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Event History Analysis of Student Retention among Engineering and Non – Engineering Programs

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***Abstract* — Ensuring the student retention and graduating in timely manner are major interests of all universities. This study aims to determine the pattern of student's retention. The study used an event history analysis using discrete – time models to identify the time at which the student is more likely to dropout or shift. The data was provided by the Pangasinan State University – Urdaneta city campus which includes demographic variables: gender, courses, number of semesters taken, and status of degree completion. The findings revealed that there is a high prevalence of dropout and shifting for six – year period while degree completion across all courses is relatively low. The study revealed that students are most likely to drop out or shift during their two semesters. The Information Technology earned the highest dropout among Non – engineering course while Architecture had all its enrollees dropout during the six – year coverage of the study. Education courses had the longest mean survival time while BS Information Technology and BS Mathematics had the lowest. Furthermore, there is a significant difference on the survival curve across all Engineering and Non – Engineering degree programs found in the study. Sex of the student was found to be not significant predictor of student's retention to both degree programs. Finally, findings suggest that the course of students is a significant prediction of the student's retention.**

Keywords* — *student retention; degree completion; event history modeling; longitudinal study

I. INTRODUCTION

Degree completion and student attrition are the two major indicators used in assessing the institutions accountability and rankings. They have long been used as performance measures for evaluating the institutional quality of colleges and universities. Thus, producing more graduates and minimizing dropout rates as well as identifying the factors that cause this event were deemed to be critical in the higher education institution.

A bachelor's degree programs are generally having a minimum of four years of completion time. However, the engineering and architecture programs have a five-year curriculum of study and are then required to take licensing examinations. By convention, students who graduate "on time" on their respective degree programs is a central factor not only to measure success of the students but the institution as well.

However, there is only a small literature which central theme is on "time to degree" completion or "the total time that elapsed between the initial enrollment in a college institution until the attainment of the degree regardless if the student is enrolled or not" [1]. Previous studies focus on various factors related to increase time of delay of completion. This can be categorized as student-related factors such as personality issues and personal motivations [2]; socioeconomic aspect also plays a part which includes increasing college costs such as tuition fees and the assurance of employment [3]; educational system for example the environment and facilities and faculty instruction and behavior were also studied [4].

In general, studies also showed that degree completion varies in every field of disciplines. In natural science, engineering and life sciences are associated with lower completion rates, higher dropout rates and higher time to degree completion than disciplines in social sciences and humanities. However, studies found out that graduates in the natural sciences complete their studies significantly faster than students in the humanities and social sciences [5][6].

Moreover, with respect to methodological approaches, the temporal dimension and event occurrence of student retention are also lacking in literature [2]. Survival analysis was employed to general population of students were being athlete or not is the general variable [7]. Their study revealed that athletes were significantly less likely to drop out during their first four years, but were at higher risk of withdrawal in their 5th and succeeding years (perhaps the loss of eligibility after four years). Furthermore, a

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study revealed that African-American students were more likely to persist than Caucasians, female students were more likely to depart than male students, and older students had a greater risk of departure than younger students [8].

Given the few existing literature that focuses on the temporal aspect the study aims to contribute to the growing body of researches using survival analysis which is infrequently employed as a methodology in educational research [2].

Survival analysis is set of statistical methods concerned with studying the time between entry to a study and a subsequent event. It is also called "time to event analysis". Timing of events is a common research question in the social and behavioral sciences (e.g., completion of college, duration of marriage, time to puberty), and these questions typically seek to determine "whether events occur" or "when events occur" [9]. It attempts to answer questions such as: which fraction of a population will survive past a certain time?; at what rate will they fail?; at what rate will they present the event?; and how do particular factors benefit or affect the probability of survival? In this study, the discrete – time completing risk hazard model be employed [10]. This analysis involves estimating, for each year after the start of study of their degree, the risk of dropping out from their degree and completion of their degree.

In this study, there will be two separate model that will be since engineering and non-engineering programs have different minimum year of completion. These models will be applied to a sample student who enrolled their degree during the period first semester of academic year 2010-2011 until second semester of academic year 2015 – 2016.

