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Mathematical Foundations and Board Examinations Performance: A Case of Caraga State University

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ABSTRACT

This study analyzed the relationship between mathematical foundations (level of mathematics taken, General Point Average (GPA) in all mathematics subjects, total number of units of mathematics subjects earned, college/advance algebra taken and its corresponding total units obtained) and the board examination performance among the graduates of selected programs of Caraga State University-Butuan City from SY 2005 to 2012. The study used logistic regression analysis and odds-ratio test to analyze the cross-sectional data gathered. Stratified random sampling in the selection of board examination takers, which includes the graduates of Bachelor of Science in Agricultural Engineering, Bachelor of Science in Geodetic Engineering, Bachelor of Science in Electronics and Communication Engineering, Bachelor of Science in Forestry, and Bachelor of Secondary Education major in Mathematics was employed. Results of the study revealed that mathematical foundations of the respondents are directly linked with the board examination performance as evidenced by the p-value (< 0.05) which is significant at 0.05 level. Therefore, mathematical foundations such as university level mathematics courses and GPA in mathematics have impacts to the board examinations performance.

Keywords: Board Examinations, Mathematical Foundations, Odds Ratio

1 Introduction

Board examination performance of the graduates has always been a significant factor to all the universities and colleges around the globe. It has been the primary hook of all the faculties as well as the administration to evaluate the overall performance of the school as well. In this study, the concern of which is focused on the predictors of the board examination that directly underscore the mathematical foundations. For many times, mathematical foundations have been observed to have a big impact in terms of the board examination of the graduates in their past records and board examinations. It is in the light of this reason that the researchers

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studied the relationship of the mathematical foundations and the board examination of the graduates from selected programs to determine the significance of this factor and the impact that it gave to the performance of the graduates in their respective board examinations.

Mathematics plays a vital role in the modernization of this civilization. It is everywhere and affects the everyday lives of people. Although it is abstract and theoretical knowledge, it emerges from the real world. Mathematics is one of the essential and basic areas of the college curriculum which has a wide field of subject matter. In education, mathematics plays an important role. It is the study of numbers, the relationship between these number and various operations performed on them that may lead to the development of higher order thinking skills. It is the science of quantity, size and shape. It is also a way to communicate and analyze ideas, a tool for organizing and interpreting data and above all, perhaps a method of logical reasoning unique to man. Mathematics is a necessary part of other sciences. Mathematics supports decision making in all aspects of life. Moreover, our society places a high economic value on mathematical literacy. Mathematical literacy is increasingly an imperative for employment. Mathematics has always been considered as one of the essential skills that students need to successfully complete a college education (Lee & Lee, 2009).

National Council of Teachers of Mathematics (NCTM/NAEYC Joint Position Statement, 2010) affirmed also that "in the changing world, those who understand and can do mathematics have significant opportunities and options for shaping their future". Thus, the statement says that in this modernized world mathematical foundation plays an important role in the success of an individual. They further stated that many adults in the US need to improve their basic mathematics skills for the success in postsecondary education and employment.

The licensure examination performance of Caraga State University-Butuan has been consistently high in some degree programs but lower in other programs. In order to understand the underlying factors of board examinations with mathematics, thus this study was conducted. This study hoped to help the administration in planning the curriculum in order to help students perform their best and be prepared for their career. It will also help teachers assess the students on the level of competency and mathematics proficiency to comply the requirements in preparation for the board examinations.

Some studies have indicated that performance of examinees in the Licensure Examination is shaped both by personal and educational factors. These were used as practical framework of the study. Several studies conducted have shown that academic performance in terms of Specialization (Computer Education, English, Filipino, Mathematics, Science and Social Studies), General Education (Social Sciences, Mathematics, Science, Filipino and English) and Professional Education serve as the strong predictor of Board Examination Performance (Pachejo & Allaga, 2013).

Several studies show the importance of mathematical foundation towards the success of an individual. Thus, the researchers envision in assessing the mathematical foundation among selected programs in selected programs in Caraga State University, Butuan City towards the performance in the licensure examination. Furthermore, this study aimed to assess the intensity of the behavior of the different factors such as: level of mathematics taken, percentage level of the graduates in terms of the GPA in mathematics, units of mathematics earned and the relation of algebra also with regards to their performance that goes behind the results of the different licensure examinations of the respective programs. The main objective of this study was to determine the effect of the mathematical foundations among selected programs in Caraga State University as basis to the performance in the board examination result. Specifically, this study envisioned to answer the problem if there was a significant relationship between mathematical foundations and board examination performance of the graduates.

