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Board Examination Performance And Academic Performance Of Civil Engineering Graduates At Mountain Province State Polytechnic College: Basis For System And Policy Formulation

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Abstract
This study investigates the performance of Bachelor of Science in Civil Engineering (BSCE) graduates from Mountain Province State Polytechnic College (MPSPC) in their licensure examinations from 2015 to 2019. The study analyzed the relationship between academic performance and board exam results, focusing on three subject categories: C1 (Mathematics, Surveying, and Transportation Engineering), C2 (Geotechnical Engineering and Hydraulics), and C3 (Structural Engineering and Construction). The study analyzed grades in key subjects and correlated them with licensure examination results for 106 graduates. Descriptive statistics revealed stable performance in C1 subjects with an average score of 81.01 and low variability, while C2 and C3 showed higher variability and lower average scores, indicating significant performance challenges. Correlation analysis identified moderate positive relationships between some subjects in C1 and licensure success, whereas correlations for C2 and C3 were weaker, with specific subjects like Steel Design showing stronger associations. The findings highlight critical areas for improvement, particularly in Structural Engineering and Construction (C3). Recommendations include curriculum enhancements, targeted intervention programs, collaborations with review centers, and improved pedagogical strategies.
Keywords: *Civil Engineering Board Examination; Engineering Education; Curriculum Improvement;*

INTRODUCTION

Background of the study

Civil engineering is a profound discipline within the vast engineering field, defined by the American Engineers' Council for Professional Development as applying scientific principles to design, construct, and operate structures, machines, or manufacturing processes. It involves deeply understanding their intended function, economic viability, and safety considerations for life and property.

In the Philippines, becoming a licensed engineer requires passing the licensure examination for Engineers conducted by the Professional Regulation Commission. This examination ensures that engineering graduates, including civil engineers, meet the necessary standards of competence and expertise. Such licensing practices are unique to the United States and the Philippines and play a crucial role in assessing and ensuring the quality of engineers working in various engineering sectors nationally and internationally. Aspiring civil engineers in the Philippines must successfully pass this examination to pursue their careers and contribute to society through their expertise in designing and managing essential infrastructure projects.

Among the finest engineering courses offered in the Philippines, Civil Engineering is among the top choices for aspiring engineers. The Mountain Province State Polytechnic College in the Cordillera Administrative Region (CAR) provides exceptional Engineering programs. The Civil Engineering program, launched in 1992 with a solitary student, has flourished and produced numerous skilled engineers.

Mountain Province State Polytechnic College (MPSPC) boasts three well-established campuses. The main campus, Bontoc, Mountain Province, is the largest and serves as the institution's central hub. The second-largest campus is in Tadian, Mountain Province, or the MPSPC-Tadian campus. Lastly, there is a campus in Paracelis, Mountain Province. Interestingly, MPSPC-Tadian is the only campus housing an engineering department among the three campuses. Moreover, it is the only school in the province offering a Civil Engineering course. Aspiring engineers in the region have a unique opportunity to pursue their Civil Engineering education at this campus.

This paper presents the outcomes of an extensive investigation into the Board Examination Performance and Academic Performance of graduates enrolled in the Bachelor of Science in Civil Engineering (BSCE)

program at MPSPC. Mejia (2025) also pointed out the need for improved curriculum mapping, stronger industry-academe linkages, and targeted board exam enhancement programs to address these persistent challenges and improve graduate outcomes. By thoroughly analyzing the gathered data, the paper intends to highlight the low-performance rates of BSCE graduates in board examinations and evaluate their overall academic accomplishments at MPSPC. Over the years, the board exam passing rates for MPSPC graduates have fluctuated, with percentages recorded as follows: 20% in May 2015, 13.16% in November 2015, 16.67% in May 2016, 3.85% in November 2016, 16% in May 2017, 20.83% in November 2017, 12.90% in May 2018, 7.14% in November 2018, 16.67% in May 2019, and 12.20% in November 2019. These figures reveal a trend of fluctuating performance among graduates, reflecting the program's challenges and successes.

The research also adheres to ethical considerations by ensuring the confidentiality and anonymity of student data. It seeks to provide a fair and unbiased evaluation of the BSCE program's effectiveness using accurate and comprehensive data. The findings offer constructive insights for improving program quality and better-preparing students for licensure examinations, ultimately contributing to developing competent and successful Civil Engineering professionals.

REVIEW OF LITERATURE

In 2016, Vallejo analyzed graduates' civil engineering licensure performance from Isabela State University's Bachelor of Science in Civil Engineering (BSCE) program. The study's recommendations emphasize the need for the university to prioritize curriculum improvement and the acquisition of laboratory equipment to enhance the program. Moreover, it suggests the implementation of a specialized faculty development program to elevate the quality of instruction. Additionally, the study proposes conducting further research to explore methods for enhancing the academic rating of the students.

