

Binary Logistic Model on Factors Affecting the Result of Licensure Examination for Teachers (LET)

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Abstract

Licensure Examination for Teachers (LET) is immensely significant, not just for the teacher education students, which strengthens and improves their professional dimensions, but also an important factor in measuring the quality of education and its whole system in general. However, passing this examination is an exceptional undertaking to deal with. Based on the previous LET figures and actual observations in the Philippine schools, poor quality of education graduates has been observed (Manila Bulletin, 2013). In response to this dilemma, the study aims to generate a model of factors affecting the result of Licensure Examination for Teachers with the aid of binary logistic regression analysis. The factors that were considered are the cognitive domain (X_1) obtained from the average grade of the students, the emotional domain (X_2) with their level of test anxiety and the physical domain (X_3) that is measured through their body mass index. The respondents of the study were the Bachelor of Secondary Education graduates of A.Y. 2014-2105 in Agusan del Sur State College of Agriculture and Technology who had taken their licensure examination on September 2015. The respondents were chosen based on a random sampling technique and were then closely monitored before and after taking the examination. The findings of this study revealed that cognitive and emotional domains were statistically significant in predicting the probability of passing the LET. Therefore, education graduates should consider their average grade and test anxiety before taking the Licensure Examination for Teachers in estimating their chance of passing the examination.

Keywords: *Licensure Examination for Teachers (LET), Binary Logistic Regression Analysis, Average Grade, Test Anxiety, Body Mass Index*

1.0 Introduction

Licensure examination is a mark of professionalism that is recognized by the government and by the public to lead the standards of excellence, rules of behavior, and guidelines of recruitment (Santos, 2003). It is one of the prime movers considered regarding the Philippine's economic and social development (Visco, 2015) wherein the teachers are the entities responsible for the development of learners (Pachejo & Allaga, 2013). Hence, the government has a function to regulate the eminence of teaching profession by requiring aspiring teachers to pass the licensure examination before engaging into the scenery. However, passing the Licensure Examination for Teachers is a tedious deliberation. As a matter of fact, based on the previous LET figures and actual observations in Philippines schools, it specifies the poor quality of the graduates that churned out by teacher education institutions (Manila Bulletin, 2013). The primary reason for this latter is due to the differences in the capability of the graduates to learn and acquire knowledge that momentarily affects their chances of passing the licensure examination (Aquino & Balilla, 2015). In taking this such examination requires adequate cognitive, emotional and physical readiness. Thus, the study considered these factors namely; cognitive, emotional and physical status of the LET-takers in predicting their chances of passing the examination.

According to Arenillo and Arenillo (2008), there is a clear case of failure to produce quality education graduates who can pass the LET. Disturbing on this fact is that graduates got high marks in school,

but very low marks in LET. Espino *et al.* (2011) study, likewise, found graduates getting a mean rating of 87.33 percent as students, but performed badly in LET. Moreover, Faltado (2014) emphasized that the type of school is not a factor in passing the Licensure Examination for Teachers. Another factor that the graduates should consider is the level of their test anxiety, which has a detrimental impact on examination performance (Putwain, 2008). And also, Body Mass Index tends to affect academic performances. According to the present findings of a study conducted by Tabriz *et al.* (2015), it shows that a lower IQ score is associated with higher BMI. Nonetheless, from all of these mentioned factors; namely, average grade, the level of test anxiety and body mass index, no further studies attempt to generate a model in predicting the probability of passing LET.

Several factors affecting the licensure examination performance had been studied in the past. However, researchers of this study would like to explore the usage of binary logistic regression in analyzing the factors namely; cognitive, emotional and physical status of the secondary education graduates that could give the best prediction to the performance of the graduates in taking the Licensure Examination for Teachers.

This study aimed to create a model that would best predict the probability of passing the LET. In the LET result, outcomes are defined in dichotomous terms (pass/fail) and because variables used to predict these outcomes happen to be in different forms, binary logistic regression is the appropriate statistical tool to be used (Hosmer *et al.*, 2013).

