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PERFORMANCE IN THE ENGINEER LICENSURE EXAMINATIONS: PHILIPPINES, 2011-2015

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ABSTRACT

The study aims to provide descriptions based on statistical evidences on how graduates of engineering performed in the last five years 2011-2015 in the licensure examinations in the Philippines. Moreover, the relevant findings of several studies conducted in various local areas in the country were gathered and analyzed to determine collectively the variables that may be considered directly related to the engineering board ratings. The average passing rate in each field of engineering was compared with the overall average passing rate covering the four fields, namely, civil, electrical, electronics and mechanical engineering. During the five-year period, on the average, 5 for every 10 examinees in the overall passed the licensure examinations. Taking into account each field board performance, on the average, for every 10 examinees -- 4 passed in civil, 5 in electrical, 4 electronics and 6 in mechanical engineering. Statistical results further revealed that the average passing rates in civil and electronics engineering are significantly lower than the overall average passing rate. On the contrary, the average passing rate in mechanical engineering is significantly higher than the overall. Electrical engineers' average passing rate compared to the overall posed no significant difference.

Keywords: ***Board Performance, Civil Engineering, Electrical Engineering, Electronics Engineering, Licensure Examination, Mechanical Engineering.***

I. INTRODUCTION

Engineering has vast influence in shaping the world physically, socially, economically and even digitally. The great challenge in this profession now is educating people in this field to become facilitators of sustainable development in physical, social, economic and technological changes. Engineering graduates today have to work across the traditional frontiers of sub-disciplines such as civil, electrical, electronics and mechanical engineering.

The top leading countries that produced engineering graduates believed that educating the engineering and scientific workforce is an essential ingredient for economic development and technological competitiveness [1]. Engineering has changed the world, but is professionally conservative and slow to change [2]. Engineering practice is accordingly shaped by those who draft standards, yet very little attention and investment is given to standards development [3]. Nowadays, because of the essential roles being played by engineers in the global society, the idea of licensing this profession becomes the focus of most countries.

In the Philippines, a certificate of registration and a professional license from the Professional Regulation Commission (PRC) are required before any person is allowed to practice engineering. The Commission is given the mandate to administer, implement, and enforce the regulatory policies of the national government with respect to the regulation and licensing of various professions in the country. All applicants for registration for the practice of engineering are required to pass the licensure examination. The first challenge therefore for engineering graduates after earning the baccalaureate degree is to comply with the requirements set by the Commission.

II. OBJECTIVES OF THE STUDY

This study aims to provide descriptions based on statistical evidences on how graduates of engineering performed in the last five years 2011-2015 in the licensure examinations in the Philippines. Moreover, the relevant findings of several studies conducted in various local areas in the country were gathered and analyzed to determine collectively the variables that may be considered directly related to the engineering board ratings.

III. METHODOLOGY

The study used the descriptive method of research. It deals with the gathering of facts or information pertaining to the given conditions or situations for the purpose of description and inclusion of proper analysis and interpretation.

The study utilized the licensure examination results published by the PRC. Four (4) out of the forty-three (43) professions being regulated by the PRC are covered in this study, namely: civil engineering, electrical engineering, electronics engineering and mechanical engineering. The board examinations on the said professions are regularly conducted twice a year.

Of the total 137,965 examinees who took the licensure examinations in the four fields of engineering in the year 2011-2015: 39.0 percent is in civil engineering; 27.0 percent in electronics engineering; 17.7 percent in electrical engineering; and 16.3 percent in mechanical engineering. Moreover, of the said total: 16.9 percent took the examination in the year 2011; 18.3 percent in year 2012; 19.9 percent in year 2013; 22.0 percent in the year 2014; and 22.9 percent in the year 2015.

Data pertaining to the national passing rates on the four mentioned fields were gathered from the results released by the PRC. It must be noted that for a graduate of engineering to be considered passed in the examination, the examinee must obtain a general weighted average rating of seventy percent (70%) with no grade below fifty percent (50%) in any group of subjects given in the examination [4], [5], [6], [7].

In this study, the percentage of examinees who passed over the total takers during the year represent the passing rate. The average passing rate for each field during the five-year period was computed using the simple mean. Likewise, the average passing rate during the five-year period for the overall taking into account the four fields of engineering was also computed utilizing the same treatment. The mean passing rate of each field was then compared with the overall and was analyzed using the t-test.