Garming (2020) investigated the relationship between Civil Engineering graduates' board exam performance and their academic performance using a quantitative-descriptive method, analyzing data from 92 first-time examinees between November 2016 and November 2018. The study found that graduates showed potential in Subject 1 and Subject 2 but struggled with Subject 3, the professional subject, with the lowest performance. Academic performance reflected strength in Subject 1 and weakness in the professional subjects, with a 29.6% correlation between board exam results and the Grade Point Average (GPA) across 23 related subjects. Key predictors included College Algebra, Analytic Geometry, Solid Mensuration, and Transportation Engineering for Subject 1; Hydraulics and Geotechnical Engineering for Subject 2; and Structural Theory 1 and Reinforced Concrete Design 2 for Subject 3. The regression model validated these predictors, except for College Algebra. The results were used to refine admission and retention policies and to develop a board exam intervention program to enhance student performance.

According to Forones Jr.'s (2012) study, the research revealed significant correlations between certain academic factors and the board examination ratings of engineering graduates. Specifically, general education grades were found to have a significant relationship with board examination ratings, supported by a Pearson coefficient of 0.209 ($p<0.05$). Similarly, professional subject grades showed a significant relationship with board examination ratings, with a Pearson coefficient of 0.190 ($p<0.05$). Additionally, the study indicated that academic performance grades were significantly related to the board examination ratings, with a Pearson coefficient of 0.218.

Tamayo, Bernardo, and Eguia (2014) on the Readiness for the Licensure Exam of the Engineering Students. The paper evaluated the performance of the civil engineering graduates of the University of Mindanao in the licensure exam for the period 2009 to 2011. The paper employed maximum likelihood estimation of a model with a categorical variable. The findings revealed that grade point average, design and construction, mathematics and Hydraulics, and survey subjects predict passing the licensure examination. A simulation of the predictor variables determines the degree of readiness of the students for the examination.

Statement of The Problem/Objectives of The Study

The initial performance of Bachelor of Science in Civil Engineering (BSCE) graduates from Mountain Province State Polytechnic College (MPSPC) in the licensure examination was promising, achieving an excellent 66.67% success rate for its inaugural batch in the November 1997 PRC CE licensure examination (Professional Licensure Examination). However, this commendable start could not

be maintained in subsequent board exam attempts, as the success rates declined over the years. This persistent issue of low board performance has become a significant concern for the MPSPC Department of Engineering. Remarkably, despite strategic curriculum revisions aimed at fortifying the BSCE program in alignment with the CHED CMO No. 92 series of 2017, which promotes Outcomes-Based Education, the challenge of low board exam performance persists.

This study's central objective is to analyze the Board Examination Performance and Academic Performance of BSCE graduates over the last five years, from 2015 to 2019. The insights derived from this study will serve as a foundation for formulating systemic policies that could significantly impact board exam results. Specifically, the study aims to address the following questions:

1. What is the graduate's performance in the Civil Engineering Licensure examination?
2. What is the graduate academic performance in terms of:

a. C1:Mathematics, Surveying, and Transportation Engineering
b. C2:Geotechnical Engineering and Hydraulics
c. C3:Structural Design and Construction

3. Is there a relationship between the Board Exam Rating and Academic performance for the following subjects:

a. C1:Mathematics, Surveying, and Transportation Engineering
b. C2:Geotechnical Engineering and Hydraulics
c. C3:Structural Design and Construction

METHODOLOGY

Research Design

The study utilized a correlational research design within a quantitative-descriptive methodology to examine the relationship between academic performance and the overall mean score of the board examination. The objective was to determine how variations in academic performance correlate with board exam results by applying correlational coefficients.

This study defines academic performance as the quantitative assessment of a student's success in coursework within the Bachelor of Science in Civil Engineering (BSCE) program at Mountain Province State Polytechnic College (MPSPC). This assessment is based on the grades obtained in key subjects categorized into three main areas: Mathematics, Surveying, and Transportation Engineering (C1), Hydraulics and Geotechnical Engineering (C2), and Structural Engineering and Construction (C3). Academic performance is evaluated by analyzing the grades students received in these subjects from 2015 to 2019. The study then correlates these grades with licensure examination results to assess the effectiveness of the BSCE program in preparing students for professional practice. This approach aims to provide insights into the program's strengths and weaknesses and suggest potential improvements.

Population Selection/Sampling Methodology

This study employs a total enumeration approach, encompassing all graduates from the Civil Engineering program at MPSPC-Tadian who completed their degrees between 2015 and 2019. The population consists of individuals who undertook the board examinations for the first time in May 2015, November 2015, May 2016, November 2016, May 2017, November 2017, May 2018, November 2018, May 2019, and November 2019. Utilizing a total enumeration method, the sampling methodology involves including all eligible graduates within the specified timeframe without exclusion. This approach ensures that the entire population of interest is represented in the study, eliminating the need for sampling and allowing for a comprehensive data analysis.