2.0 Conceptual/Theoretical Framework

The study had looked into the possibilities of using the LET takers-related status; namely, cognitive status as to average grades (X_1), emotional status as to the level of test anxiety (X_2), and physical status as to Body Mass Index (X_3) as factors in predicting the probability of passing the LET. The theoretical considerations of the study were anchored in the following:

The knowledge of the students obtained from their preservice education was significantly related to their board performances (Arenillo and Arenillo, 2009). This result is also in accordance to the study of Castillo (2014), which disclosed that the academic achievement of the graduates in general education subjects was found to be the best determinant of success of the Bachelor of Secondary Education (BSEd) graduates in the LET.

Based on the study of Neuderth *et al.*, (2009) test anxiety can interfere study habits, and students may have difficulty learning and remembering what they need to know for the test. Too much concern may block performances. Therefore, students may have difficulty in demonstrating what they know during the test (Miller, 2016).

Atare & Nkangude (2014) studied the relationship of BMI on academic performance in Nigeria not to mention among undergraduate students in Physical Education where it is assumed that those with normal weight would excel more than the overweight academically. It is possible to think that weight may be endogenous to academic attainment.

Figure 1 shows the schematic diagram of the study. The explanatory variables are the student-related status, namely cognitive, emotional, and physical. The response variable is the LET result whether passed or failed.

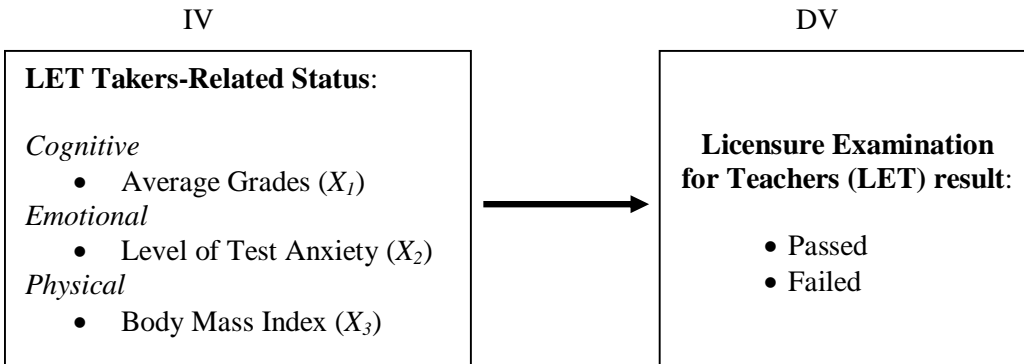


Figure 1. Schematic Diagram of the Study

3.0 Research Design and Methods

The researchers secured permission from the registrar's office to get the complete list of secondary education graduates of A.Y. 2014-2015 in Agusan del Sur State College of Agriculture and Technology. The data utilized in this study was obtained through a personal interview. After identifying the target respondents of the study, researchers started to collect the copy of their Transcript of Record, and also administered immediately the adapted questionnaires on the test anxiety and measuring the BMI right after the September 2015 licensure examination.

For the data analysis in this study, the researchers used the binary logistic regression. The logistic regression analysis was carried out through the logistic procedure in a statistical software. The regression model will be predicting the logit, that is, the natural log of the odds of having made one or the other decision.

In this study, the expected full model equation takes the form as:

$$\ln\left(\frac{p(\bar{\mathbf{x}})}{1-p(\bar{\mathbf{x}})}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon$$

where $p(\bar{\mathbf{x}})$ = the predicted probability of passing the LET

$1 - p(\bar{\mathbf{x}})$ = the predicted probability of failing the LET

β = the parameter of the logistic model

X_1 = Average Grade

X_2 = Level of Test Anxiety

X_3 = Body Mass Index

ε = Error.

4.0 Results and Discussion

The results of the logistic regression analysis using the statistical software are shown in the table below. The data in Table 1 shows the LET result and its corresponding codes of selected 50 BSE Graduates of ASSCAT who had taken the Licensure Examination for Teachers last September 2015. Among these LET takers, 64 percent passed, and 36 percent failed. The response variable data for LET taker's result is coded as passed = 1 and failed = 0, indicating the interest of this study is predicting the probability of passing the Licensure Examination for Teachers. In this case, logistic regression will predict the log odds of passing.

