

Likelihood Estimation Of Passing The Licensure Examination For Teachers (Let) Using Multivariate Method

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Abstract

The main objective of the research was to determine the main components where BS Secondary Education Graduates (BSEG) should focus on their undergraduate academic subjects in preparation for the LET. The researchers used the Logistic Regression (LR) procedure in STATA using the grades of the 138 BSEG from 2010-2014. The dependent variable represents the result whether or not the BSEG has passed the LET. Five predictors were used; three were continuous and were transformed to be normally distributed. This was done so as to yield meaningful interpretations after the method. The transformed variables were the average grades in (1) basic non-mathematics subjects, (2) basic math subjects, and (3) Professional Education subjects. The other two were indicators of (4) the gender of the BSEG as well as (5) their majors, where math is in focus. The results showed that of the five predictors, only the education subjects and gender were significant. The outcome was then used to build an LR Model. It also implies that the education subjects, being a component in LET, must be given greater essence by the Teacher Education Institution, other stakeholders, and ultimately, future LET takers in order to have a better chance of becoming professional teachers especially on the first take. This paper can serve as a guide in remodeling curricula as well since notably, while the General Education Subjects provide aspiring teachers more knowledge in other fields, it is not tantamount to gaining higher probability of passing the professionalization.

I. INTRODUCTION

The road to becoming a professional teacher requires hard work and preparations. These things are done in order to acquire the necessary knowledge and skills to teach young minds of students through valuable lessons within and outside the classroom. The Policy and Planning Wing of the Ministry of Education of Pakistan considers “knowledge and understanding” of the pedagogies are essential for the order are important for teachers.

In the Secondary Education setup, like any

1.1 Background of the Study

preliminary grounding of teachers in their country (2009). The same is true in Australia. According to the Board of Studies, Teaching and Educational Standards NSW of Australia, the necessities to gain the ability to share knowledge to learners are respectable education, competence, and qualifications earned from young experiences in the profession (2014). Indeed, suitable overall training and qualifications of the highest

other countries, high school education in the Philippines can be realized in either a private

or a public school. Both types of schools require premier credentials from their teachers to ensure that the learners will benefit the most. However, a public school has a mandatory requirement which is the license for teaching. Possessing this distinction signifies that the teacher, aside from passing the board exam for the profession, has enough to outstanding scholastic preparation, is privileged to work directly for the State, and connotes other benefits from lesser important to the renowned should the holder decides to work for the government.

The Philippine Government through the Philippine Regulatory Commission (PRC) screens eligible professionals that meet the global standards including educators. It is the office that set the norms for future and established teachers as well. With the standards set by the PRC, teacher education institutions (TEIs) are continuously improving their curriculum. Moreover, TEIs pursue various accreditations to maintain and improve their performance in producing competent graduates that are ready in taking the Licensure Examination for Teachers (LET). To ensure that the goals will be met, efforts are being done by TEIs to ensure good performance in the LET by studying the factors that can enhance the performance on the said professionalization. This paper aims to do the same, but shall use factors that have been used from previous studies with the addition of other and new categorical ones.

1.2 Statement of the Problem

The researcher conducted the study in the attempt to identify the following:

1. The profile of the LET takers according to:
 - a. Status after taking the LET
 - b. Major
 - c. Gender
2. Determine the significant factors in passing the LET among the following:
 - a. Average of grades in Basic Math Subjects
 - b. Average of grades in Minor Subjects
 - c. Average of grades in Education Subjects
 - d. Math as major
 - e. Gender
3. From the significant factors, determine the odds ratio, build a multivariate model, and use a simulation for easy understanding

1.3 Scope and Limitation

This study used 138 graduates of Bachelor of Science in Secondary Education of De La Salle University – Dasmariñas (DLSU-D) from 2010-2014. The quantitative variables (grades in different subjects) were accessed from the database of the College of Education of the said University. Only those samples that have complete data (academic grades and LET results) and took the LET for the first time after graduation were used. All other factors, both internal and external that may not be contributory to the outcomes of this research were not included anymore.