Moreover, the study will also focus on the major aspects: First, we will determine whether men or women are more likely to complete their degree in timely manner. This statement will be studied by comparison of engineering and non – engineering courses. Second, we will investigate whether their course play a vital role in their dropout rates. It is interesting to analyze whether there are differences in the degree completion by programs and identifying programs with the highest dropout rate. Furthermore, link between the course and degree completion the common belief is that, engineering courses are less likely to complete their degree than in non – engineering programs.

The primary objective of the study is to determine the factors influencing to the student retention among engineering and non – engineering programs by utilizing Event History Analysis. Specifically, it aims to:

1. Describe the pattern of student retention among engineering and non – engineering programs.
2. Determine the difference in the survival time (time to drop out or shift) between courses.
3. Establish a model that would describe the relationship between the profile variables and the time wherein the student decided to either drop from the course or shifted to another course.

II. METHODOLOGY

Research Design

This study was descriptive in nature. The data shall then be analyzed with descriptive statistics and furthered by utilizing the Survival Analysis approach. This approach was used to determine if there is significant difference in the student retention of the students in their course across the profile variables, and will estimate time to event for a group of individuals.

Research Framework

The framework shows independent or explanatory variables: gender and course which were used to correspond unto two survival analysis models: Engineering and Non – Engineering Programs. The dependent variables used in this study are particular time period which provides an indication of how many semesters a student was enrolled before they drop out from their study, if none of this outcome occurred then the respondent will be classified as censored data which indicates that a student graduated the course he enrolled at the start of the study period, otherwise, it was distinguished as dropout when a student did not enroll for the that specific time period.

Survival models relate the time that passes before dropping occurs to one or more covariates that may be associated with number of semesters taken.

Data

The respondents of this study are the students in PSU- Urdaneta City Campus who were enrolled and started studying their course during the School Year 2010-2011 and were followed until School Year 2015-2016. The data include twelve-semester six years duratioduration of information on these students. The study has not included summer of each academic year since some course do not subject offering during the prescribed period. Also, transferees during these school years were not included in the study.

The outcome variables in the current study are event of occurrence (drop out or not) and time to event. The outcome variable for this study is the event of occurrence, which has a value of "1" if the student graduated in a given semester, a value of "0" if the

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student departed or did not experience either event during the six - years (i.e., censored) until the end of the time frame being considered. Predictor variables that were selected in this study are: sex and course were used to estimate the hazard of the outcome.

Statistical Treatment

a. Event History Analysis

Logistic regression is described as the study on relationship of how risk factors are associated with presence or absence of disease. Sometimes, though, it is interested in how a risk factor or treatment affects time to disease or some other event. For example, consider modeling the presence or absence of coronary heart disease and its relationship to age.

In survival analysis, it is usually defined as a set of methods for analyzing data where the outcome variable is the time until the occurrence of an event of interest. This analysis measure time from a starting point until the occurrence of an event of interest. The response is often referred to as a failure time, survival time, or event time. The event can be death, occurrence of a disease, graduation, finishing a doctoral dissertation, tumor recurrence, etc. (Sullivan, n.d.). The time to event or survival time can be measured in days, weeks, semesters, etc. For example, if the event of interest is graduation, then the survival time can be the semester until a student finishes his course.

Standard survival models assume that all cases will eventually fail, if given sufficient time, that is, the model assumes that all observation is "at risk" of the event occurring. For college completion, students are "at risk" of graduating from college given they did not graduate in a previous semester. That is, every student that enrolls in college is "at risk" of graduating but when a student graduates, he or she is no longer at risk (Radcliffe, Huesman and Kellog, 2006).

b. Discrete – time models

In survival analysis, time scale can be categorized into continuous or discrete time. Given the complexities of the continuous-time survival models and the more frequent need for discrete-time models in the social sciences. A discrete-time survival analysis is used in this study since time is measured by the number of semesters taken by students.

c. Censoring

Observations will be "censored", or no longer observable upon graduation. However, the model will still attempt to determine their likelihood of dropping the subject or shifting to other course. These data occur because individuals in the dataset will either never experience the event or did not experience the event during the time frame being studied (Singer & Willett, 2003). Censoring can be classified into right-censoring and left-censoring. Left-censoring occurs when the event of interest is experienced before the time frame being studied; whereas right-censoring occurs when the event of interest is experienced after the time frame being studied.