The study includes 106 graduates from the Civil Engineering program at MPSPC-Tadian who obtained their degrees between 2015 and 2019. This population size represents the total number of eligible respondents for the study, and as such, all individuals within this group will be included in the analysis.

Data Gathering Procedure

The data collection process involved obtaining academic grades from the registrar's office at MPSPC-Tadian for the academic years 2015 to 2019. These grades encompassed various subjects essential to the Civil Engineering curriculum. Within the category of Mathematics, Surveying, and Transportation Engineering (C1), subjects such as College Algebra, Plane and Spherical Trigonometry, Analytic Geometry, Solid Mensuration, Differential Calculus, Integral Calculus, Differential Equation, Probability and Statistics, Advance Engineering Mathematics, Elementary and Higher Surveying, Engineering

Economy, Engineering Surveys, Highway Engineering, and Transportation Engineering were included, totaling 14 subjects. For hydraulics and geotechnical engineering (C2), fluid mechanics, hydraulics, soil mechanics, and Hydraulics were considered, making up four subjects. In the category of Structural Engineering and Construction (C3), subjects such as Mechanics of Deformable Bodies, Structural Theory 1 and 2, Construction materials and Testing, Reinforced Concrete Design 1 and 2, Timber Design, Steel Design, Prestressed Concrete, Earthquake Engineering, Construction Engineering and Management, and Foundation Engineering were analyzed, amounting to 12 subjects. In total, 30 subjects were identified and collected for analysis to provide a comprehensive overview of academic performance in the Civil Engineering program.

The data collection process also involved procuring board examination ratings from the Professional Regulation Commission (PRC) for the Bachelor of Science in Civil Engineering (BSCE) program. This data was obtained through direct correspondence with the offices of the President and the Vice President for Academic Affairs at MPSPC-Tadian. Collaborative efforts ensured the acquisition of accurate and comprehensive board examination ratings for the BSCE program. This information was crucial for correlating academic performance with board exam scores and evaluating the effectiveness of the Civil Engineering program at MPSPC-Tadian in preparing students for licensure examinations.

Throughout the data collection process, ethical considerations were paramount. Confidentiality of students' academic records and board examination results was strictly maintained. All data were anonymized to protect the identities of the individuals involved. Informed consent was obtained from relevant institutional authorities to access and utilize the academic and board exam data. The study was conducted in compliance with institutional policies and applicable legal and ethical guidelines to ensure the integrity and ethical soundness of the research. Data handling and analysis were performed with the utmost care to uphold the principles of fairness, accuracy, and respect for all participants involved in the study.

Data Analysis /Treatment of Data

This study used various statistical tools to analyze the data and fulfill the objectives effectively. Descriptive statistics were utilized to summarize the performance ratings per subject area in the licensure exam over the five years from 2015 to 2019. Mean scores and standard deviations provided insights into the central tendency and variability of performance within each subject area, highlighting areas of strength and weakness. Correlation analysis was conducted to explore the relationship between licensure exam performance and academic achievement in specific subjects. Calculating Pearson correlation coefficients determined the strength and direction of associations between variables, aiding in identifying subjects with stronger predictive value for exam success. Additionally, the comparative analysis allowed for comparing Civil Engineering students' performance across different subject areas and over time. Mean scores, standard deviations, and passing percentages were compared between subject areas and across different years of the licensure exam, enabling the identification of trends and areas requiring improvement.

Results and Discussion

Board Exam Performance

The performance ratings per subject area in the licensure exam have consistently needed improvement, leading to low passing percentages over the past five years. Notably, in May 2015, only one out of three first-takers passed, followed by a 4/16 ratio in November 2015. Subsequent May 2016 and November 2016 exams saw zero passers each, indicating a significant issue. This trend continued with only one out of seven passing in May 2017, six out of twenty-five in November 2017, one out of four in May 2018, and two out of twenty-one in November 2018. The May 2019 exam saw no passers, while November 2019 had four out of fourteen passing. The consecutive zero passers in the May and November 2016 examinations, taken immediately after graduation, suggest that civil engineering graduates must be adequately prepared to undertake the board exam right after their studies.

	2015	2016	2017	2018	2019	Mean	Std. Deviation

C1: Mathematics, Surveying, and Transportation Engineering	60.04	65.00	57.97	61.52	67.35	61.42	11.468
C2: Hydraulics and Geotechnical Engineering	60.04	55.67	62.75	59.04	57.5	59.90	16.216
C3: Structural Engineering and Construction	53.91	44.67	52.69	51.24	48.75	51.42	12.674
Overall Average	**57.90**	**55.08**	**57.55**	**57.18**	**57.86**	**57.46**	

Table 2. Board Exam Performance

The analysis of performance data across various subjects reveals several important observations, particularly regarding the standard deviation (SD) values. For C1: Mathematics, Surveying, and Transportation Engineering, the average score is the highest at 61.42, and it also has the lowest standard deviation of 11.468. This low SD signifies that the scores are closely clustered around the mean, indicating a relatively consistent level of performance among students in this subject. The minimal variability suggests that students' understanding and skills in C1 are uniformly distributed, reflecting a stable and predictable outcome.