REVIEW OF RELATED LITERATURE

2.1.1. On the importance of professionalization

Studying in college is generally preparing a student in the professional world. According to ACT Inc., students should be well directed already in choosing their path in the future (2013). They furthered that even high school students should be encouraged to prepare themselves in their future aspirations. There are students that have planned ahead about their career tracks. Some of them have already thought of teaching young minds. Teaching, like other professional jobs, require highest order of qualifications. In the Philippines, passing LET is a dream achievement of any teacher as it serves as gateway to more career opportunities. It is also the passport to work in public schools. It is therefore an important distinction that is being instilled to Teacher Education Students (TES). According to Riney, Phd, et. Al

(2006), 89% of their TES samples from a regional college in Texas consider professionalization as a remarkable attribute of their specialization. Some of their respondents also reiterated that “required tests” are significant in maintaining competency from their field. This is also an identical to the claim of HM Inspectorate of Education of Scotland (2009). According to their paper, The Standard for Chartered Teachers (CT) has been reformed in order to achieve spontaneous improvement in educational escalation. They also asserted that CT promotes tailored academic programs and better accomplishment for the youth.

2.1.2. On the contents of LET

The LET for Secondary Education is composed of three components. These are General Education (20%), Professional Education (40%), and the Specialization of the taker (40%). The General Education subjects, more commonly known as “minors”, is a component that contains various items coming from different subjects. These questions may come from, but not limited to Basic Mathematics, Philippine History, Filipino, Science, and English. In the Philippine educational system, majority of these subjects, if not all, are being taught in any course. The Professional Education on the other hand is composed of the 18 units that are offered by the respective school of the takers. Twelve of the 18 units are set by the PRC as the minimum requirements. The last one is the Specialization which is customarily known as the “major” of the taker. This breakdown served as the inspiration of the researchers to use grades in minors, Professional Education, and major, where math is in focus.

2.1.3. On General Education (math and nonmath)

In the near future, the minor subjects in Philippine Educational System may be purged already. However, some researchers believe that General Education (GE) is a

necessity for students to learn things outside their chosen field. This is especially true to teachers since they are expected to be well-rounded in their craft and the society. Every college curriculum has GE subjects. According to The Task Force on General Education of Harvard University (2007), GE advances undergraduates to be aware of what is happening around them and integrate it in their existence “personally, professionally, and socially”. This claim was supported by the paper of Dr. Jackson claiming that General Education subjects bring about enduring education for students. It essentially makes someone ready to produce remarkable impacts in the community as well (2012). The GE subjects also have some fundamental math subjects. However, even basic math may be challenging to some students. Willingham (2010) stated that mathematics may quite possibly be harder for students but “persistence and hard work” can counter the difficulties brought by the subject. Since basic math is part of GE of the LET, it is inevitable and needs ample attention too. Thus, this paper will attempt to generalize if indeed, minor subjects are good predictors of passing the mentioned licensures given the recent times.

2.1.4. On Gender and Math as Major

The DLSU-D offers five majors which are Mathematics, Filipino, English, Biology, and Social Studies. It is a well-known fact that people have different interests. Innate skills may also vary between persons specifically when connected to gender. In college, some courses are ordinarily dominated by a specific gender in terms of number of enrollees. Thus, studying the differences in gender becomes crucial.

According to Dee (2006), the research of the National Assessment in Educational Progress revealed that since 1970s, girls are superior to boys in reading tests but appears to lag behind to the latter in math and science. An interesting finding in the paper is that it seems easily, that the academic performances of male students are better with male teachers and female students under the management of female teachers. In relation, Ali et. al (2009)