IV. RESULTS AND DISCUSSION

4.1 Performance in the Civil Engineer Licensure Examination

The civil engineering program comprises of five main disciplines: construction engineering and management, geotechnical and geoenvironmental engineering, water resources engineering, structural engineering and transportation engineering [8].

he civil engineer licensure examination covers: mathematics, surveying and transportation engineering (35%); hydraulics and geotechnical engineering (30%); and structural engineering and construction (35%) [4].

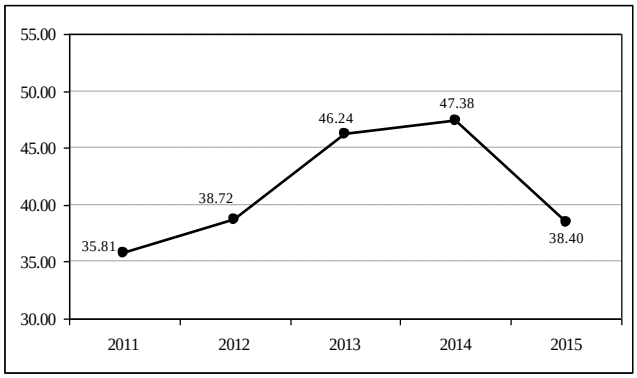

Fig. 1. Civil Engineering Passing Rates: 2011-2015

The passing rates in civil engineer licensure examination showed an upward trend from 2011 to 2014. In 2015, the rate declined from 47.38 to 38.40 (Fig. 1). During the five-year period, the average passing rate of 41.31 with a standard deviation of 5.16 for civil engineering was compared with the overall average passing rate of 49.55 for all fields (civil, electrical, electronics and mechanical engineering). A t-value of -3.5708 with a corresponding p-value of 0.0234 revealed that the passing rate for civil engineering is significantly lower than the overall passing rate. It may be noted that there was no period during the past five years that the passing rate in civil engineering posed at least at the level of the overall passing rate of 49.55 as reached on the average by the four fields.

A study conducted by Forones disclosed that general education grades and professional subject grades are both significantly related to the board examination ratings of the civil engineering graduates. Accordingly, the grades in non technical subjects and professional subjects were observed to be strong determinants of the board performance [9]. On the other hand, Tamayo, Bernardo and Eguia found out in their investigation that the following predict the passing in the licensure examination for civil engineering: grade point average; grades in mathematics subjects; grades in hydraulics and survey subjects; and grades in design and construction subjects. The design and construction subjects according to the researchers have relatively the strongest influence to pass, followed by mathematics, and then the least to show influence was hydraulics and survey [10].

Surio, in his conduct of a correlation study of college academic performance and civil engineering board ratings, concluded that it is not the curriculum content that has a direct relation to the graduate's performance in the civil engineering licensure examination, but the academic performance of the students who followed it [11]. The performance of civil engineering examinees who did not attend the review classes, as investigated by Llanes, was affected specifically in mathematics, surveying and transportation engineering, hydraulics and geotechnical engineering, and construction and structural engineering [12].

4.2 Performance in the Electrical Engineer Licensure Examination

The field of electrical engineering deals with the generation, transmission, distribution and utilization of electricity. It also deals with the design, operation and protection, maintenance and economics of electrical systems with emphasis on ethical values to harness economically and safely the materials, and forces of nature for the benefit of society and the environment [13].

The electrical engineer licensure examination covers: mathematics (25%); engineering sciences and allied subjects (30%); and electrical engineering professional subjects (45%) [5].

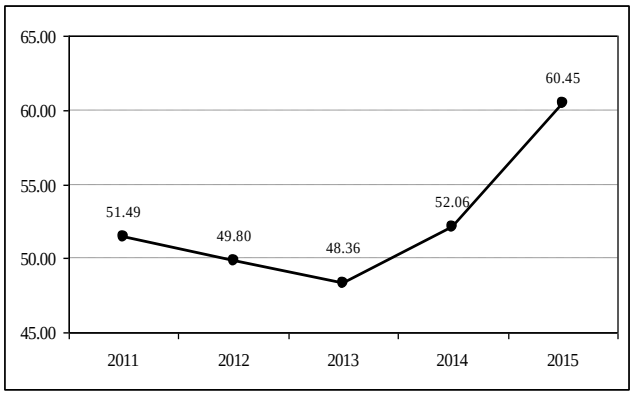

Fig. 2. Electrical Engineering Passing Rates: 2011-2015

The passing rates in electrical engineer licensure examination showed a downward trend from 2011 to 2013 (Fig. 2). However, starting 2013, an upward movement was observed till 2015. During the five-year period, the average passing rate of 52.43 with a standard deviation of 4.71 for electrical engineering was compared with the overall average passing rate of 49.55 for all fields. A t-value of 1.3673 with a corresponding p-value of 0.2433 is indicative of no significant difference between the passing rates for electrical engineering and the overall. It can be gleaned from the figure that during the five-year period, it was only in the year 2013, when there was a shift in direction, that the passing rate displayed a lower rate as compared to the overall of 49.55.