2 Materials and Methods

This study investigated the predictors of the board examinations which include the total units in mathematics, GPA in Mathematics, level of Mathematics taken (University) and the total units specifically in College/Advanced Algebra in relation to the performance of the board examination takers. The study used

logistic regression analysis and odds-ratio test to analyze the cross-sectional data gathered from the registrar with permission. Stratified random sampling was employed in selecting the board examination takers from selected programs as the participants. This study attempted to analyze the success of the graduates on the board examination among selected programs in Caraga State University on the basis of Mathematical Foundation. From the analysis of these data, possible suggestions were given for the development and success of graduates.

The respondents of the study were the graduates of Caraga State University on the following selected programs: Bachelor of Secondary Education major in Mathematics, Bachelor of Science in Electronics and Communications Engineering, Bachelor of Science Agricultural Engineering, Bachelor of Science in Geodetic Engineering and Bachelor of Science in Forestry; who at the same time takes the licensure examination on the school year 2005-2006, 2006-2007, 2008-2009, 2010-2011 and 2011-2012.

Table 1
Distribution of the Respondents

	Respondents					
	BS GE	BS Ag Eng	BS ECE	BSF	BSEd-Math	Total
Number of takers	49	15	10	64	68	206

Frequency and percentage was used to describe the profile on the degree program of the graduates as well as the year they graduated. The analysis of the study was limited to Logistic regression since the dependent variable is set to be dichotomous (pass or fail) with the independent variables which were also coded and treated as continuous and nominal variables. Chi-square was also used to analyze the independent variables; GPA in Mathematics, university level of Mathematics taken, total number of units earned in Mathematics and total number of units in College/Advanced Algebra subject in terms of Program, College and Year graduated.

3 Results and Discussions

Majority of the respondents were female (53%) and most of them graduated from the Bachelor of Science in Forestry (32%). In terms of the total units in College/Advanced Algebra, the data show a 0.285 level of significance implying no significant relationship towards the board examination result of the respondents. Based on the result, the study's main variables have significant relationship in terms of the respondents Program and College with a significant value greater than the 0.05. In general, the results revealed that the GPA in mathematics has a significant relationship towards the success in the board examination with a 0.007 level of significance.

Table 2
Analysis of the Data in terms of Program and Mathematics Foundations using the Chi-Square test

Dependent variable	Independent variable	p-value	Decision	Conclusion
PROGRAM	Level Mathematics (University)	0.000	Reject H_0	Significant
	GPA in Mathematics Interval	0.002	Reject H_0	Significant
	Total No. of Units in Mathematics	0.003	Reject H_0	Significant
	Total No. of Units in College/ Advanced Algebra	0.003	Reject H_0	Significant

Tested at 0.05 level of significance.

Table 2 shows that all of the independent variables are significant to the dependent variable which is the program having a p-value less than the specified level of significance. This indicates that every independent

variable have a significant relationship on the program of the respondents. The significant relationship expresses an immense impact of the mathematics foundations to the performance of the graduates in their board examinations as it has a direct effect in the respective programs of the graduates.

Table 3

Analysis of the Data in terms of College and Mathematics Foundations using the Chi-Square test

Dependent variable	Independent variable	p-value	Decision	Conclusion
College	Level Mathematics (University)	0.000	Reject H_0	Significant
	GPA in Mathematics Interval	0.026	Reject H_0	Significant
	Total No. of Units in Mathematics	0.002	Reject H_0	Significant
	Total No. of Units in College/ Advanced Algebra	0.002	Reject H_0	Significant

Tested at 0.05 level of significance.

Table 3 shows that all of the independent variables are significant to the dependent variable which is the college having a p-value less than the specified value of the level of significance. This indicates that every independent variable have a significant relationship on the college of the respondents. It bears a greater effect on the graduates' proficiency in a better performance to their board examinations. It has significantly concluded that the mathematics foundation of the graduates in terms of the college they came from has affected their performance.