sampled 75 male and 75 female students taking up medicine in Pakistan to understand the differences between the mental capacities of both genders in a homogeneous test. Their results showed that the group of males has slight yet statistically significant advantage over the female group. However, they suggested that more research should be done to draw clearer conclusions on the inequality among the genders. In addition, Niederle and Vesterlund (2010) stated that each gender seems to have different competition reactions. This in turn stretches the scores in assessments in math with some partiality for males. They furthered that males prefer majors which are “intensive” in math which all the more spikes competition amongst them compared to, for example, oral assessments. Struggles in math, moreover, can be caused by diverse factors. The study of Nuñez-Peña et. al (2013) determined that “math anxiety” is one of these familiar aspects. According to them, such inconveniency deeply affects the performances of college students in their grades in Research Design Course – an indispensable subject in any collegiate education. They have found sufficient evidences that those who failed the subject are categorically more anxious in math than those who have passed it. The authors adjoined that such apprehensions may influence the progression of students in their tertiary level as well. In addition, they concluded that the youth of this generation are shaped by such burden in their career path and preferred courses in college. Rezazadeh and Tavakoli, on the other hand, had generalized that on a broader scope, females have higher levels on anxiety than males in terms of taking assessments (2009). They also stated that more psychological stress are carried by females. This predicament begets females having high anxieties on taking exams – contemplating it as a possibility of committing disappointment. Moreover, their research revealed, consistent to prior papers, that anxieties in taking exams is negatively correlated to scholastic success. Such Professional Education to TES, the researchers decided include this component variable.

METHODOLOGY

evidences on gender effect, basic math performance, and math as major spurred the authors of this research to use these two as added variables.

2.1.5. On Professional Education

The TES are expected to be well geared on their field. The communal curriculum subjects of Education majors in the Philippines are grouped into three, namely, General Education subjects, the Specialization of choice of the TES, and the Professional Education Subjects. Aside from experiences gained from exposures through becoming Student Teachers, the Professional Education subjects serve as the guiding paradigm of the TES. The Professional Education classes incorporate both theoretical and practical approaches in aiding students learn in the most effective way. According to the research of the Department of Education and Training in Melbourne, educators must have a profound grasp of their specialty for them to become competent (2005). Nowadays, numerous states have shifted their teacher education curriculum in preparing the TES to become professional in an academic surrounding – reducing scholastic foundations while suitably harmonizing philosophies and training as stated by OECD (2011). It cannot be denied that learning the basics inside the classroom is quintessential. Although on-the-job training experience is incalculable and gives first hand encounter in real and professional life, it is still ideal to learn primarily from those who have more experiences like established professors. The National Council for Accreditation of Teacher Education (NCATE) in the United States affirmed that teachers should have ample groundwork of their specialization and teaching as profession since it is where “instructional decisions” should be based from (2008). With such strong claims to the importance of

The researchers used a total of 138 samples. They are distributed in five majors, namely, Mathematics, Biology, Filipino, English, and Social Studies. The time frame was specified since from 2010, the curriculum has been

changed, and was then applied until 2014. For convenience, only those BSEG that have complete data and took the LET for the first time were included for data extraction.

The authors used the Logistic Regression (LR) Method. This a robust multivariate technique implying that the assumptions of normality, independence, and linearity are most of the times not observed compared to those that are used in predicting “location and scatter”, such as Multiple Linear Regression (eolss.net, 2005). It is also the appropriate multivariate technique for a categorical dependent variable and a combination of qualitative and quantitative predictors. This

procedure is comparable to any multivariable statistical techniques that allow the users to determine their factors of choice. This is the foundation for the authors in choosing the used variables, especially math as major, too, as stated in Part 2.1.4. Furthermore, it uses significant factors and estimates the quotient of estimated success against approximation of failure which leads to an Odds Ratio (OR) estimate. The OR denoted by θ in this paper will then be the basis of predicting success in the LET for this research.

It is noticeable that grades in college are interval in nature. In DLSU-D, the grades equivalents are as follows:

Table 1. *Grading system of DLSU-D for undergraduates.*

Grade Point	Percentage
4	98-100
3.75	95-97
3.5	92-94
3.25	89-91
3	86-88
2.75	83-85
2.5	80-82
2.25	77-79
2	74-76
1.75	71-73
1.5	68-70
1.25	64-67
1	60-63
0	Below 60
N.C.	No Credit
O.D.	Officially Dropped

Table 1 shows the grading system applied for undergraduate students of DLSU-D.