In contrast, C2: Hydraulics and Geotechnical Engineering shows a higher standard deviation of 16.216, indicating a more comprehensive range of scores and more significant variability than C1. This broader spread highlights that student performance in C2 is more diverse, with substantial differences in individual scores. The increased variability suggests that some students excel while others struggle significantly, pointing to potential inconsistencies in preparation or teaching within this subject area.

C3: Structural Engineering and Construction exhibits the highest standard deviation of 12.674 alongside the lowest average score of 51.42. The high SD reflects a considerable range of performance levels, with scores deviating markedly from the mean. This indicates that students experience many outcomes in C3, suggesting that the subject might be more challenging or less uniformly taught. The persistent low scores in C3 further underscore the need for targeted interventions to address potential gaps in student understanding or instructional effectiveness.

A similar study by Garming (2020) also observed improvements in the 2018 board exam results, particularly in S1: Mathematics, Surveying, and Transportation Engineering, where the score increased to 65.69, and in S3: Structural Engineering and Construction, which improved to 52.75. Although the S1 score is still classified as inferior, it remains within the passing range for the board exam, especially if supplemented by high scores in S2 and S3, considered professional subjects. However, the consistently lowest rating in S3: Structural Engineering and Construction suggests that more intervention programs may be required for higher professional subjects within the curriculum.

The data from 2017 to 2019 reveals a concerning decline in performance within C2 and C3, with some years showing scores significantly below the passing rate for board exams. The increasing standard deviation during this period indicates that student performance is becoming more variable, with growing disparities in outcomes. This trend highlights underlying issues in the educational framework or learning environment that could impact students' ability to perform consistently.

These observations suggest that while C1 benefits from stable and consistent performance, C2 and C3 face significant challenges with greater variability and declining trends. To address these issues, it is crucial to implement targeted educational reforms and support measures to improve consistency and address students' specific difficulties in these subjects. Enhancing instructional quality and providing additional support align student performance more closely with the standards required for licensure exams.

El-Hassan (2021) found that students didn't see the exit exam as an effective way to measure their knowledge or learning outcomes, though it helped with job interview preparation. Their performance

varied based on preparation, interest, and exam difficulty. Students suggested more practice questions to improve results and make the exam count more towards their grades. These findings support the need for targeted reforms in C2 and C3, where variability and declining trends indicate similar challenges. Continuous improvements could enhance student outcomes and attitudes toward assessments, aligning them more closely with licensure exam standards.

Table 3. Academic Performance in C1: Mathematics, Surveying, and Transportation Engineering of Civil Engineering First time taker from 2015-2019 (n=106)

Subject	Mean	Std. Deviation	Remarks
COLLEGE ALGEBRA	79.14	4.754	Fair
PLANE AND SPHERICAL TRIGONOMETRY	78.96	5.116	Fair
ANALYTIC GEOMETRY	82.01	6.136	Fairly Good
SOLID MENSURATION	81.68	5.651	Fairly Good
DIFFERENTIAL CALCULUS	79.11	4.255	Fair
INTEGRAL CALCULUS	81.64	4.880	Fairly Good
DIFFERENTIAL EQUATION	81.05	5.574	Fairly Good
PROBABILITY AND STATISTICS	80.89	5.040	Fair
ADVANCE ENGINEERING MATH	82.09	4.869	Fairly Good
ELEMENTARY AND HIGHER SURVEYING	81.32	5.178	Fairly Good
ENGINEERING ECONOMY	80.13	5.437	Fair
ENGINEERING SURVEYS	81.25	5.409	Fairly Good
HIGHWAY ENGINEERING	82.38	4.217	Fairly Good
TRANSPORTATION ENGINEERING	82.44	4.997	Fairly Good
Overall Average	**81.01**		

The data in Table 3 provides a detailed overview of academic performance in C1: Mathematics, Surveying, and Transportation Engineering for first-time civil engineering examinees from 2015 to 2019. The overall average score of 81.01 reflects a generally good performance across the various subjects within this category.

Among the subjects, College Algebra and Differential Calculus have relatively lower means of 79.14 and 79.11, respectively, and exhibit standard deviations of 4.754 and 4.255. These scores fall into the "Fairly Satisfactory" and "Fair" categories, indicating that while students meet basic expectations, there is room for improvement. The moderate standard deviations suggest a moderate level of consistency in students' performance, with some variation in scores.

Subjects like Analytic Geometry, Solid Mensuration, Integral Calculus, and Differential Equation achieve "Fairly Good" ratings with means ranging from 81.05 to 82.09. These subjects have relatively higher means and exhibit standard deviations between 4.255 and 6.136, indicating a generally positive performance with a moderate spread in student scores. The performance in these subjects is consistently good, reflecting students' stronger grasp of these topics.