Table 4

Analysis of the Data in terms of the Board Examination Performance and Mathematics Foundations using the Logistic Regression Analysis test

Dependent Variable	Independent Variable	p-value	Decision	Conclusion	Odds Ratio
Board Examination Performance	Total Number of Units in Mathematics	0.328	Failed to reject H_0	Not Significant	1.220
	GPA in Mathematics Interval	0.007	Reject H_0	Significant	1.749
	Level of Mathematics Taken (University)	0.024	Reject H_0	Significant	0.058
	Total Number of Units in College/ Advanced Algebra	0.285	Failed to reject H_0	Not Significant	1.268

Hypotheses were tested at 0.05 level of significance.

In Table 4, the independent variables that have a significant relationship to the dependent variable are the GPA in Mathematics and the Level in Mathematics (University). Because of its probability values less than the specified level of significance which is 0.05. This means that, if the students who have good foundation or good grade in Mathematics subject, they are more likely successful in passing the board examination. Using the odds ratio result, with the odds value equal to 1.749, this imply that the odds of the respondents who got higher grade point average in mathematics subjects is more likely to pass than fail the board examination. Or in other words, 74.9% of the students are more likely to pass than fail the board examination, when they have good grades in mathematics subject.

This agrees with the result of the study of Lee & Lee (2009) where both engineering and business students show a significant association between grades in mathematics courses and success in the major, as well as general academic success. Accordingly, engineering and business students with advanced skills in mathematics would have a good chance at succeeding in college. It implies that mathematics can develop higher order thinking skills (Bialik & Kabbach, 2014) which is needed in the board examinations. Thinking critically, which is a form of higher order thinking in the board examinations will increase the chance to

pass the exam. Firdaus et al. (2015) pronounced that mathematics is one of the learning areas where critical thinking skills can be developed. Critical thinking skills can be developed through the process of mathematics learning because mathematics has a structure and a strong and clear connectivity between its concepts and the presence of complex mathematical tasks (Aizikovitsh & Amit, 2010).

The second independent variable that has a significant relationship of the board examination result is the Level of mathematics (University). The odds (0.058) of the students who took the mathematics in university level is less likely to pass than fail the board examination. The reason for this result is due to the content of the subject under in the university level. Since the board examination does not require higher knowledge in mathematics and it needs only the basic skills and analytical skills in solving word problems. Prior study of Lee, Brian and Lee, Jungsun (2009, p. 2) indicate that students' mathematical backgrounds positively influence their success in college. According to the study a student does not need University Level Mathematics to pass the board examinations. One of the reasons is because the board examination does not necessarily include higher level mathematics or the University Level Mathematics such as continuity & functions, discrete structures & logic, Euclidean and non-Euclidean geometry, probability, statistics application and the like but only on the basic skills and analytical skills in solving word problems. Needless to say that the board examinations given by the Philippine Regulatory Commission (PRC) does not require University Level Mathematics. Thus, in this case there is a need to look into the level of mathematics set as a minimum standard compared to the standard set by other countries.

Nonetheless, these studies do not clarify whether students' mathematical background represent their proficiency in mathematics, the level of commitment to academic performance, or the level of their intellectual capacity. The total units in mathematics and in College/Advanced Algebra do not significantly affect the performance of the board examination result. This means that even if the students have numerous number of units in mathematics and in College/Advanced Algebra, it does not assure that he/she pass the board examination.

The result implies that the GPA in Mathematics and the Level in Mathematics (University) has a greater impact on the graduates' knowledge of mathematics that can help them in their field of work. It has a direct effect on their performance in the board examination that contain mostly of mathematical questions and problems because having a good grade in mathematics and learning the university level mathematics manifest a good understanding of the related situations given in the board examination.

4 Conclusions and Recommendations

Mathematical Foundations such as University Level Mathematics courses and GPA in mathematics have impacts to the Board Examinations performance. Based on the findings of this study, if the students who have good foundation or good grade in Mathematics subject, they are more likely successful in passing the board examination.

It is recommended that the University may initiate activities and programs to enhance teaching and learning in mathematics. If possible, tutorial activities and enrichments may be in place to help students to cope up with mathematics difficulties. It is also possible to encourage students to only enroll University Level Mathematics, thus, opportunities to learn will be widened to possible exposure to these subjects.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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