Taken from:

<http://www.dlsud.edu.ph/Registrar.htm>

The researchers clustered all the collected grades into three, namely Basic Mathematics Subjects (Contemporary Math and Integrated Math), Professional Education (Foundations of Education 1 and Principles of Teaching), and minors that are free of mathematics contents but are related

to a course track of students as seen in Part 2.1.4 (Basic History, Basic Biology, Basic Filipino, and Basic English). Since the data collected showed only the corresponding Grade Point of each samples, the authors used the percentages. This was done to alleviate the problems that may incur such

as failed grades which will only show 0.00 but not the numerical values. The percentages in each cluster were used to get the medians. The medians in each of the three clusters were subsequently used to get the averages. These averages were standardized afterwards - using STATA, the averages were run to get a new set of values with mean 0 and variance 1. This procedure is commonly explained in basic statistic

courses. This was done to yield a practical and meaningful interpretation after running the data in the software as well. Lastly, an LR Model was thereafter built with a simulation for better comprehension.

RESULTS

This chapter contains the outputs with the interpretations of each tables and LR Model.

Table 2: Distribution of Majors

Major	Freq.	Percent
Non-Math	125	90.58
Math	13	9.42
Total	138	100.00

To distinguish another variable, the researchers sorted the math majors and non-math majors as seen on Table 2. This table shows that 9.42% of the samples were Math majors while 90.57% are taking other fields.

Table 3: Distribution of Status

Status	Frequency	Percent
Failed	33	23.91
Passed	105	76.09
Total	138	100

Table 3 shows that of the samples who took the LET for the first time after graduating, 84.68% have passed and 15.32% of them have failed.

Table 4: The variable names used in the software

<u>Variable name</u>	<u>Actual Variable</u>
Male	Gender (male=1)
Math	If EG is math major (math major = 1)
znonmath2	Standardized Average Grades (SAG)in basic non-mathematics subjects (minors)
Zmath	SAG in basic math subjects

Zeduc	SAG in Professional Education subjects
_cons	Constant (as generated by the model)

Table 4 shows the variable names as representation of the actual variables used in the software for convenience.

STATA Commands:

```
. gen pass = status==1
. gen male = gender==1
. gen math = mathmajor==1
. egen znonmath =std(nonmath)
. egen znonmath2 = std(M)
. egenzmath= std(maths)
. egenzeduc = std(educ)
. logistic pass male math znonmath2
zmathzeduc
```

STATA Output:

```
Logistic regression
Number of obs = 138
LR chi2(5) = 26.55
Prob> chi2 = 0.0001
Log likelihood = -62.636346
Pseudo R2 = 0.1749
```

Table 5. The actual results from the software

Pass	Est.	S.E.	Z	P> z
male	0.39	.21	-1.75	0.079
math	1.54	1.45	0.46	0.644
znonmath2	0.96	0.33	-0.12	0.901
zmath	1.22	0.44	0.55	0.584
zeduc	2.49	0.88	2.58	0.010
_cons	4.69	1.33	5.45	0.000

Table 5 shows that of the five pre-determined variables, only the gender, and grades in professional education subjects are the significant contributors in passing the LET on the first take at 90% confidence level.

The LR Model:

$$\hat{\theta} = \frac{\exp(4.69 + 0.39\text{male} + 2.49\text{zeduc})}{1 + \exp(4.69 + 0.39\text{male} + 2.49\text{zeduc})}$$

The model states that holding the SAG in Professional Education constant, a unit increase in gender (i.e. the change or difference in gender from female to male)

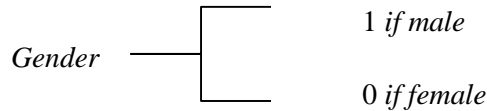
increases the log odds (θ) of passing the LET by 0.39 on the average. On the other hand, restraining the gender variable fixed, every unit increase in the SAG generates the log odds of being successful in the LET boosted by 2.49 on the average

