

## **Curricular Program Status of the Mechanical and Electrical Engineering Colleges of Cebu Technological University in the Licensure Examination**

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### **ABSTRACT**

The performance of an institution in the licensure examination is a measure of the quality of the curricular program in developing the core competencies of students. Thus, this study aimed to evaluate the quality of the Engineering Programs of Cebu Technological University through the performance of the graduates in the licensure examination in comparison with the national passing percentage as reference standard. It also aimed to benchmark its performance with the top four private universities in Cebu offering engineering programs. The data used in this study were obtained from the Professional Regulation Commission from school year 2005 to 2012. Results of the study showed that there is no significant difference between the performance in the licensure examinations of the Mechanical and the Electrical Engineering of Cebu Technological University with that of the national passing percentage performance. Similarly, there is no significant difference between the performance of the two engineering programs of Cebu Technological University with the performance of the top four private universities in Cebu offering Mechanical and Electrical Engineering programs. It can be concluded that the performance of Cebu Technological University Engineering Programs in the licensure examinations was within the prescribed national standard, and at par with the performances of the top four private engineering universities in Cebu. It implies that the two programs of the Engineering Department of Cebu Technological University had produced graduates that are also equipped with the required competencies along with the graduates from other universities that are offering engineering courses in the place.

**Keywords:** Engineering education, national standard performance, benchmark, t-test, one-way, analysis of variance

### **INTRODUCTION**

Licensure examination performance provides a clear indication of the quality of the curricular program that has developed the core competencies of students. It also serves as a gauge in measuring the effectiveness of the curricular program in providing quality education which is at par with other universities that have similar course offering in the place. Licensure guarantees a threshold of competence on the part of the examinee to safeguard the public (Pitter et. al. (1997). The Professional Regulation Commission guarantees that by passing the licensure examinations, the country's graduates are globally competent to practice in their chosen fields.

McGourty et.al. (2013) declared that outcome-driven assessment processes provide critical information to faculty and administration on the effectiveness of design, delivery, and direction of an educational program. They further stated that effective assessment processes must ascertain whether the graduates acquired the knowledge and skills defined by predetermined educational objectives of a particular university.

The Cebu Technological University (CTU) is a multifaceted institution which was granted a university status in 2010 after almost ten decades of existence. As a technological university, one of its curricular offerings is the varied engineering programs which has a formidable mission to fulfill along with other courses. The College of Engineering started its operation in 1996, offering Mechanical Engineering and Electrical Engineering. This college envisions itself to be globally recognized in engineering education excellence. Even in its short existence as a college of engineering, it has already produced top performers in the licensure exams and winners in the national, regional, or locally sponsored quiz bowls and contests. Its graduates are already employed in big companies here and abroad. In other words, it has kept up its mission, and it is on its way to realizing its vision. In 2012, the Mechanical, Electrical and Industrial Engineering Programs were granted Level 1 Accreditation status by the Accrediting Agency of Chartered Colleges and Universities in the Philippines. Even with these achievements, there is still a long way to go for this institution. As such, it is continually striving to improve its faculty profile, its facilities especially its laboratories, its teaching and research, its graduate employability, and its licensure test performance.

For a university, with engineering programs, the performance of its graduates in the licensure examinations is very significant because it gives prestige to the university, and it reflects the overall quality of the engineering programs. It is also one of the requirements for accreditation, particularly by AACUP or Accrediting Agency of Chartered Colleges and Universities in the Philippines. Furthermore, it is used by the Commission on Higher Education and the Professional Regulation Commission as a measure of the institution's fitness and competence to continue offering such programs. Lastly, it considerably affects its graduates' chances of employment in companies here and overseas.

Therefore, it is imperative that the performance of the College of Engineering after sixteen years of operation be carefully assessed and evaluated because of the above cited reasons. One of the most reliable measures of the quality of its output is to benchmark its performance in the licensure exams with the national standard, and the performance of the top engineering schools in Cebu City such as University of San Carlos, Cebu Institute of Technology University, University of Cebu, and University of San Jose Recoletos in the Mechanical and Electrical Licensure Examinations from 2005 to 2012. Thus, this study was conducted.

