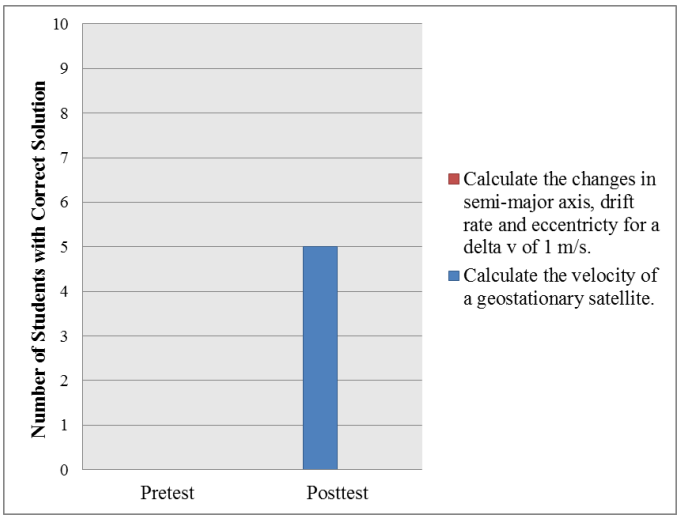

Figure 7. Part V Examination Result

A course experience questionnaire (CEQ) authored by the researcher was administered to the ECE graduating students after the two-week industrial immersion. The Modified Program or Student Education Outcomes of the Electronics Engineering Program from ABET Criteria 2000 scale is the assessment of the program or student outcomes. The first 11 entries specify what students are expected to know and be able to do by the time of graduation. As ABET's definition of engineering (1985), "Engineering is a profession in which a knowledge of the mathematical and natural sciences gained by study, experience and practice is applied with judgment to develop ways to utilize, economically the materials and forces of nature for the benefit of mankind."

Engineering involves social change in an essential way. The critical role of the tensions between science and business in shaping the engineering profession is reiterated by the fact that engineering is a scientific profession, yet the test of engineers work lies not in the laboratory, but in the marketplace [2]. Professional discretion and judgment could entail hazardous engineering activity in the satellite industry that will cause loss of revenue on the part of the company. Herewith, engineering design must commensurate importance because it is the very core of the engineering profession. The Student Outcomes relate to the skills, knowledge, and behaviors that the students acquire as they go through the program.

TABLE III. FREQUENCY DISTRIBUTION OF ECE GRADUATING STUDENTS' RESPONSES TO THE MODIFIED PROGRAM OUTCOMES OF THE ELECTRONICS ENGINEERING PROGRAM FROM ABET CRITERIA 2000

Graduate Qualities Scale		Five-point Likert Scale					Summary Evaluation (Mean Value) n=10
		SA	*A*	*N*	*D*	*SD*	
		5	4	3	2	1	
1.	I can apply knowledge of mathematics, science and engineering.	10					5
2.	The laboratory experiments done in my undergraduate studies helped me analyze and interpret data.		5	5			3.5
3.	I can design a system, component or process to meet desired needs.			5	5		2.5
4.	I can function on multi-disciplinary and multi-cultural teams.	5	5				4.5
5.	I can identify, formulate, and solve engineering problems.		10				4
6.	I fully understand the effects of engineering solutions in a comprehensive context.				10		2
7.	I can communicate effectively.				5	5	1.5
8.	I have broad orientation and understanding regarding the impact of engineering solutions in global and societal context.	5	5				4.5
9.	I recognize the need for life-long learning and I can engage in it.	5	5				4.5
10.	My education at Columban College made me aware of contemporary issues.	5	5				4.5
11.	I can use techniques, skills and modern engineering tools necessary in the Satellite Company.			10			3

Herewith as depicted in Table III, the ECE graduating students perceived their strengths as the ability to work in multi-disciplinary and multi-cultural teams, life-long learning, awareness of contemporary issues and the ability to apply knowledge of mathematics, science and engineering. Attention must be rendered to the shortfall in the ability to communicate effectively, understand the effects of engineering solutions in a comprehensive context, analyze data, tool use and design of a system, component or process to meet desired needs in the perspective of a satellite industry. As revealed from the result, the students have not acquired the fundamental knowledge of Digital Communications, Wireless Communication and Satellite communications during their undergraduate study.