Table 1. Licensure Examination for Teachers Result of the Graduates

	LET Result		Total
	Passed (1)	Failed (0)	
Frequency (f)	32	18	50
Percent (%)	64	36	100

The data in Table 2 shows the descriptive measures of the explanatory variables. The average grades (X_1) ranged from 1.73298 to 2.63778. The Level of Test Anxiety (X_2) was coded as 3 = very low, 2 = moderate and 1 = very high. The level of test anxiety distribution was classified as 28 percent very low, 64 percent moderate and 8 percent very high. The BMI (X_3) predictor was coded based on the cut-off points classification, where 6 = class III obesity, 5 = class II obesity, 4 = class I obesity, 3 = Overweight, 2 = Normal Weight, and 1 = Underweight. The BMI distribution was 10 percent overweight, 78 percent normal weight, and 12 percent underweight.

Table 2. Description of the Explanatory Variables Data Set for Logistic Regression

Statistics	Average Grade	Test Anxiety			BMI		
		3	2	1	3	2	1
Mean	2.1689	-	-	-	-	-	-
Standard Deviation	.15850	-	-	-	-	-	-
Variance	.02512	-	-	-	-	-	-
Minimum	1.73298			1			1
Maximum	2.63778	3			3		
Frequency	50	14	32	4	5	39	6
Percent	100	28	64	8	10	78	12

Before jumping into a regression analysis, it is vital to detect collinearity or correlation among independent variables to be used in generating the model. In addressing variables that are highly collinear is by identifying which can make one of these variables almost redundant in some cases. From this consideration, it can give a best possible binary logistic regression model. Thus, Figure 2 has been shown to detect the presence of multicollinearity.

Figure 2 shows the graphical representation of collinearity among independent variables using principal component analysis. It clearly shows from this graph of correlations among independent variables that no multicollinearity has been illustrated.

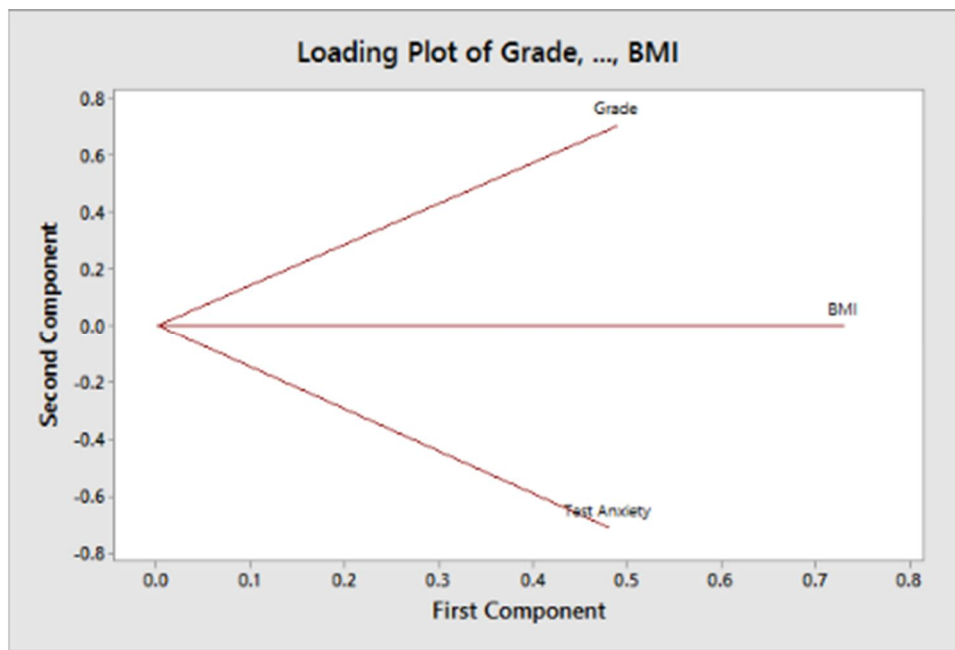


Figure 2. Principal Components Analysis in Testing the Collinearity

Also, formal statistical test for multicollinearity has been provided. Table 3 shows that there are no VIFs greater than 10 in the collinearity statistic column, an indication that there are no independent variables that are highly correlated to each other. Thus, multicollinearity will not interfere the estimation of the model's parameters. Hence, the model that can be generated in this study using the Logistic Regression Analysis will be adequate in predicting the probability of passing the LET.