## **Theoretical Framework**

In thinking about learning theories that may be relevant for Engineering and Technology Education, Schunn & Silk (2011) emphasized the importance of being explicit about the outcomes that educators would like to see in their students.

For an engineering graduate to become a licensed engineer, he must first comply with the requirements set by the law, specifically, Republic Act No. 7920 for Electrical Engineering and Republic Act No. 8495 for Mechanical Engineering. One of these requirements is to pass the licensure examination. "Licensure is intended to ensure a threshold of competence on the part of the examinee to safeguard the public," (Pitter et. al.,1997). The Professional Regulation Commission ensures global competence for professionals who pass the licensure examination.

The Accreditation Board for Engineering Technology (ABET) discussed the importance of accreditation as proof that a collegiate program has met certain standards necessary to produce graduates who are ready to enter their professions. "Accreditation provides an opportunity for academic institutions to demonstrate that they are committed to maintaining their programs' quality and that their programs are performing at the level required by the professions they serve," it further added.

The Accrediting Agency of Chartered Colleges and Universities in the Philippines (AACCU) viewed accreditation "as a process by which an institution at the tertiary level evaluates its educational activities, in whole or in part, and seeks an independent judgment to confirm that it substantially achieves its objectives and is equal in quality to comparable institutions." In 2012, the Commission on Higher Education Task Force on Quality Assurance declared that program excellence is manifested through accreditation, Centers of Excellence and Development, and international certification. Pitter et.al. (1997) argued that licensure examinations are more a measure of the student's ability than of program quality. However, they cautioned that rates below the national passing should be a cause for self-scrutiny for any program deficiencies.

Wulf (2002) argued that the current approach of engineering education is not keeping up with the growing demands of the 21<sup>st</sup> century. He proposed a major shift from the engineering science model – which emphasizes the scientific and mathematical foundations of engineering - to a radical new approach to transform a student-engineer who is far more skilled and versatile to deal with the more complex global issues. Koehn and Malani (2004) said that well motivated students, who complete a comprehensive review course, experience a high pass rate on the Fundamentals of Engineering examination.

The study of Vodovozov et. al., (2010) stated that the ultimate goal of the assessment is to improve student learning. Felder and Brent (2004) stressed the importance of assessment and evaluation in engineering education. They further added that program accreditation is all about assessment and evaluation of training. Assessment processes must be designed to provide administration, faculty, and students with useful performance information that can be readily applied to individual development and program improvement (McGourty et. al., 2013). The authors found out from their experience that a focused, integrated, and consistent assessment program will support the significant development of student learning outcomes and development of engineering education. Programme accreditation in the Philippines is a predictor for successful Licensure Examinations as concluded by Arcelo (2003).

## MATERIALS AND METHODS

The study used the descriptive design. The research locale of this study were the two Colleges of Engineering of Cebu Technological University. The graduates of the College of Engineering from 2005 to 2012, in both mechanical and electrical fields who took their respective licensure examinations were the subjects of the study. The data used in the study were the results of the sixteen licensure examinations in each program within the period 2005 to 2012. These results were used to indicate a pattern or a trend of performance of the graduates from the two Colleges of Engineering of Cebu Technological University.

In the evaluation of the performance of the examinees, the total takers and total passers were considered without differentiating the first-time examination takers from repeaters. The data containing the results of the licensure examinations taken by the CTU graduates in mechanical and electrical engineering from 2005 to 2012 were requested from the Professional Regulation Commission (PRC). The rest of the data were derived from the website of PRC. Consent and confidentiality of the examination results were not an issue because such data were published in newspapers and can also be seen online at PRC website after every licensure examination. Therefore, these data can be accessible to anybody without violation of the Research Ethics Protocol.