The Principles of Communications subject was not able to provide a sound base in the science of telecommunication engineering and Satellite Communications. The subject Digital Communications does not lay the foundations necessary to understand transmitter baseband throughput, modulation/coding, hub or remote modem output power in relation to the C/N at the receiving end. In the subject Digital Communication, the coding techniques such as Forward Error Correction (FEC) particularly Turbo FEC in Satellite modems were not discussed. FEC codes such as Reed-Solomon, Viterbi, TPC, eTPC and LDPC were not discussed in Digital Communication and Wireless Communication. In Digital Communication, the effect of phase noise in low modulation schemes such as BPSK and higher modulation scheme such as BPSK, QPSK, 8PSK and QAM particularly 16 QAM are not taught and related to decoding. In the subject Digital Communication, the performance of digital satellite systems is not introduced relating to the estimation of bit error rate which is based on carrier to noise ratio. In the subject Digital Communication the importance of MODCOD (Modulation and Coding), Spectral Efficiency, Eb/No for BER in relation to maximum data rate are not introduced significantly. The subject Digital Communications does not lay the foundations necessary to understand the relationship between the MODCOD (Modulation and Coding) and changes in the RF link in relation to IP throughput.

Moreover, the subject Microwave Communications has not presented Satellite Communication as a special type of communication link, complete with its own design formats, analysis procedures and performance characteristics to the communication engineer. VSAT technology is not discussed in Wireless and/or Microwave Communications. Students were not able to synthesize the relationship of Electronics and Communications in engineering solutions. For example, Forward Error Correction techniques in satellite communication and broadcasting systems improve link budget without the use of expensive power amplifiers and large dishes.

Electronics 1 and 2 were not able to relate amplifiers and its impact to Satellite Communications. The power amplifiers in Satellite systems such as TWTA and SSPA are not introduced in Wireless Communications and/or Microwave Electronics as the main contributor of interference issues. Its impact to the performance of a link were not discussed using transfer curve as a visual aid for the analysis of transmit power versus output backoff and output backoff versus input backoff of the SSPA or TWTA transponder transfer curve. The amplifying action in Electronics 1 and 2 is not compared to saturation where in an amplifier reaches the non-linear part of

the power transfer. Its effect in spectrum spreading is not further investigated. Intermodulation was not discussed in Principles of Communication in this context. Overall, instructional materials have not strengthened the problem-solving expertise of the students and will not carry them into successful career in Satellite Communication industry. Table IV gives the summary evaluation for each major item in each division.

TABLE IV. FREQUENCY DISTRIBUTION OF ECE GRADUATING STUDENTS' RESPONSES TO THE SATELLITE COMMUNICATIONS COMPETENCY

Satellite Communications Competency	Five-point Likert Scale					Summary Evaluation (Mean Value)
	SA	***A***	***N***	***D***	***SD***	
	5	***4***	***3***	***2***	***1***	
12. The Principles of Communications subject provided a sound base in the science of telecommunication engineering and Satellite Communications.				10		2
13. The subject Signal, Spectra, Signal Processing introduced the fundamental ideas of signals and system analysis used in Satellite Communication.		10				4
14. Since ECE is working on frequency, the major subjects in the curriculum have provided me enough overview regarding bandwidth considerations, the FCC and the electromagnetic spectrum as it is regarded in practice emphasizing on the difference among frequencies and their properties, the impact of frequency reusein the engineering frequency plan and theissue of interference plaguing the Satellite industry.	5	5				4.5
15. I can use Network Architecture and Cisco related skills such as IP configuration of the hub site and remote site.	5	5				4.5
16. The Transmission Fundamentals studied in Principles of Communications were useful to be prepared in a Satellite Communications company.		10				4
17. Adequate introduction in the classroom discussion provided me a foundation to numerous other courses that deal with signal and system concepts directly and indirectly.		10				4

CONTINUATION OF TABLE IV

Satellite Communications Competency	Five-point Likert Scale					Summary Evaluation (Mean Value)
	SA	***A***	***N***	***D***	***SD***	
	5	***4***	***3***	***2***	***1***	
18. I can differentiate linear polarization from circular polarization and the corresponding considerations in the design of a wireless link as an outcome of the subject Communications 2 (Transmission Lines and Antenna) and Communications 4 (Wired and Wireless Communications).		5	5			3.5
19. The subject Digital Communications laid the foundations necessary to understand transmitter baseband throughput, modulation/coding, hub or remote modem output power in relation to the C/N at the receiving end.			5	5		2.5
20. Due to the inherent "long-haul" nature of satellite communication requiring many phases of modulation, frequency conversion, amplification, transmission and demodulation I recognize the challenge of error correction. In the subject Digital Communication, the coding techniques such as Forward Error Correction (FEC) particularly Turbo FEC in Satellite modems were discussed.			5		5	2
21. FEC codes such as Reed-Solomon, Viterbi, TPC, eTPC and LDPC were discussed in Digital Communication and Wireless Communication.				5	5	1.5
22. In Digital Communication, the effect of phase noise in low modulation schemes such as BPSK and higher modulation scheme such as BPSK, QPSK, 8PSK and QAM particularly 16 QAM are taught and related to decoding.			5	5		2.5
23. In the subject Digital Communication, the performance of digital satellite systems is introduced relating to			5	5		2.5