Table 3. Variance Inflation Factor of Independent Variables

Model	Collinearity Statistic	
	Tolerance	VIF
Average grade	0.929	1.077
Test Anxiety	0.931	1.075
Body Mass Index	0.876	1.141

Table 4 shows the result in identifying the statistically significant factors on the explanatory variables to the graduates' performance in LET. From this Table, Average grade (X_1) first entered the model and reported a p -value of 0.000 which is less than 0.05. This indicates that Average grade (X_1) significantly contributes to the predictive ability of the model. In the second step, Level of Test Anxiety (X_2) entered and obtained a p -value of 0.035 which is less than 0.05. This indicates that adding the variable Level of Test Anxiety (X_2) from Model 1 significantly contributes to the predictive ability of the model. This implies that the factors Average Grade and Level of Test Anxiety are statistically significant in the LET result. These results are in agreement with the findings of Pascua and Navalta (2011) that the Grade Point Average has a significant relationship with LET performance of graduates and according to Trifoni & Shahini's (2011) conclusion that test anxiety negatively affects the motivation, concentration, and achievement, as it increases the errors during exam, creates problems recalling the material previously learned and prevents efficient study. However, BMI (X_3) was not included in the model. This result is supported by the study of Atare and

Nkangude (2014) on Physical and Health Education and Sports Courses that BMI is not related to academic performance, so there is no basis to judge a student generally by body mass profile.

Table 4. Identification of the Best Logistic Model

	Variable in the Model	-2 log Likelihood	Omnibus Test of Model Coefficients	<i>p</i> -value
Null Model	None	65.342	-	-
Model 1	X_1	52.583 ^a	12.759	0.000
Model 2	X_1 and X_2	45.900 ^b	6.683	0.035

Table 5 shows the result of identifying the best model through the inferential goodness-of-fit test, the Hosmer–Lemeshow test. The Hosmer-Lemeshow statistic indicates a poor fit if the *p*-value is less than 0.05. Here, Model 1 with Average grade (X_1) obtained a *p*-value of 0.598 that is greater than 0.05. This indicates that the model fits the data. Model 2 with Average grade (X_1) and Level of Test Anxiety (X_2) obtained a *p*-value of 0.526 that is greater than 0.05, suggesting that the model also fits the data. This result only explains that both models adequately fit the data.

Table 5. Adequacy of the Model

Model	Independent Variable Included	Chi-square	df	<i>p</i> -value	Nagelkerke R Square
1	X_1	6.440	8	.598	.309
2	X_1 and X_2	7.103	8	.526	.442

Also, Table 5 shows the Nagelkerke *R*-Squared Statistics which measures the variability of the dependent variable that can be explained by independent variables included in the model. The model with the largest R^2 statistic is best according to this measure. It can be clearly seen that Model 2 (0.442) has a greater Nagelkerke *R*-Square statistic compare to Model 1 (0.309). This is convincing evidence to show that Model 2 is significantly better than Model 1.

Table 6 displays the coefficients of the variables that entered the model. Average grade (X_1) has a coefficient of -12.393 and its corresponding *p*-value is less than 0.05 which means that the LET taker's average grade significantly affects the prediction of the probability of passing the LET. The Level of Test Anxiety (X_2) reported a Wald value of 4.786 in a very high category, 3.022 Wald value in moderate category and 4.864 Wald value in a very low category of which only very high category reported a *p*-value that is less than 0.05. This implies that very high level of test anxiety also significantly affects the prediction of the probability of passing the LET.