Allison (2010) describes how separate analysis for each event can be performed without producing biased parameter estimates and only a slight loss of precision. This allows the researcher to focus on the event of interest and allows for different models to be considered for different types of events. Fitting the graduation model, for example, involves treating students who departed as being censored.

d. Hazard Function

Although an important function in summarizing the occurrence of events over time by providing a cumulative longitudinal summary of the proportion of students who have not graduated, the survival function confounds information about graduation for each semester with cumulative information from the prior semesters. If graduation is an event and the "risk" of experiencing the event in each semester is the outcome of interest, the survival function masks critical information about risk. The hazard function provides a better summary.

Central to an understanding of the hazard function is the "risk set". The risk set for the present study is defined as all those students still enrolled at the beginning of first semester of academic year 2010-2011. These students represent those who have not left the institution for some reasons other than graduation or have not graduated, so they are "at risk" of graduating at the end of that semester, and represent the denominator of the hazard probability.

The numerator of the hazard probability is the number of students out of the risk set who graduate. The hazard probability is the proportion of students in the risk set for each semester who graduate during that semester. These hazard probabilities represent the conditional probability that a student will graduate during the current semester given that they have not graduated in any prior semester. The conditional nature of hazard probabilities is the feature that makes the hazard function a better metric of risk or event occurrence. Students remain part of the risk set, hence the analysis, until they either leave the institution, graduate, or are censored. For example, all students are part of the risk set in the first semester but no one graduates during the first semester, so the hazard

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probability is 0. A plot of hazard probabilities over time determines the hazard function, a chronological summary of the risk of graduating.

e. Life Table Analysis

The life table gives us a good indication of the distribution of drop outs every semester. However, for predictive purposes it is often desirable to understand the shape of the underlying survival function in the population. The major distributions that have been proposed for modeling survival or failure times are the exponential (and linear exponential) distribution, the Weibull distribution of extreme events, and the Gompertz distribution.

f. Kaplan-Meier Product-Limit Estimator

The Kaplan Meier method is widely used to estimate and especially for graph survival probabilities as a function of time. It can be used to obtain univariate descriptive statistics for survival data, including the median survival time, and compare the survival experience for two or more groups of subjects. To test for overall differences between estimated survival curves of two or more groups of subjects, such as males versus females, or treated versus untreated (control) groups, several tests are available, including the log-rank test. This can be motivated as a type of chi-square test, a widely used test in practice, and in reality is a method for comparing the Kaplan-Meier curves estimated for each group of subjects.

g. Cox's Proportional Hazard Model

A common research question in medical, biological, or engineering (failure time) research is to determine whether or not certain continuous (independent) variables are correlated with the survival or failure times. There are two major reasons why this research issue cannot be addressed via straightforward multiple regression techniques (as available in Multiple Regression): First, the dependent variable of interest (survival or failure time) is most likely not normally distributed -- a serious violation of an assumption for ordinary least squares multiple regression. Survival times usually follow an exponential or Weibull distribution. Second, there is the problem of censoring, that is, some observations will be incomplete.

The proportional hazard model is the most general of the regression models because it is not based on any assumptions concerning the nature or shape of the underlying survival distribution. The model assumes that the underlying hazard rate (rather than survival time) is a function of the independent variables (covariates); no assumptions are made about the nature or shape of the hazard function. Thus, in a sense, Cox's regression model may be considered to be a nonparametric method.

III. RESULTS AND DISCUSSION

Students' Retention

Table 1 presents the number of student who dropped out, shifted and graduated from school year 2010 – 2011 to School Year 2015 – 2016. It can be seen from this table that about 300 students enrolled in the engineering courses dropped out or shifted during the six - year period. Meanwhile, percentage of students who graduated in both curricular programs is about twenty percent which is relatively low.

Table 1. Student Retention of Student Who Enrolled during School Year 2010 – 2011 (N = 860)

Status	Curricular Programs			
	Engineering Courses		Non - Engineering Courses	
	F	%	F	%
Graduated	78	20.7	104	21.5
Drop out or Shifted	298	79.3	380	78.5

This finding support the study of Cenas and Colobong (2011) in which they have forecasted that about 400 students will move out of PSU after the second semester of 2011 – 2012 and around 500 students after the second semester 2015 – 2016 [12].