Advance Engineering Math, Elementary and Higher Surveying, Engineering Surveys, Highway Engineering, and Transportation Engineering also fall into the "Fairly Good" category, with means from 80.89 to 82.44 and standard deviations between 4.217 and 5.651. The higher means and moderate

standard deviations in these subjects suggest that students perform well, with some variation in scores indicating differing proficiency levels.

The data indicates that students in the C1 category generally perform well, with most subjects rated as "Fairly Good." The performance is reasonably consistent, although there is some variation in individual subject scores. The overall positive performance across C1 subjects suggests a strong foundation in mathematics, surveying, and transportation engineering, which is crucial for licensure exam success. However, attention to subjects with lower scores and higher standard deviations could further enhance student outcomes.

Awange (2017) examined the impact of hands-on workshops introduced in 2009 for the CVEN2000 Civil Engineering Drawing and Surveying course at Curtin University. The workshops aimed to enhance practical surveying skills. Analyzing data from 160 students in 2012 and 2013, the study found that the workshops significantly improved students' critical thinking (93.6%), problem-solving skills (96.6%), and their ability to connect theory to practice (97.9%). In 2013, 70% of students reported improved overall skills, and the workshops enhanced communication and teamwork. Most students (97.9%) were satisfied, and 98.9% would recommend the workshops as a practical learning tool. The study concluded that the workshops were valuable for developing essential learning skills.

Table 4. Academic Performance in C2: Hydraulics and Geotechnical Engineering of Civil Engineering First time taker from 2015-2019

Subject	Mean	Std. Deviation	Remarks
FLUID MECHANICS	77.71	3.769	Fair
HYDRAULICS	79.50	3.938	Fair
SOIL MECHANICS	81.36	5.820	Fair
HYDROLOGY	80.19	4.777	Fair
Overall Average	**79.69**		**Fair**

The academic performance of civil engineering first-time examinees in C2: Hydraulics and Geotechnical Engineering, as presented in Table 4, indicates a general level of achievement categorized as "Fair," with an overall average score of 79.69. This suggests that while students demonstrate an acceptable grasp of the material, there is significant room for improvement.

In Fluid Mechanics, students achieved an average score of 77.71 with a standard deviation of 3.769. This relatively low average indicates that students have a basic understanding of the subject but could benefit from additional support to deepen their comprehension and enhance performance. The narrow standard deviation suggests consistency in the performance levels yet highlights the need for targeted improvements.

Hydraulics shows a slightly higher average score of 79.50 and a standard deviation of 3.938. Although the performance is somewhat better than Fluid Mechanics, it falls within the "Fair" category. The performance variability is minimal, reflecting consistent results and emphasizing areas where academic interventions could further support student learning.

In Soil Mechanics, students achieved an average score of 81.36 with a standard deviation of 5.820. This higher average suggests a better grasp of the subject than Fluid Mechanics and Hydraulics. However, the more significant standard deviation indicates a broader range of student performance levels, pointing to inconsistencies that could be addressed through more tailored educational strategies.

Hydrology yielded an average score of 80.19 with a standard deviation of 4.777. This result is comparable to that of soil mechanics, indicating fair performance. The variability in scores suggests that while most students perform satisfactorily, there is potential for improved consistency with targeted academic support.

The performance data for C2 subjects reflect a need for enhanced educational strategies to improve student outcomes. By addressing the specific challenges in Fluid Mechanics and Hydraulics and working

to reduce performance inconsistencies in Soil Mechanics and Hydrology, academic support can be tailored to foster better overall performance in Hydraulics and Geotechnical Engineering.

Table 5. Academic Performance in C3: Structural Engineering and Construction of Civil Engineering First-time taker from 2015-2019

Subject	Mean	Std. Deviation	Remarks
MECHANICS OF DEFORMABLE BODIES	80.37	5.051	Fair
STRUCTURAL THEORY 1	82.57	4.240	Fairly Good
CONSTRUCTION MATERIALS AND TESTING	83.49	4.723	Fairly Good
STRUCTURAL THEORY 2	81.22	3.516	Fairly Good
REINFORCED CONCRETE DESIGN 1	81.59	3.472	Fairly Good
TIMBER DESIGN	84.28	4.991	Fairly Good
REINFORCED CONCRETE DESIGN 2	84.21	4.714	Fairly Good
STEEL DESIGN	81.58	3.064	Fairly Good
PRESTRESSED CONCRETE	83.68	3.379	Fairly Good
EARTHQUAKE ENGINEERING	86.46	4.400	Good
CONSTRUCTION ENGINEERING AND MANAGEMENT	86.03	3.773	Good
FOUNDATION ENGINEERING	79.42	4.495	Fair
Overall Average	**82.91**		Fairly Good

The overall academic performance of civil engineering first-time examinees in the C3: Structural Engineering and Construction category demonstrates a generally strong understanding of the subject matter, with an average score of 82.91, categorized as "Fairly Good." This indicates that students are achieving above-average scores across most subjects within this category. The relatively low standard deviation of 4.835 suggests that the scores are fairly consistent, with less variation among students' performances.