CONTINUATION OF TABLE IV

Satellite Communications Competency	Five-point Likert Scale					Summary Evaluation (Mean Value)
	SA	***A***	***N***	***D***	***SD***	
	5	***4***	***3***	***2***	***1***	
the estimation of bit error rate which is based on carrier to noise ratio.						
24. In the subject Digital Communication the importance of MODCOD (Modulation and Coding), Spectral Efficiency, Eb/No for BER in relation to maximum data rate are introduced significantly.				5	5	1.5
25. The subject Digital Communications laid the foundations necessary to understand the relationship between the MODCOD (Modulation and Coding) and changes in the RF link in relation to IP throughput.				10		2
26. The quantitative analysis techniques studied in Communications 4 (Wired and Wireless Communications) was useful for my job.		10				4
27. Discussions on Link budget analysis in the subject Microwave Communications is realized useful in Satellite Communications.	5	5				4.5
28. The subject Microwave Communications have provided significant introduction regarding the applications, future trends and advanced concepts of Satellite Communications.	1	4	4	1		3.5
29. The subject Microwave Communications has presented Satellite Communication as a special type of communication link, complete with its own design formats, analysis procedures and performance characteristics to the communication engineer.			5	5		2.5

CONTINUATION OF TABLE IV

Satellite Communications Competency	Five-point Likert Scale					Summary Evaluation (Mean Value)
	SA	***A***	***N***	***D***	***SD***	
	5	***4***	***3***	***2***	***1***	
30. An introduction to antenna systems, RF systems and baseband systems were provided during lectures.		5	5			3.5
31. VSAT technology is discussed in Wireless and/or Microwave Communications.				5	5	1.5
32. I can synthesize the relationship of Electronics and Communications in engineering solutions. For example, Forward Error Correction techniques insatellite communication and broadcasting systems improve link budget without the use of expensive power amplifiers and large dishes. (Note: The discussion of power amplifiers in Electronics 1 and 2 are important foundations to understand its implication in the Satellite Communication System.)		5	5			3.5
33. Following the preceding argument, Electronics 1 and 2 related amplifiers and its impact to Satellite Communications.				10		2
34. The power amplifiers in Satellite systems such as TWTA and SSPA which are introduced in Wireless Communications and/or Microwave Electronics are regarded as the main contributor of interference issues and its impact to the performance of a link were discussed using transfer curve as a visual aid for the analysis of transmit power versus output backoff and output backoff versus input backoff of the SSPA or TWTA transponder transfer curve.					10	1
35. As a stepping stone to this vast concept in the preceding item, the				10		2

CONTINUATION OF TABLE IV

Satellite Communications Competency	Five-point Likert Scale					Summary Evaluation (Mean Value)
	SA	*A*	*N*	*D*	*SD*	
	5	*4*	*3*	*2*	*1*	
amplifying action in Electronics 1 and 2 is compared to saturation where in an amplifier reaches the non-linear part of the power transfer.Its effect in spectrum spreading is investigated.						
36. Intermodulation distortion in Communications 1 (Principles of Communications) is reexamined here looking into the relationship in a particular Electronics topic which is amplifier.				10		2
37. Instructional methodologies improve my interpersonal skills.	10					5
38. Instructional materials strengthen my problem-solving expertise and will carry me into successful career in Satellite Communication industry.				10		2
39. I am ready to belong in a climate of continuous learning embracing the challenges of the technicalities of Satellite Communications.	10					5
40. Experiential learning (learning by doing) is incorporated in the curriculum.				10		2
41. I can identify and find solution to complex network faults causing intermittent downtime in the Satellite service.				10		2
42. The curriculum provided an opportunity to develop the concept of professional practice significant to business perspective.				10		2
43. Instructional materials provided by the ECE course meet my learning needs to pursue a career in Satellite Communications.				10		2
44. I can exemplify the relationship of the basic terminologies in Satellite Communication to the mission analysis of the satellite such as roll, pitch, yaw, inclination,						

CONTINUATION OF TABLE IV

Satellite Communications Competency	Five-point Likert Scale					Summary Evaluation (Mean Value)
	SA	*A*	*N*	*D*	*SD*	
	5	*4*	*3*	*2*	*1*	
longitude, latitude and eccentricity.	1	4	4	1		3.5
45. I understand the importance of bandwidth test done before the initialization of carriers because bandwidth efficiency is a critical network requirement, and service providers are always looking for smarter ways to save on bandwidth costs.	5	5				4.5
46. I acknowledge the dignity of my profession servicing the globe 24/7. In line with this, I am willing to work for 8, 16 to 24 hours and even during holidays.		10				4