Table 6: Simulation using the Model

Row	β_0	β_1	Gender	β_2	SGPE	θ
1	4.69	0.39	1	2.49	0.5	99.82%
2	4.69	0.39	0	2.49	0.5	99.74%
3	4.69	0.39	1	2.49	0	99.38%
4	4.69	0.39	0	2.49	0	99.09%
5	4.69	0.39	1	2.49	1	99.95%
6	4.69	0.39	0	2.49	1	99.92%
7	4.69	0.39	1	2.49	-2.5	24.14%
8	4.69	0.39	0	2.49	-2.5	17.73%

Where: β_0 = constant

β_1 = Gender Coefficient



SGPE = Standardized Average Grade in Professional Education Subjects

θ = the Odds Ratio

Table 6 shows a mock-up of likelihood of passing the LET using the significant factors retained in the model. For better comprehension, the differences specifically through the effect of gender are seen in rows 1, 2, 7, and 8. Rows 1 and 7 assume that a LET taker is a male while 2 and 8 assumes a female one. Recall that a standard normal distribution has a mean of 0 and variance of 1. Therefore, a 0.5 in SAG in Professional Education implies that the undergraduate had relatively good grades in that cluster of subjects. The 0 signifies fairly acceptable performance while the -2.5 entails poor performance and not necessarily negative nor below 0. According to the table, there is not much difference in the OR of passing the LET for both genders if the SAG is good as seen in Rows 1 and 2. However, the disparity becomes prominent as shown in Rows 7 and 8 when the performance in SAG is considerably poor. This therefore strongly suggests that Professional Education is a vital in the aspirations of overcoming the LET.

DISCUSSIONS AND CONCLUSIONS

5.1 Discussions

As stated by the Department of Education and Training in Melbourne (2005), teachers must fully embrace their chosen craft. Accordingly, future educators should render high importance to the pedagogies that shall be incorporated to them by their school. This study also makes it clear that even with a trend of countries shifting into more of experienced-based learning as stated by the OECD (2011), at least locally and with the current components of the licensure, learning the philosophical foundations of education inside the classroom is still indispensable. There should also be a conscious and sound effort to embrace Professional Education for TES. According to the NCATE, resolutions in teaching should be carried out from the fundamentals and experiences that an educator has learned (2008).

On the other hand, the gender gap in some areas of study, consistent to the findings of Dee (2006), is basically evident in this paper. In addition, this research is in one way or another parallel to the findings of Ali et. al (2009) that in a standardized test, males tend to perform fairly better from their female counterparts. It is highly probable as well that anxiety in assessments with math contents are affecting females harder and thus bring unfavorable outcomes as concluded by NuñezPeña et. al (2013). Furthermore, males

have better response when competition exists as asserted by Niederle and Vesterlund (2010). Rezazadeh and Tavakoli also interpreted in their study that in a wider spectrum, females appear to exhibit higher levels of anxieties in taking assessments (2009). They also maintained that such mental pressures have adverse impacts on academic success as was already claimed by earlier studies. Putting these generalities together, it can be construed that in a standardized set of exams like the LET which has immense pressure, can bring anxiety over math contents (in General Education and in specialization). It also encompasses competition that may be brought by peers and other factors to which males appear to have an edge over females. This research does not consider major as a factor at least in the mathematics side as well. This, however, needs further verification due to minimal samples.

5.2 Conclusions

This paper was able to ascertain that Professional Education Subjects and gender can have significant role in attaining higher likelihood of passing the teacher professionalization. This implies that Education units are vital in passing the LET, and therefore, must be taken with rather genuine focus by students that have desires to be registered professionals. Males appear to

have statistically higher likelihood of passing the LET compared to females as well. This indicates that TEIs should give more emphasis in building confidence for the exam takers particularly to females.

An interesting finding here is that it appears that taking math as forte may not necessarily be a guarantee of having higher chances of passing the LET. However, this result needs further substantiations due to the limited sample size. Correspondingly, although General Education subjects, including basic math, teach TES more knowledge in different areas, it does not seem to augment the probability of passing the LET. This study may help TEIs and colleges in general in remodeling their curricula as well since the result appears to support the purging of minors in tertiary classes. Lastly, a nice continuation of this research is to study if the interaction of gender and math as major as a new variable is significant in passing the LET or any other board exams.