The data that were taken from these sources were statistically treated using t-test and one-way analysis of variance. The former was used to determine if there is significant difference between the CTU passing percentages and the national passing percentages of the licensure examinations in mechanical engineering and electrical engineering administered semi-annually from year 2005 to 2012. The latter was used to determine if there is also significant difference between the 2010 to 2012 licensure examination passing percentages of CTU and the top four private engineering schools of Cebu namely: Cebu Institute of Technology University (CITU), University of San Carlos (USC), University of Cebu (UC), and University of San Jose Recoletos (USJR).

## RESULTS AND DISCUSSION

The performance of CTU in the sixteen licensure examinations from 2005 to 2012 in the National Passing Percentage for both engineering programs with two examinations in a year is shown in Table 1. Results in data analysis using t-test at 5% level of significance showed that there is no significant difference between the CTU passing percentages in two engineering licensure examinations and the national passing percentages from 2005 to 2012 which consists of sixteen licensure examinations (Table 2).

Table 1. CTU Licensure Exam Performance in ME and EE from 2005 to 2012

MECHANICAL ENGINEERING			ELECTRICAL ENGINEERING		
Licensure Exams	CTU Passing	National Passing	Licensure Exams	CTU Passing	National Passing
Apr 2005	52.94	45.45	Apr 2005	50	47.06
Oct 2005	47.62	45.5	Sept 2005	41.18	51.12

Apr 2006	50	45.21	Apr 2006	40	48.86
Oct 2006	68	49.68	Sept 2006	33.33	41.09
Apr 2007	63.64	49.96	Apr 2007	16.67	36.43
Oct 2007	76.47	52.75	Sept 2007	31.82	37.42
Apr 2008	53.85	56.66	May 2008	57.14	30.19
Oct 2008	62.75	56.3	Sept 2008	50	38.15
Apr 2009	43.75	48.25	May 2009	37.5	35.2
Oct 2009	57.14	60	Sept 2009	63.64	42.25
Mar 2010	100	51.98	May 2010	33.33	28.39
Sept 2010	70	66.6	Sept 2010	6.67	34.05
Mar 2011	41.48	53	Apr 2011	75	40.42
Sept 2011	71.15	67	Sept 2011	52.94	58.02
Mar 2012	66.67	59.69	Apr 2012	66.67	43.69
Sept 2012	77.78	69.86	Sept 2012	58.33	53.24

Table 2. Significant difference between the CTU passing percentage and the national passing percentage in Mechanical and Electrical Engineering licensure examinations

	CTU Passing	National Passing	T-test	Interpretation
Electrical Engineering	38.44	39.18417	-0.15	no significant difference
Mechanical Engineering	62.18	52.36167	2.03	no significant difference

The performance of CTU Engineering programs in the licensure examinations were also benchmarked with the top four performing universities in Cebu, which include the Cebu Institute of Technology University (CITU, University of San Carlos (USC), University of Cebu (UC), and University of San Jose Recoletos (USJR), as shown in Table 3.

Data analysis using the one-way analysis of variance (ANOVA) at 5% level of significance revealed that there is no significant difference between the 2010 to 2012 Engineering licensure examination results of CTU and the top four private engineering schools of Cebu (Table 3, 4,5 and 6). However, there is significant difference between the results of the University of San Carlos and the University of Cebu in terms of the electrical engineering licensure examination.