TABLE V. FREQUENCY DISTRIBUTION OF ECE GRADUATING STUDENTS' RESPONSES TO THE COLUMBAN COLLEGE ECE DEPARTMENT SCALE

Columban College ECE Department Scale	Five-point Likert Scale					Summary Evaluation (Mean Value)
	SA	*A*	*N*	*D*	*SD*	
	5	*4*	*3*	*2*	*1*	
47. Engineering educators in the ECE department of Columban College made every coursework exciting, creative, adventurous, rigorous, demanding, and empowering environments.				10		2
48. Columban College is successful in developing a job-ready graduate by looking into the efficiency of the student experience to balance theory and practice.				10		2
49. The technical knowledge I acquired in my undergraduate study is limited to be able to apply in Satellite Communication career.		10				4
50. I am excited about potential career and course work in Satellite Communication.	10					5

Unanimously with a rating of "Agree", students perceived the technical knowledge they acquired in their undergraduate study is limited to be applied in a Satellite Communication career. Since the satellite communications is a fast-pacing industry with lots of new challenges, it is always on the forefront and there is never a dull moment. Satellites are working on technology that literally connects the world. With this, students remain to be excited about their potential career

and course work in Satellite Communication as revealed in Table V entry 50.

B. Assessment Result of the ECE Graduates Employed in ABS

The field of satellite communications is overcrowded. In this note, it means the satellite industry is interdisciplinary. Since satellite industry engineers provide engineering support for satellites and ground systems, it is recognized that ECE graduates will continue to build on the foundations that their engineering education has provided. This section unveils the relevance of the engineering education imparted to the ECE graduates employed in ABS by the ECE department in the perspective of satellite industry.

In line with this, Table VI illustrates that the 10 ECE graduates employed in ABS felt the technical knowledge they acquired from their undergraduate study is limited to be applied in a Satellite Communication career. In deference to the preceding, the study seeks the adjustments and interventions needed to make them competitive and prepared. In line with this, survey responses will be presented for each department.

TABLE VI. FREQUENCY DISTRIBUTION OF ECE GRADUATES EMPLOYED IN ABS RELATED TO COMLUMBAN COLLEGE ECE DEPARTMENT SCALE

Columban College ECE Department Scale	**Five-point Likert Scale**					**Summary Evaluation (Mean Value)**
	SA	***A***	***N***	***D***	***SD***	
	5	***4***	***3***	***2***	***1***	
1. Engineering educators in the ECE department of Columban College made every coursework exciting, creative, adventurous, rigorous, demanding and empowering environments.		3	6	1		3.2
2. The technical knowledge I acquired from my undergraduate study is limited to be applied in a Satellite Communication career.	4	4	2			4.2
3. The ECE Department of Columban College is successful in developing a job-ready graduate in the field of Satellite Communications.	5		5			4

Unanimous level of feedback regarding the deficiency in laboratory equipment such as modulator, demodulator and test equipment specifically spectrum analyzer and scalar analyzer were accumulated. Since the old curriculum of the ECE program do not include a practicum program, no exposure in the actual field was rendered. Too much concentration on books was practiced by the professors, as per 2012 graduate. Satellite operation and orbital analysis were not included in the two-chapter allocation for Satellite Communications in the subject Wireless Communication. Reinforcement of the shortfall continues to be expected since Communications 4 in the ECE prospectus comprises both Wired and Wireless Communication. Communications 5 which is the last Electronic Communication subject deals with Microwave Design. Interview with a TAC member revealed that the graduate just realized the novelty of the subject during job tasks in the TAC team.

C. The BBS Philippines

The site consists of four groups, the Fleet Operations Group, Ground and Teleport Support Group (GSS), TAC and MCR.

During the acquisition of MSC by ABS, selected 2012 graduating students were given opportunity to have practicum in BBS as part of the clean-up drive. These students worked in the GSS. Today two of the three students are employed in the Sat Ops and MCR department.

D. Satellite Career in the MCR Group

Since the MCR Operations Engineer is responsible for the provision of network services and maintenance of BBS systems including satellite digital TV broadcasting systems and data systems, the job requires the graduate to have know-how in monitoring Video Automation System and Master Control for Satellite TV. The group handles real time program transmission operation for both pre-recorded materials playout and live broadcast, prepares on-air materials, monitors performance of broadcasting services, handle ad hoc situation for the operation and prepares operational report for services outage and abnormalities. The job requires understanding of broadcast operations, strong problem solving and communication skills, good command of spoken English, self-motivated and great sense of responsibility. Candidates with less experience will be considered as Junior MCR Operations Engineer.