As can be seen in the comparative bar chart shown in Figure 2, a large discrepancy in the number of student who dropped out or shifted and those have completed their course was observed during the six-year coverage the study. The chart also shows that there were higher number of student who dropped out or shifted for the non – engineering courses than those students who enrolled in the engineering courses during the time – frame being studied. Furthermore, it can be observed that a smaller number of students who graduated in the Engineering courses than non – engineering programs.

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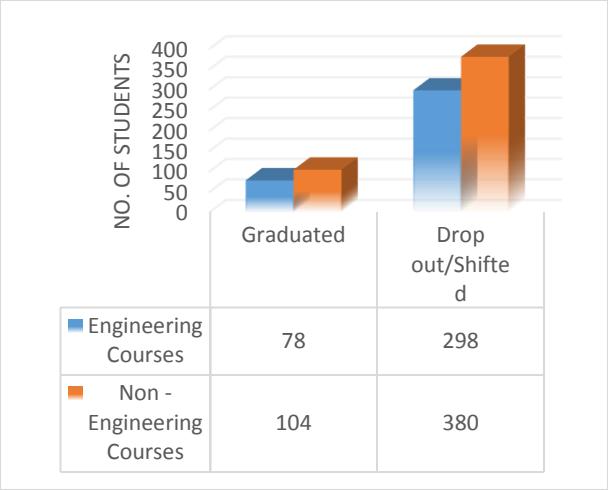

Figure 2. Comparative Bar Chart of Number of Graduated and Drop – out or Shifted from 2010 – 2016.

Pattern of Student Retention

Life tables provide information on the number of drop – out and shiftee as well as number of graduate in each semester interval. Tables 2 shows the summary on the number of exposed to risk (student who are still enrolled), censored (graduating), and terminal events (drop – out or shiftee during the semester interval.

As seen on table 2, many students dropped out or shifted at the start of the first semester of SY 2010 – 2011 and continuously increased on the second semester of SY 2010 – 2011 for those who enrolled on engineering courses. Number of drop – outs start to decrease on the next semesters and remain stationary until the 12th semester. Interestingly, almost half of students dropping out or shifting occurs after the first year of enrollment.

Table 2. Life Tables for Engineering and Non – Engineering Programs

INTERVAL START	MASTERS DEGREE PROGRAM														
	MAED			MACE			MDM			MME			MS AGRICULTURE		
Semester	No. Exposed to Risk	No. Withdrawing during Interval	No. of Terminal Events	No. Exposed to Risk	No. Withdrawing during Interval	No. of Terminal Events	No. Exposed to Risk	No. Withdrawing during Interval	No. of Terminal Events	No. Exposed to Risk	No. Withdrawing during Interval	No. of Terminal Events	No. Exposed to Risk	No. Withdrawing during Interval	No. of Terminal Events
0	208	46	0	12	7	0	12	5	0	11	2	0	7	2	0
2	162	52	3	5	1	0	7	4	0	9	4	0	5	2	0
4	107	49	10	4	2	0	3	2	0	5	3	2	3	0	0
6	48	26	8	2	2	0	1	0	0	-	-	-	3	1	1
8	14	4	6	-	-	-	1	1	0	-	-	-	1	0	1
10	4	0	2	-	-	-	-	-	-	-	-	-	-	-	-

TheIn addition, students graduating for all engineering courses can also be observed on the 12th semester. These were students with failing subjects who continually pursued their studies and eventually complete their degree on the 12th semester.

For Non – engineering degree programs, 1st and 2nd semester of SY 2010 – 2011 have the highest number of students who drop – out/shifted which can also which has the same observation and pattern as the engineering programs. Compared to other Non – Engineering programs, BS Information Technology has the highest number of students who dropped out or shifted with 95 on the 1st semester and with a slight decrease of 81 on the 2nd of SY 2010 – 2011. This is simply because BS IT has the highest number of enrollees and providing higher number of student who are at risk to drop out or shift. For education courses, we have observed that no student continued to complete their degree from 10th – 12th semester coverage of the study. That is, those students who reached the 8th semester did not continue to pursue their courses.