Subjects like Earthquake Engineering and Construction Engineering and Management achieve average scores of 86.46 and 86.03, respectively, and are classified as "Good." These subjects also exhibit relatively low standard deviations (4.400 and 3.773), indicating a high level of proficiency and consistent performance among students. The lower variability in scores for these subjects suggests that the instructional strategies and learning materials in these areas effectively support student learning.

Conversely, subjects such as Mechanics of Deformable Bodies and Foundation Engineering have lower average scores of 80.37 and 79.42, respectively, and are rated "Fair." The standard deviations for these subjects (5.051 and 4.495) are higher than those in higher-performing subjects, reflecting more significant

variability in student scores. This variability may indicate inconsistencies in understanding or difficulties in the subject matter that warrant further investigation.

The mixed results highlight a disparity in performance across different subjects, with some areas showing strong student proficiency while others reveal notable weaknesses. The higher standard deviations in lower-performing subjects suggest that additional support and targeted interventions may be necessary to address these gaps and improve student outcomes.

In summary, while the performance in C3: Structural Engineering and Construction is generally positive, the variations in subject scores and standard deviations point to the need for ongoing assessment and refinement of the curriculum. Focusing on subjects with higher variability and lower average scores could enhance the program's effectiveness, ensuring students are well-prepared for their licensure examinations.

Table 6. Relationship between Licensure Exam Performance and Academic Performance in C1: Mathematics, Surveying, and Transportation Engineering

Subject	r-value	Remarks
COLLEGE ALGEBRA	.337**	Medium Correlation
PLANE AND SPHERICAL TRIGONOMETRY	.055	No Correlation
ANALYTIC GEOMETRY	.229*	Low Correlation
SOLID MENSURATION	.214*	Low Correlation
DIFFERENTIAL CALCULUS	.015	No Correlation
INTEGRAL CALCULUS	.225*	Low Correlation
DIFFERENTIAL EQUATION	.201*	Low Correlation
PROBABILITY AND STATISTICS	.249*	Low Correlation
ADVANCE ENGINEERING MATH	.260**	Low Correlation
ELEMENTARY AND HIGHER SURVEYING	.324**	Medium Correlation
ENGINEERING ECONOMY	.149	Low Correlation
ENGINEERING SURVEYS	.209*	Low Correlation
HIGHWAY ENGINEERING	.232*	Low Correlation
TRANSPORTATION ENGINEERING	.271**	Low Correlation

*. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

The correlation analysis offers insights into how different subjects within C1: Mathematics, Surveying, and Transportation Engineering impact licensure exam performance. Specifically, College Algebra (r = 0.337) and Elementary and Higher Surveying (r = 0.324) exhibit medium positive correlations with success in licensure exams. This indicates that strong performance in these subjects is closely linked to higher scores on the licensure tests. The significant correlation underscores the need to prioritize academic efforts in these areas, as proficiency in these subjects will likely lead to improved licensure exam results.

In contrast, subjects such as Advanced Engineering Math (r = 0.260), Transportation Engineering (r = 0.271), and Probability and Statistics (r = 0.249) exhibit low positive correlations with licensure success. Although these subjects contribute positively to licensure performance, their impact is less direct than that of medium-correlation subjects. While proficiency in these areas is beneficial, it is not as critical as the medium-correlation subjects in determining licensure exam results.

Other subjects within this category, including Analytic Geometry (r = 0.229), Solid Mensuration (r = 0.214), Integral Calculus (r = 0.225), Differential Equation (r = 0.201), Engineering Surveys (r = 0.209), and Highway Engineering (r = 0.232), also show low positive correlations. These subjects contribute to licensure success in a supportive role but are less impactful than those with medium correlations. This suggests that while these subjects are important, their influence on exam performance is secondary to that of the medium-correlation subjects.

Subjects with very weak correlations, such as Plane and Spherical Trigonometry (r = 0.055), Differential Calculus (r = 0.015), and Engineering Economy (r = 0.149), show minimal direct influence on licensure exam performance. These findings indicate that the effectiveness of these subjects in preparing students for the licensure exams may be limited. Reevaluating the role and integration of these subjects within the curriculum could be necessary to improve their relevance and impact on exam success.

The analysis underscores the need for a targeted academic strategy. Emphasizing subjects with stronger correlations, like College Algebra and Elementary and Higher Surveying, can significantly benefit licensure exam preparation. At the same time, addressing subjects' needs with lower correlations and rethinking the role of subjects with weak correlations can lead to a more balanced and practical approach to preparing students for licensure exams, ultimately enhancing their performance and readiness.