One of the three graduates of Columban College employed in the MCR department is a Media Control Room Operations Engineer. The graduate imparted her main task is to monitor the channels they are transmitting in BBS to their customers. The team does an hourly monitoring of the video and audio quality of the transmitted channels and also the video and audio quality on the received side. They also ensure the carrier frequencies of the monitored channels are on the nominal rate. As a whole the MCR is responsible in making sure that the programs for the channels they are transmitting will be received by their customers are in good quality. They are ensuring there will be no “lost on-air” job for all the channels. Since the group is dealing with SPA, exposure to the technical applications of broadcasting via satellite is recommended to the academe.

E. Satellite Career in Satellite Operations

Three ECE graduates of Columban College are employed in the Satellite Operations (SatOps) team. Their main task is monitoring of spacecrafts in orbit. They are capable of executing orbit and maneuver plans provided by Satellite Engineering (SatEng) and Mission groups. They are

responsible of issuing spacecraft commands and monitoring and analyzing telemetry, and implementing corrective actions. They manage software and hardware used to operate spacecraft, detect system anomalies, degradation or failures.

During the undergraduate study, students need to know more how satellite works and moves around the world. Since OJT in this department is not possible due to ITAR, satellite operation and orbital analysis must be included in the Satellite Communication subject. Students also need to know some basic commands and programs that are used in operations. The Computer Fundamentals and Programming plays a vital role in this aspect. Today, Computer Fundamentals and Programming (ITE 101C) is in the First Year (Second Semester) curriculum. For the ECE curriculum, this is the only subject where programming is supposed to be incorporated.

F. Satellite Career in Spacecraft Engineering

The spacecraft engineer manages the spacecraft maneuvers, performance, orbit or simply all about spacecraft activities. The Satellite Engineering and Mission Analyst manage the state of health covering the fleet of satellites, detect, decide and react immediately to all satellite anomalies and prepare to take whatever action necessary to restore the satellite to its normal configuration. The spacecraft engineer manages daily satellite operations activities and prepares command procedures and manages the execution of command procedures during stationkeeping maneuvers and normal on-orbit operations. Two problems regarding the satellite are launching and putting the satellite into geostationary orbit following Kepler's Laws and maintaining the satellite into its orbit. Once the satellite is launched into space on a rocket and is inserted into the operational orbit, it will be maintained in that orbit by means of thrusters onboard the satellite itself. They also decide how to safeguard the satellite in case of anomaly during contingency operations. His job includes preparation of bi-weekly, monthly satellite health and satellite activities report. He also prepares documentation for all satellite activities and anomalies. This job may require excellent computer skills and the ability to write software programs, as well as strong written and verbal communication skills.

The spacecraft engineer imparted the deficiencies in his undergraduate study in the field of Satellite Communications that is necessary in the current job. He believes it would be better if the graduate have more knowledge and skills in programming and have deep knowledge in Communications, Electronics, Math, Physics, Thermodynamics, Navigational Aids, Logic Circuits, Data Communication, Celestial Mechanics, Astronomical Physics, Trigonometry, Applied Physics, Calculus, Integral Calculus, Differential Equations, Statistics, Geometry, Analytic Geometry and Algebra which could be a great leverage to quickly solve a problem especially during anomalies, gather and analyze spacecraft data, automate daily operation and lessen operation difficulties, etc.

Adjustments of the ECE Department of Columban College include enhancement of problem solving skills, experimental curiosity and learning independence of students. Students must be able to acquire self-directed learning, read more and be more aggressive in learning more. Students must not be complacent and try to absorb and understand all ECE subjects. Someday all knowledge acquired will be great advantage handling work related job and problems. Students must explore outside their campus and invest in knowing the current technology around. It would be better to have OJT not only in satellite operators but as well as telecommunications, data handling, broadcasting companies or any related companies. Additional comment on the Electronics Engineering Department of Columban College was provided. ECE is a very broad course and has a long list of subjects that should be focused on. It will be a good strategy to focus more in the basic subjects which will be the students core then let them focus more in the skills and experience as well as their attitude.

A spacecraft engineer must be detail-oriented and analytical, with an understanding of spacecraft subsystems, satellite communication systems, spacecraft operations and ground control systems. Satellite operations engineers' responsibilities can include the more complex testing and analysis activities involving satellite operations such as launch, early-orbit operations and anomaly support. At the last part of the interview question, the respondents were asked to rank the following from 1 to 10 according to importance 1 being the highest. Herewith, Table VII summarizes the important abilities and competencies commensurate with its importance in the perspective of each satellite career.