This result supported the findings of Flores, where he concluded from his investigation that there was no significant difference between the electrical engineering's performance in the licensure examination, of the college he considered in his research locale, as against the national passing rate. He further concluded in his research that the board performance provides an indication of the effectiveness of the curricular program to develop core competencies of students [14].

Tamayo found out from his study that the academic grade point average could predict board outcome of the electrical engineers. It was further determined in his research that among the three subject clusters, the engineering science had the strongest influence on the board examination, followed by the professional subjects, and the mathematics cluster [15].

4.3 Performance in the Electronics Engineer Licensure Examination

Electronics engineering is a branch of engineering that integrates available and emerging technologies with knowledge of mathematics, natural, social and applied sciences to conceptualize, design, and implement new, improved, or innovative electronic, computer and communication systems, devices, goods, services and processes [16].

The electronics engineer licensure examination covers: mathematics (20%); electronics engineering (30%); general engineering and applied sciences (20%); and electronics systems and technologies (30%) [6]

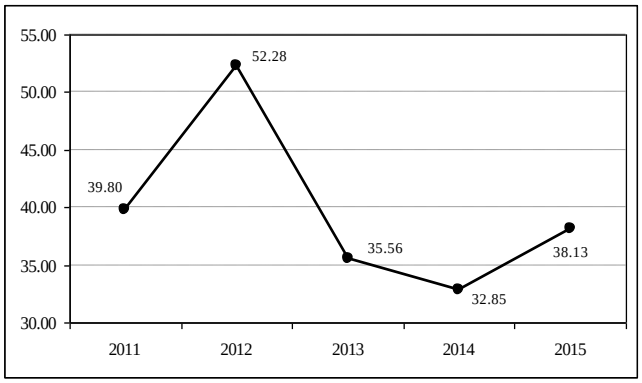

Fig. 3. Electronics Engineering Passing Rates: 2011-2015

The passing rates in electronics engineer licensure examination clustered closely with a range of 32.85-39.80 during the five-year period, except in 2012 when an abrupt rise in the rate was recorded at 52.28 (Fig. 3). From 2011 to 2015, the average passing rate of 39.72 with a standard deviation of 7.50 for electronics engineering was compared with the overall average passing rate of 49.55 for all fields. A t-value of -2.9307 with a corresponding p-value of 0.0428 implied that the passing rate for electronics engineering is significantly lower than the overall. It can be observed from the figure that the passing rates during the five-year period generally fall below 40. It was only in the year 2012 that the passing rate of 52.28 reached a value higher than the overall of 49.55.

The study of Hafalla disclosed that there are marked significant differences between passers and non-passers of electronics engineer board examination as regards to their grade point average, the number of subjects failed, the number of re-take in the board examination, as well as the time interval between those takes. Accordingly, the results also showed that the lowest rates of the examinees in the licensure examination are in the areas of general engineering education and communication [17].

In the investigation made by Tamayo and Cañizares, the students' grade point average and the grade in a correlation course, which was added in the curriculum to enhance chances of passing the licensure examination, were determined as predictors of performance in electronics and communication engineer licensure examination. It was further observed in their study that in order to pass the board examination, the applicant must obtain good grades in the following subjects: mathematics; electronics; general electronics and applied science; and electronics science and technology [18].

Moreover, Forones also found out that the general education grades and professional subject grades are both significantly related to the board examination ratings of the electronics engineering graduates. Similar to his findings earlier mentioned for civil engineering, the non technical subjects' grades and the professional subjects'

grades are also observed to be strong determinants of the board examination ratings of the electronics engineering [9].

4.4 Performance in the Mechanical Engineer Licensure Examination

Mechanical engineering is a profession that concerns itself with mechanical design, energy conversion fuel and combustion technologies, heat transfer, materials, noise control and acoustics, manufacturing processes, rail transportation, automatic control, product safety and reliability, solar energy, and technological impacts to society [19].

The mechanical engineer licensure examination covers: mathematics, engineering economics, and basic engineering sciences (35%); industrial and power plant engineering (35%); and machine design, materials and shop practice (30%) [7].