Table 7. Relationship between Licensure Exam Performance and Academic Performance in C2: Hydraulics and Geotechnical Engineering

Subject	r-value	Remarks
FLUID MECHANICS	.270**	Low Correlation
HYDRAULICS	.234*	Low Correlation
SOIL MECHANICS 1	.259**	Low Correlation
HYDROLOGY	.189	Low Correlation

*. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

The correlation analysis for C2: Hydraulics and Geotechnical Engineering provides insights into how performance in these subjects relates to licensure exam success. Fluid Mechanics (r = 0.270), Hydraulics (r = 0.234), and Soil Mechanics 1 (r = 0.259) all show low positive correlations with licensure exam performance. Despite being statistically significant, these correlations are relatively modest, indicating that while proficiency in these subjects does contribute to licensure success, the effect is not strong.

Fluid Mechanics and Soil Mechanics 1 exhibit the highest correlations within this category, suggesting that they are more influential in licensure outcomes than Hydraulics. However, all three subjects' correlations fall within the low range, indicating a need for a broader academic focus beyond these subjects to improve overall licensure performance.

Hydrology (r = 0.189) shows the weakest correlation among the C2 subjects. Although it approaches statistical significance, its minimal impact on licensure performance suggests it plays a limited role in determining exam success compared to Fluid Mechanics, Hydraulics, and Soil Mechanics 1.

Overall, the analysis indicates that while Fluid Mechanics, Hydraulics, and Soil Mechanics 1 positively impact licensure exam performance, their low correlations imply that they should be part of a more comprehensive study strategy. Emphasizing these subjects can be beneficial, but a balanced approach that includes other curriculum areas is essential for improving licensure outcomes.

Table 8. Relationship between Licensure Exam Performance and Academic Performance in C3: Structural Engineering and Construction

Subject	r-value	Remarks
MECHANICS OF DEFORMABLE BODIES	.222*	Low Correlation
STRUCTURAL THEORY 1	.107	Low Correlation
CONSTRUCTION MATERIALS AND TESTING	.093	No Correlation
STRUCTURAL THEORY 2	.205*	Low Correlation
REINFORCED CONCRETE DESIGN 1	.218*	Low Correlation
TIMBER DESIGN	.243*	Low Correlation
REINFORCED CONCRETE DESIGN 2	.241*	Low Correlation
STEEL DESIGN	.299**	Low Correlation
PRESTRESSED CONCRETE	.218*	Low Correlation

EARTHQUAKE ENGINEERING	.216*	Low Correlation
CONSTRUCTION ENGINEERING AND MANAGEMENT	.043	No Correlation
FOUNDATION ENGINEERING	.174	Low Correlation

*. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

The correlation analysis for C3: Structural Engineering and Construction sheds light on how academic performance in these subjects correlates with licensure exam outcomes. The subjects show varied levels of correlation, all of which fall within the low correlation range, indicating that while there are relationships between academic performance in these areas and licensure exam success, these relationships could be stronger.

Steel Design (r = 0.299) demonstrates the strongest positive correlation among the subjects in this category, suggesting it has a more significant impact on licensure performance than other subjects. Despite this, the correlation remains low, implying that while Steel Design contributes to licensure success, it is not the sole determinant.

Subjects such as Timber Design (r = 0.243), Reinforced Concrete Design 2 (r = 0.241), and Reinforced Concrete Design 1 (r = 0.218) also show positive correlations, though they are similarly categorized as low. These subjects, along with Mechanics of Deformable Bodies (r = 0.222) and Earthquake Engineering (r = 0.216), indicate a modest association with licensure outcomes.

Conversely, Construction Materials and Testing (r = 0.093) and Construction Engineering and Management (r = 0.043) exhibit weak or no significant correlation with licensure exam performance. These subjects contribute the least to licensure success, suggesting that improvements in these areas may have a limited impact on exam outcomes.

In summary, while subjects within Structural Engineering and Construction show some correlation with licensure exam performance, the overall low correlation values suggest that a comprehensive approach addressing multiple areas of the curriculum is necessary for improving licensure outcomes. Emphasizing subjects like steel design and reinforcing other vital areas could better prepare students for licensure exams.

CONCLUSION

The analysis of civil engineering licensure exam performance over the past five years reveals a persistent issue with low passing rates and significant variability in student outcomes. Notably, several exam sessions, particularly in May and November 2016, experienced zero passers, indicating a serious gap in graduate preparation for the licensure exams. The subject-specific performance data further underscores these challenges: Mathematics, Surveying, and Transportation Engineering (C1) show a relatively stable mean score of 61.42 with low variability, suggesting a solid grasp of these areas. In contrast, Hydraulics and Geotechnical Engineering (C2) and Structural Engineering and Construction (C3) reveal troubling trends with higher variability and lower average scores, highlighting student performance and preparation inconsistencies.