TABLE VII. COMPETENCIES IN A SATELLITE CAREER RANKED FROM 1 TO 10 ACCORDING TO IMPORTANCE (1 BEING THE HIGHEST)

Competency	Spacecraft Engineering	Satellite Operations	MCR	TAC	GSS
Working under pressure	4	1	9	5	1
Oral communication skills	3	2	10	1	6
Accuracy and attention to detail	1	9	2	6	5
Working in a team	10	5	6	2	2
Time management	7	6	8	9	4
Adaptability	9	3	1	8	7
Initiative	8	7	4	7	8
Working independently	6	10	5	10	10
Taking responsibility and decisions	2	8	7	4	3
Planning, coordinating and organizing	5	4	3	3	9

In the spacecraft engineering career, accuracy and attention to detail ranked first since the main job are in maneuvering and orbital corrections of the spacecraft. Orbital correction is carried out by command from the TT&C earth station which monitors the satellite position. East-west and North-south station keeping maneuvers are usually carried out using the

same thrusters as are used for altitude control. Taking responsibility and decisions ranked second demanded for decision making regarding anomalies. This entails originality in problem solving since it is considered complex engineering problem because it has no obvious solution and require originality in analysis.

As revealed in Table VII, for the spacecraft engineering oral communication skills, working under pressure, planning, coordinating and organizing, working independently, time management initiative and adaptability follows respectively. Working in a team ranked last but should not be regarded as the least since all these soft skills are required in a satellite career. In the satellite operations career, the three respondents decided as a team and as a group agree on one ranking, working under pressure being the highest and working independently as the last.

G. Satellite Career in Ground Support System (GSS)

Facility manages the site's orderliness and functionality. The GSS set up and configure ground communications support. The RF team prepares transmission of TT&C carriers (Telemetry, Tracking and Command). Telemetry, Tracking and Command (TT&C) is a system that provides two-way communication between an earth station and the satellite to monitor spacecraft systems and to send instructions for changes. These carriers are used for ranging and tracking.

The deficiencies of the undergraduate study in the field of Satellite Communications that is necessary in the current job of the GSS group reiterated the unfamiliarity with equipment used in Satellite Communication especially test equipments. Suggested adjustments to make the graduates of the ECE Department of Columban College competitive and prepared in the field of Satellite Communication include more exposure to the industry, not only with satellite communication but broad exposure to different industries.

H. Satellite Career in Network Operations Center-Technical Assistance Center

The NOC-TAC group is responsible for monitoring the operation of all ABS satellite transponders, ABS-1, ABS-1A, ABS-2i, ABS 2, ABS-3 and ABS-7. Its main function is to ensure the efficient use of both C- and Ku-band transponders by monitoring the signals of all users so that they are operating within nominal power level.

It is the main concern of the group to ensure that there is an effective utilization of its available bandwidth. The company is working on different aspects to make sure the customers have uninterrupted communications which is so vital in their operations. The NOC TAC 1, TAC 2 and TAC 3 are concerned with customer support, payload and ground respectively.

The TAC group handles interference following guidelines starting with customer report, logging of information, gathering of information, traffic restoration and isolation of the source of interference. As a general rule, the group never takes the word of an uplink operator as the only proof. They always have the operator demonstrate to the TAC team member what the uplink operator is doing and ask lots of specific questions.

Moreover, in the TAC group, proficiency with technical writing skill is important for effective communication. As revealed in Table VII, the two respondents ranked oral communication skills as the highest since this satellite career entails responding to emails and phone calls. Professional appearance and professional demeanor are important in responding to clients, co-workers and supervisors. In ABS beyond technical skills, interpersonal skill is necessary because professionals here work together in a cooperative environment. As an industry where the world is flat brought about by the convergence of companies of MSC and ABS, shifting towards a knowledge-based economy relied on human capital. Their knowledge means capacity for effective action, which includes information, belief and understanding of causalities that are useful for effective action. Consistent with Table VII, working independently ranked last since professionals in this group discuss among themselves the problems or issues to be solved. This allows them to consider the viewpoint of each other, develop a sense of teamwork and use their critical thinking skills at the same time. This calls for the realization regarding the difference of industry and academic environment. In ABS, regardless of position, educational attainment and culture, employees nurture the sense of belongingness and respect the contribution of one another to accomplish a common goal that is to close the link of communication.

I. Affective Evaluation of the ECE Graduating Students

Observation of activities in the NOC/TAC group to measure the affective domain of ECE graduating students was done by the proponent. Interaction with industry practitioners who have volunteered their time, expertise, effort and enthusiasm promoted self-assessment of their individual skill set technically and emotionally. Before the blossoming of their ability to compete, industry immersion learning commenced with the first day jitter. The affective domain consists of self-identity, self-value, self-directedness, and self-accountability factors. As their professor who had an industry immersion in the same company, it is also important that experiences are shared so that they may be able to establish issues and concerns looking both at student's and professor's perspective. The students entered the area of Satellite Communication with just little concrete idea of what it is all about. They took chances to learn all the things that they could learn within a limited period of time given to them as their interests on communication field go fonder. Exceptional experiences were gained through exposing their mind in a real situation. Learning the basic principles from the academic point and applying it to an industry for a better understanding. As the TAC group is the interface of the company to their customers, the students displayed cooperation and modesty in every task given to them without showing their limited technical ability at hand. The students witnessed the job done by the TAC team and identified their ability in this activities.