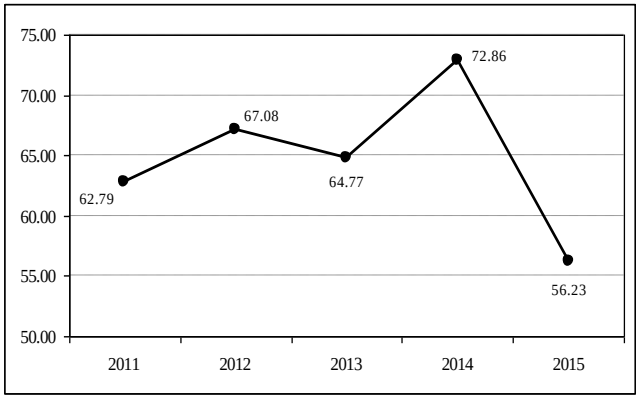

Fig. 4. Mechanical Engineering Passing Rates: 2011-2015

The passing rates in mechanical engineer licensure examination displayed ratings above 62 in 2011-2014. In 2015, an abrupt decline placed the rate at 56.23 (Fig. 4). During the five-year period, the average passing rate of 64.75 with a standard deviation of 6.08 for mechanical engineering was compared with the overall average passing rate of 49.55 for all fields. A t-value of 5.5902 with a corresponding p-value of 0.0050 signified that the passing rate for mechanical engineering is significantly higher than the overall. It can be grasped from the figure that the passing rates in the civil engineering were consistently higher than the overall rate of 49.55 from 2011 to 2015.

This is aligned with the findings of Flores when he concluded that the performance of the selected engineering graduates in the mechanical engineer licensure examination was comparable, not only with the national standard, but also with the performances of the top four private engineering schools in the local area that he considered in his study [14].

The performance in the board examination of the mechanical engineering graduates, according to Serrano, was significantly affected by their perspective in the in-house review program, review school attended and individual/personal skills [20]. On the other hand, Laguador and Dizon observed that the affective domain is significantly related to licensure examination performance of the mechanical engineering graduates. Accordingly, this learning domain established patterns of results nearly the same with their board performance,

specifically, for being patient and attentive, calm and focus, well-disciplined, maintained a high level of interest, and honest [21].

V. CONCLUSIONS

Based on the significant findings of this study, as well as the results of some local studies mentioned in this research, the following conclusions are drawn:

During the five-year period, on the average, taking into consideration the four fields of engineering (civil, electrical, electronics and mechanical), five (5) for every ten (10) examinees passed the licensure examinations. Moreover, taking into account each field board performance, on the average, four (4) for every ten (10) examinees passed in civil engineering; five (5) for every ten (10) examinees passed in electrical engineering; four (4) for every ten (10) examinees passed in the electronics engineering; and six (6) for every ten (10) examinees passed in mechanical engineering.

In comparison with the overall passing rate during the five-year period, the electrical engineering's passing rate has no significant difference. Lower passing rates were observed in the civil and electronics engineering. On the contrary, higher passing rate was posted in the mechanical engineering.

Based on relevant findings of some studies conducted in the local areas in the country, the performance of the engineering graduates in the licensure examinations may be attributed to the following: their grades in all their subjects in the baccalaureate, from the general education subjects to the professional engineering subjects; their participation in the review classes or engagement in intervention programs; their consideration as regards to the time interval of taking or re-taking the examination; their skills and affective domain.

VI. RECOMMENDATIONS

Since college academic performance is evidently related to the board performance, this study recommends the following:

The educational institution with engineering courses must conduct a curriculum audit for the program offerings to be more responsive to the learners and be able to achieve at least the national passing rate. The school may set up institutional internal quality assurance systems to assess the school's strengths and weaknesses as regards to the offering of the engineering programs. They may establish closer linkages with the world of engineering profession to ensure relevance of the course offerings.

The educators must maintain the highest standard of instruction in teaching all subjects, from the general education subjects to the professional engineering subjects. They must consistently monitor the academic performance of their students and provide closer guidance to low achievers. They must promote a positive learning environment and guide their students towards achieving greater expectation of success in their academic undertakings.

The engineering students must instill in their minds the importance of all their subjects from first year to their final year in college. They must recognize that those subjects are all contributory factors to realize the holistic learning of engineering education and the mastery of engineering profession. They may take into consideration

attending review classes or engage themselves in intervention programs that simulate the board examination to increase their chances of passing.

The future researchers may consider another set of variables to be studied along with the performance of the engineering students in the licensure examinations. They may also include other fields of engineering to be able to get a larger consolidated picture of the performance of those graduates in engineering education. Similar studies may also be conducted focusing on the licensure examination performance in other professions such as those in the fields of accountancy, architecture, education, law, allied health and sciences.

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