Performance analysis by subject area offers more profound insights into these challenges. In Mathematics, Surveying, and Transportation Engineering (C1), students generally exhibit strong performance with an average score of 81.01, reflecting a solid foundation in these areas. The low standard deviation in this category indicates consistent student performance, suggesting that these subjects are relatively well understood. However, subjects such as Plane and Spherical Trigonometry and Engineering Economy point to areas needing improvement with lower average scores and higher variability

Conversely, there is notable variability in Hydraulics and Geotechnical Engineering (C2), with an overall average score of 79.69. This variability suggests a need for targeted interventions to address student performance disparities and enhance understanding. Similarly, in Structural Engineering and Construction (C3), while the average score of 82.91 is relatively strong, there is significant variability across different subjects. This variability indicates that while students perform well overall, specific

subjects such as Mechanics of Deformable Bodies and Foundation Engineering require focused improvements.

Correlation analysis further illuminates the relationship between academic performance in various subjects and licensure exam success. For C1, subjects like College Algebra and Elementary and Higher Surveying exhibit medium positive correlations with licensure performance, emphasizing their importance in exam preparation. In contrast, subjects such as Plane and Spherical Trigonometry and Differential Calculus show minimal impact, suggesting a need to reassess their role within the curriculum. In the C2 category, subjects like Fluid Mechanics and Soil Mechanics 1 have modest positive correlations, indicating a need for a more comprehensive study approach. For C3, Steel Design demonstrates the strongest positive correlation, although it remains low, highlighting the need for balanced attention across all subjects.

To address these issues and improve licensure exam outcomes, it is crucial to implement targeted interventions and curriculum enhancements. Focused review programs and additional support for subjects with lower performance and higher variability can address specific student needs. Aligning the curriculum with licensure exam requirements by emphasizing subjects with stronger correlations to exam success and continuously evaluating and refining educational practices will further enhance student preparedness. By adopting these strategies, academic institutions can better prepare civil engineering graduates for licensure exams, improving their overall competence and success.

Recommendations

Based on the comprehensive analysis of academic performance and licensure exam outcomes in Civil Engineering over the past five years, several key recommendations emerge to address identified challenges and enhance overall student success. Firstly, a critical evaluation and adjustment of the existing curriculum are essential. Subjects such as Hydraulics, Geotechnical Engineering, and Structural Engineering have consistently shown lower average scores and higher variability in board performance. This underscores the need for a more robust and comprehensive curriculum that covers these subjects in greater depth and ensures that students gain a solid understanding and are well-prepared for the licensure exams. By enhancing the curriculum to address these challenging areas better, institutions can provide students with the foundational knowledge required to excel in their professional assessments.

Additionally, implementing targeted intervention programs is crucial. The data indicates that students struggle significantly in specific areas, particularly Hydraulics and Geotechnical Engineering (C2) and Structural Engineering and Construction (C3). To address these challenges, intervention programs should be designed to offer remedial classes, additional support, and intensive review sessions tailored to these subjects. These programs help reinforce students' understanding and improve their proficiency. Educational institutions can provide more targeted assistance to improve overall outcomes by focusing on the areas where students consistently perform poorly.

Collaborating with reputable review centers is another essential strategy. Previous studies have highlighted the effectiveness of preparatory activities offered by review centers in improving exam performance. Partnering with these centers to provide structured review programs can offer Civil Engineering students additional resources and tailored preparation for the licensure exams. These collaborations can bring expert insights and proven strategies into the academic setting, helping to bridge gaps identified in student performance and better align their preparation with the demands of the licensure exams.

Enhancing pedagogical strategies is also vital to improving student performance. Faculty members should leverage their pedagogical expertise to adopt more effective teaching methodologies. This includes incorporating experiential learning approaches, such as hands-on projects and real-world problem-solving scenarios, to make complex concepts more accessible and engaging. By using innovative teaching methods, instructors can better facilitate student understanding and retention of challenging material, which is crucial for subjects with noted variability in performance.

Establishing comprehensive student support services within academic institutions is essential. These services should include academic advising, tutoring, and study groups aimed at helping students identify and address their areas of weakness. Providing additional resources and support can significantly aid students who struggle with challenging subjects, offering them the tools and guidance needed to improve their academic performance. Institutions can enhance student preparedness and confidence by fostering a supportive learning environment, leading to better licensure exam outcomes.

Continuous monitoring and evaluation of student performance in licensure exam-relevant subjects are also necessary. Implementing a robust system for tracking academic progress and performance trends will allow institutions to identify issues early and intervene as needed. Data analytics can assess student performance, monitor improvements, and make informed decisions about necessary educational practices and support system adjustments. Early intervention can help address academic difficulties before they impact exam success.

In conclusion, by adopting these recommendations—curriculum enhancement, targeted interventions, review center collaborations, improved pedagogical strategies, comprehensive student support services, and continuous monitoring—academic institutions can significantly improve Civil Engineering students' readiness for licensure exams. These strategies will help align student preparation with the requirements of the licensure exams, ultimately enhancing their overall competence and success in the field.

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