Table 6. Model 2 Logistic Regression Analysis Forward Stepwise (Likelihood Ratio)

Predictor	Category	$\hat{\beta}$	S.E.	Wald	df	p-value	Exp ($\hat{\beta}$)
Average		-12.393	4.383	7.993	1	.005	.000
Anxiety	Very high	-3.926	1.794	4.786	1	.029	.020
	Moderate	-2.015	1.159	3.022	1	.082	.133
	Very low			4.864	2	.088	
Constant		29.644	10.240	8.381	1	.004	7.484E12

Moreover, Table 6 shows the log of the odds of passing the Licensure Examination for Teachers is negatively related to the absolute value of average grade as well as to the level of test anxiety. In other words, for every regress in the general average grade of the graduate, one expects a 12.393 decrease in the log-odds of passing the LET as level of test anxiety held constant; if the graduate's level of test anxiety is classified as very low, there will be no change in the log-odds of passing the LET as average grade held constant; if the graduate's level of test anxiety is classified as moderate, it leads to the decrease of 2.015 in the log-odds of passing the LET as average grade held constant; and as the graduate's level of test anxiety is classified as very high leads to the decrease of 3.926 in the log-odds of passing the LET as average grade held constant, but only very high level of test anxiety is included in the model since it is the only level of test anxiety that reported a p -value that is less than 0.05 (.029). The result showed that logit model for this study is

$$\ln\left(\frac{p(\bar{\mathbf{x}})}{1-p(\bar{\mathbf{x}})}\right) = 29.644 - 12.393X_1 + X_2$$

where $X_2 = 0$, if the level of test anxiety is very low and moderate, and

$X_2 = -3.926$, if the level of test anxiety is very high.

To determine the effectiveness of the logistic model identified, classification tables is constructed by predicting the probability of passing or failing of each LET taker and compare the overall predictions to the

base level which is given by $\max\left(\frac{n_1}{n}, \frac{n_0}{n}\right)$ where n_1 is the number of respondents who passed and n_0 is the

number of respondents who failed. As shown in Table 7, the percents of correct prediction are 81.2 for LET Takers who passed and 55.6 for LET Takers who failed. Overall, 72.0 percent were correctly classified which is greater than the base level equal to 0.64. This result indicates that the identified logistic model is deemed useful for predicting the probability of passing the LET.

Table 7. Observed and the Predicted Frequencies of LET Result

		Predicted		% Correct
		Failed	Passed	
Observed	Failed	10	8	55.6
	Passed	6	26	81.2
Overall Percentage				72.0

Diagnostic Checking of Logistic Regression Analysis Model

The generated logit model must be subjected to diagnostic checking whether it satisfies the assumptions of the absence of outlier and the sample size.

Regarding the adequacy of sample size, the data set of this study met the minimum sample requirement of 15 to 20 cases per independent variables. By a minimum ratio of observation-to-predictor ratio of 10 to 1, the data set has 50 cases and three independent variables for a ratio of 12 to 1. Thus, the study met the minimum ratio. Therefore, the results reported in this study were considered stable.

Table 8 shows the portion of the probabilities for the D^2 scores after sorting in ascending order to find the smallest probability value. It shows that there are no values less than 0.001. This implies that there are no cases designated as outliers.

Table 8. Mahalanobis Distance for an Outlier Observation

Observation	Mahalanobis Distance	p -value
1	12.58535	0.005625
2	9.251044	0.026133
3	7.070075	0.069697
4	6.588449	0.086239
5	6.43595	0.092223
⋮	⋮	⋮
50	0.13991	0.98665

5.0 Conclusions

After executing the Binary Logistic Regression Analysis procedure, the result revealed that variables average grade (X_1) and level of test anxiety (X_2) found to be statistically significant in predicting the probability of passing the LET. On average grade, as this factor declines, one is less likely to pass the LET. Therefore, there's less probability of passing the LET as a graduate gets failing average grades. And for the test anxiety, as this factor goes to a "very high" level, the LET taker is less likely to pass the LET. Therefore, passing the LET is associated with obtaining a moderate and very low level of test anxiety. In conclusion, to pass the Licensure Examination for Teachers, academic average grades and test anxiety must be considered.

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