Employers want from their employees the skills that will contribute innovation in their company. Lot of books from the academe was just to satisfy the buds of their mind, but in the

industry they found the substance that they were craving for. Being exposed to an industry as a trainee does not only give them experiential knowledge, it also gave them a new sense of living. It will help them prepare a harmonize relationship with their workmates in the near future. It was really appreciable to encounter professionals who were willing to teach and help them understand the things they want to learn. Everything starts with the first day of queries, how to act professionally while asking questions is very important.

Assessment of the behavior should consider the type of environment and people in the surrounding. Once the largest U.S. military naval base in Asia, history reveals the global competitiveness required in SBMA as it continues to be one of the country's major economic engines. As maritime and electronics firms are Subic Bay's top employers, career opportunities require the critical need for the ability to work effectively in multi-disciplinary and multi-cultural teams. That is to become competent engineers must work effectively with people who define problems differently than oneself, specifically depending upon the culture.

Global competency adds to engineering education the human dimensions of how to address employers and supervisors from different countries. In carrying out engineering work, it is necessary that engineers and non-engineers negotiate and decide among themselves the solution to the complex engineering problems. Filipinos in the TAC group as service providers of satellite applications should manage a blended portfolio of customers thus creating value that differentiates their services. Creating customer value needs to operate at peak performance, optimize and extend network operations and deliver customer experience. As satellite operators deliver capacity through diverse business models minimizing risk, answering calls of customers requires a comprehensive understanding of customers. This entails another dimension of global competitiveness.

Since BBS Philippines values professional culture and teamwork, human relation is not a problem in the workplace. The readiness of the ECE graduating students to belong in this ideal environment was investigated. Failure to show good work ethics and pleasing personality will mean declinable employment as revealed by one of the TAC engineers. Deliberate modesty by being low profile in the workplace was observed.

Every day was an opportunity to meet the management team of talented and experienced professionals through the operation or lunch. Interview-like conversations to managers and supervisors were grabbed as an opportunity to assess the preparedness of the ECE graduating students. Problem of cultures can emerged from these situations but was handled gracefully by the students. One of the key enabler is the best regards for emotional intelligence. As a basic rule, intelligence quotient will make one hired but emotional intelligence will make one promoted.

Since the Subic Space Center (SSC) facility is staffed by highly trained personnel and engineers working on a 24/7 operating schedule tedious efforts are done to make a 24/7 operation possible. In evaluating the ECE graduating students, their readiness to belong in this workload was investigated since behavior of people is related to the amount of sleep. During the industrial immersion, the ECE graduating students bravely embraced the affliction of the schedule and displayed enormous enthusiasm to learn as rated with a summary evaluation of "Agree" in Table IV entry 46.

Learning is the foundation of education and experience is the substance of learning. As students endlessly crave for knowledge, it is indeed a great opportunity to be exposed in an industry where they can perceive the things they want to know while in the process of learning. Student's curiosity must not be contained in the school. It must be sprouted out in an industry where they can see their strength and flaws while learning to learn.

J. Assessment Result as Change Agents

The implementation of OBE curriculum in all engineering courses as stated in CMO 37 Series of 2012, had given a positive implication to measure quality education not only through effectiveness, efficiency and sustainability but also by relevance. Relevance in education would mean addressing the needs of the students and employers of today and providing the future graduates a curriculum of global comparability. This is a big enigma to the higher education institutions offering engineering programs. Moreover, SBMA is anticipated as the most competitive international service and logistics center in the Southeast region. Quality assurance may vary depending on the field of activity. As Juran (1999) defined quality as fitness for purpose [3]. Relevance of a higher education institution specifically Columban College must consider the need of the industries where its graduates will be employed after graduation.

Taking advantage of the 500 hours spent in ABS, the practicum became a communication channel between the institution and industry for feedback on the quality of the teaching-learning process and the relevance of the curriculum contents to the global market place. Moreover, the industry immersion education enabled the students to show immense personal and professional growth. Herewith, the ECE course must be reviewed and modified in accordance to the requirement of the industry within close proximity

Asia Broadcast Satellite is a young, dynamic and fast growing global satellite operator, with an entrepreneurial and creative business approach. A satellite career in ABS leverages the exposure of its engineers to globally since ABS has offices and executives based in Bermuda, United States, Dubai, South Africa, Germany, Philippines, Indonesia, Malaysia and Hongkong. ABS operates a fleet of six satellites and has procured two Boeing satellites, allowing ABS to provide global coverage to their customers. In addition to the successful expansion of their global satellite fleet, the company invested significantly in their ground facilities and teleports in the Philippines, Bahrain and Tel Aviv. ABS has signed a multi-year and multi-million dollar contract agreement with FOX International Channels Philippines Corporation (FIC) for MCPC services, playout and satellite capacity on ABS-1 and ABS-2 satellites.