Table 3. ME Licensure Exam Passing Percentages of CTU and the top Engineering schools of Cebu

	MECHANICAL ENGINEERING				
	Cebu Technological University	CIT University	University of San Carlos	University of Cebu	University of San Jose Recoletos
March 2010 September	100.00	57.00	68.00	54.00	71.00
2010	70.00	76.79	55.56	58.49	72.22
March 2011 September	41.18	55.81	66.67	44.44	18.75
2011	71.15	67.27	84.62	65.79	56.25
March 2012 September	66.67	48.48	50.00	72.09	50.00
2012	77.78	71.43	88.24	75.00	40.91

Average	71.13	62.80	68.95	62.79	51.52
Variance	359.17	115.55	237.21	170.80	403.82

Table 4. ANOVA results Between CTU and the Top Performing Schools in Cebu in Mechanical Engineering 4

ANOVA						
Source of Variation	SS	df	MS	F	value	F crit
Between Groups	1394.275	4	348.569	1.355	0.278	2.759
Within Groups	6432.728	25	257.309			
Total	7827.003	29				

Table 5. EE Licensure Exam Passing Percentages of CTU and the top Engineering schools of Cebu

	ELECTRICAL ENGINEERING				
	Cebu Technological University	CIT University	University of San Carlos	University of Cebu	University of San Jose Recoletos
May 2010	33.33	55.00	50.00	12.00	0.00
September 2010	6.67	44.19	60.00	23.68	18.18
April 2011	75.00	34.48	75.00	20.00	28.57
September 2011	52.94	60.87	73.33	43.90	52.17
April 2012	66.67	41.79	42.86	14.29	47.06
September 2012	58.33	48.53	56.52	17.07	50.00
May 2010	33.33	55.00	50.00	12.00	0.00
Average	48.23	47.48	59.62	21.823	436.35

Table 6. ANOVA Results between CTU and the Top Performing Schools in Cebu in Electrical Engineering

ANOVA						
Source of Variation	SS	df	MS	F	P- value	F crit
Between Groups	5287.18	4	1321.79	4.566	0.007	2.759
Within Groups	7236.59	25	289.463			
Total	12523.8	29				

It is worthy to note that these top four engineering schools of Cebu are also recognized as belonging to the top engineering schools of the country especially the University of San Carlos and CIT University. USC's Mechanical and Electrical Engineering programs are both level 2 accredited by the Philippine Association of Accrediting Agencies of Schools, Colleges and Universities (PAASCU). Furthermore, both programs are granted Centers of Development by the Commission on Higher Education. CIT University's Mechanical and Electrical Engineering programs are level 2 accredited by the Philippine Association of Colleges and Universities Commission on Accreditation (PACUCOA). The Commission on Higher Education Task Force on Quality Assurance declared that program excellence is manifested through accreditation, Centers of Excellence and Development, and international certification.

Being quite at par with these top engineering schools in Cebu in terms of licensure examination performances, is a reflective of quality of CTU's engineering programs. Although there is significant difference on ANOVA at 5% level of significance however, looking at the

average of the national passing percentage of CTU in the EE, it ranks second from the highest which is USC, and followed by CIT. CTU being Level-1 accredited, it concurs well with AACUP's confirmation that accreditation implies equal in quality with other institutions. Felder and Brent (2004) really stressed the importance of assessment and evaluation in engineering education to monitor the quality of its implementation. The findings are also supported by Arcelo (2003) who said that Program Accreditation in the Philippines is a predictor for successful Licensure Examinations.

### **CONCLUSIONS**

Based on the findings, it can be concluded that the performance of CTU College of Engineering in the licensure examinations is comparable with that of the national standard and the performances of the top four private engineering schools of Cebu. Since both engineering programs being Level-1 accredited by AACUP, thus, results of the study is a confirmation that the Engineering Programs of CTU as a tertiary level institution substantially achieves its objectives in offering quality engineering program or education.

### **RECOMMENDATIONS**

CTU College of Engineering must set the bar examination higher and improve the status quo. It must continuously adopt the standards set by the Professional Regulation Commission, Commission on Higher Education, Accrediting Agency of Chartered Colleges and Universities in the Philippines, and the Washington Accord. It should start adopting the Outcomes-Based Education design advanced and advocated by countries who were signatories of the Washington Accord, letting go of the traditional approach to education. This study may also be used as a basis of comparison between the effectiveness of the traditional approach to engineering education and the outcomes-based education model.

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