REFERENCES

ACT Inc. (2013). Readiness Matters: The Impact of College Readiness on College Persistence and Degree Completion. Retrieved June 17, 2015, from <https://www.act.org/research/policymakers/pdf/ReadinessMatters.pdf>

Ali, et. Al. (2009). COMPARISON OF GENDER PERFORMANCE ON AN INTELLIGENCE TEST AMONG MEDICAL STUDENTS. Retrieved 2015, from http://www.researchgate.net/publication/47369201_Comparison_of_gender_performance_on_an_intelligence_test_among_medical_students

Board of Studies, Teaching and Educational Standards NSW. (2012). AUSTRALIAN PROFESSIONAL STANDARDS FOR TEACHERS. Sydney.

Office of School Education, Department of Education & Training, Melbourne. (2005). Professional Learning in Effective Schools: The Seven Principles of Highly Effective Professional Learning.

DLSU-Dasmariñas, R. (n.d.). Retrieved May 15, 2015, from <http://www.dlsud.edu.ph/Registrar.htm> Dee, T. (2006).

How a Teacher's Gender Affects Boys and Girls. The Why. Retrieved 2015, from https://cepa.stanford.edu/sites/default/files/ednext20064_68.pdf

Dee, T. (2006). How a Teacher's Gender Affects Boys and Girls. The Why. Retrieved 2015, from https://cepa.stanford.edu/sites/default/files/ednext20064_68.pdf

HM Inspectorate of Education. (2009). Learning Together: Improving teaching, improving learning. Retrieved 2015, from http://www.educationscotland.gov.uk/Images/ltcfe_tcm4712914.pdf

Jackson, B. (2012). Why is general education important? Retrieved May 1, 2015, from <https://www.ccis.edu/nationwide/newsletters/MoberlyNews-2012-03.pdf>

Niederle, M., & Vesterland, L. (2010). Explaining the Gender Gap in Math Test Scores: The Role of Competition. *Journal of Economic Perspectives*, 24(2), 129-144. Retrieved 2015, from <http://web.stanford.edu/~niederle/NV.JEP.pdf>

Nuñez-Peña, M., Bono, R., & Suarez-Pellicioni, M. (2015). Feedback on students' performance: A possible way of reducing the negative effect of math anxiety in higher education. *International Journal of Educational Research*, 80-87. doi:doi:10.1016/j.ijer.2015.02.005

OECD. (2011). Building a High-Quality Teaching Profession: Lessons from around the world. Retrieved 2015, from <https://www2.ed.gov/about/inits/ed/international/backgound.pdf>

Retrieved 2015, from <http://www.education.vic.gov.au/Documents/school/teachers/profdev/proflearningeffectivesch.pdf>

PRC Board News. (2015). LET 2015

schedule of exam, program deadline of filing application announced. Retrieved 2015, from <http://www.prcboardnews.com/2014/12/let2015-schedule-of-exam-program-and-deadline-of-filingapplication-announced.html>

Rezazadeh, M., & Tavakoli, M. (2009). Investigating the Relationship among Test Anxiety, Gender, Academic Achievement and Years of Study: A Case of Iranian EFL University Students. 2(4). Retrieved 2015, from <http://www.ccsenet.org/journal/index.php/elt/article/viewFile/4449/3789>

Riney, M. (2006). National Implications: Teacher Education Students' Perceptions of State Licensure Requirements and Pedagogical Training.

16(3). Retrieved 2015, from <http://www.nationalforum.com/ElectronicJournal>

Volumes/Riney, Mark Teacher Education Students Perceptions of State Licensure.pdf.pdf Task Force on General Education, Harvard University. (2007). Report of the Task Force on General Education. Retrieved 2015, from [http://isites.harvard.edu/fs/docs/icb.topic830823.files/Report of the Taskforce on General Education.pdf](http://isites.harvard.edu/fs/docs/icb.topic830823.files/Report%20of%20the%20Taskforce%20on%20General%20Education.pdf)

Willingham, D. (2010). Is it true that some people just can't do math? Retrieved 2015, from <http://www.aft.org/sites/default/files/periodicals/>