In the year 2013, the company had made several senior appointments globally as they continue to grow and expand

their leadership level and expertise. Moving forward, ABS is committed to the long term global growth of the company by exploring innovated opportunities to increase its fleet and global footprint. They are continuing their efforts to secure more expansion slots and leveraging their orbital locations by bringing in new satellites that will compliment and expand their global fleet.

Dynamic and young as ABS, ECE graduates of Columban College aspiring satellite career in ABS upon entry in the company will be not given so much time to read manuals and cope with the complex engineering problems encountered in the operations. Since engineering research seeks to advance the practice investigating and defining the properties of existing systems so that their use can be more appropriate and reliable to the end-user, there is an identified urgent need to focus the ECE curriculum to Satellite Communications technology.

This is an innovative educational initiative of the researcher to identify the essential core-academic, general education and non-academic elements that are considered success indicators in the space industry by looking into the different satellite careers in the MCR, satellite operations, spacecraft engineering, GSS and the TAC group. This will lead to better preparation of engineering students to function effectively in global environments such as Asia Broadcast Satellite.

As far as the proponent knows, there is no university degree specifically focused on satellite technology in the Philippines. It is usually a specialization under engineering. Prerequisite competency to satellite technology includes understanding of basic electromagnetic wave propagation and characteristics, communications theory and basic concepts of mechanics and gravitation comprising the satellite technology. Aside from a comprehensive overview of satellite technology, its application and management are required foremost to practical understanding of the basic construction and usage of commercial satellite networks, how parts of a satellite system function, how various components interact and the role each component plays.

Since elective subjects in the ECE curriculum can be geared towards the need of the industry in close proximity to the academic institution specifically Columban College, modification is herewith suggested. In line with this, the researcher recommends Satellite Communication in Elective 3 instead of Telemetry. A recommended syllabus is devised. Values grid is integrated in the syllabus to incorporate the nontechnical attributes necessary to a satellite career.

IV. CONCLUSION

In this study, the competencies and graduate attributes are interpreted in the perspective of Satellite Communication through industrial immersion of the ECE faculty and the ECE graduating students. Assessment of the ECE graduates of Columban College employed in ABS was also conducted to identify the deficiencies of the ECE Department. Interventions are suggested by the researcher and the ten graduates of Columban College to ameliorate to some extent the industry-academe gap identified.

The Course Experience Questionnaire (CEQ) was conducted to determine the student's preparedness in pursuing their profession in the field of Satellite Communication after graduation. Certain issues like their degree of preparation academically and emotionally were established. It was achieved through the technical examination and CEQ administered to the group of respondents before and after their industrial immersion. Shortfall in technical preparation is identified. On the other hand, fostering soft skills such as communication, interpersonal skills, ability to work in teams and leadership potential must commensurate significance while students learn technical skills.

With the uncovered communication processes for satellite communication through engaging in VSAT-based Satellite Transmission Network activities and NOC activities particularly by working with a Technical Assistance Center Engineer, learning experiences have provided the researcher and the ECE graduating students meaningful context of the ECE profession, integrated subject domains necessary for Satellite Communications, emphasized active learning and design, promoted reflection and self-assessment of learning and lectures taught to students and provided significant interaction with experts by experience and faculty as coach. As their professor who had an industry immersion in the same company, it is important to measure the practicum experience to establish issues and concerns looking both at student's and professor's perspective. Moreover, the learning experience fosters systems thinking looking at the holistic view of the four dimensions of the engineering profession namely as a strategist, scientist, businessman and a doer. A missing ingredient for success in the satellite industry is not only technical ability but also marketing acumen. Herewith, engineering activities in a satellite company elevate the importance of ethical, environmental, political and societal concerns as a lifeline of general communications technology.

While the principles of satellite technology remain constant, the satellite industry is one of the most dynamic sectors of the global economy. Since the industry is constantly changing and progressing, career in the industry requires more of an aptitude to learn and adapt to changing situations than a rigid technical training. Herewith, ECE graduating students remain excited about potential career and course work in Satellite Communication.

As stated by Figueiredo (2008), "The most virtuous creations of the new are often built over the ruins of a glorious past." This will reclaim the educational future of Columban College to liftoff.

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