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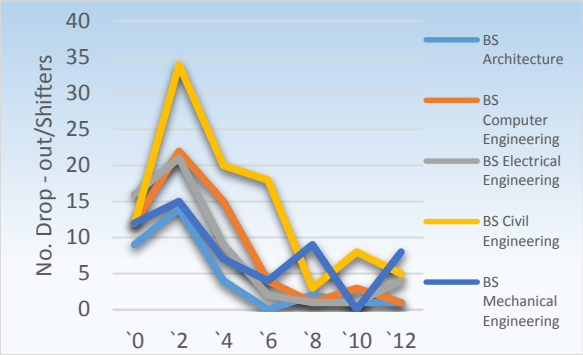

Figure 3. Sequence chart of the Number of Drop out or Shiftee for Engineering degree programs from SY 2010 – 2011 to SY 2015 – 2016.

Figure 3 provides a clearer visual display of table 3. The sequence chart shows the comparative number of drop – outs or shifteres during the 12 – semester coverage of the study. As seen in the figure, high number of drop out can be observed on the 1st and 2nd semester of SY 2010 – 2011, then starting 3rd semester a steady decrease of drop out was noted. This is because there was a decrease in the number of student who were at risk since many students have already drop out/shifted during the 1st and 2nd semester of SY 2010 – 2011. It can also be observed in the figure that provides the highest number of dropped out or shifted among the five courses under the Engineering programs.

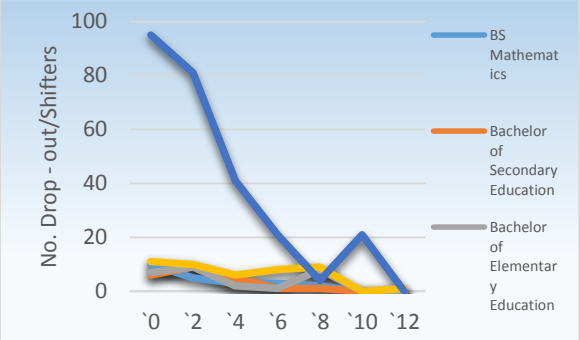

Figure 4. Sequence chart of the Number of Drop out or Shiftee for Non – Engineerinng degree programs from SY 2010 – 2011 to SY 2015 – 2016.

Non – engineering programs have more number of enrollees than engineering programs and it is greatly dominated by the BS Information Technology with a total of 293 enrollees. With the high number, it expected that there are more number of students who are at hazard of dropping or shifting. As shown in Figure 4, a large discrepancy in the number of drop – outs compared to other four non – engineering courses can be observed. A steady decrease can be seen from the 1st semester until the 8th semester coverage and a slight increase on the 10th semester.

Difference of Survival Curves of Student Retention

The Kaplan Meier method provides information on the overall differences between estimated survival curves of two or more groups of subjects. In the study, survival curves of each course under the engineering and non – engineering programs were compared. Difference of survival curve of male and females was also studied.

Table 4. Summary on Student Retention by Profile Variable among Engineering Programs

Profile Variable	N	Drop - out/Shifted		Graduates	
		f	%	f	%
Course					
BS Architecture	31	31	100.00	0	0.00
BS Computer Engineering	73	58	79.50	15	20.50
BS Electrical Engineering	80	54	67.50	26	32.50
BS Civil Engineering	129	100	77.50	29	22.50
BS Mechanical Engineering	63	55	87.30	8	12.70
Sex					
Male	291	233	80.10	58	19.90
Female	85	65	76.50	20	23.50
Overall	**376**	**298**	**79.30**	**78**	**20.70**

Table 4 provides a summary of the students' retention among Engineering programs. As seen in the table, all student of BS architecture experienced the event drop out or shifted for the 12 – semester coverage of the study. BS Electrical Engineering provides the smallest number of drop outs or shiftees with a dropout rate of 67.50% while BS Civil Engineering has the highest number of graduate with 29 students or about 22.5% of the total number of enrollees. Moreover, BS Mechanical Engineering shows the second highest number of dropout with 55 out of the 63 students or about 87.30% of the total enrollees.

Drop – out and graduation rate for male and female were almost similar with about 80% and 20%, respectively. This figure also reflects the overall rate for the drop – out and graduation.

Table 5 provides a data on the median survival time of courses under the Engineering programs. The table also offers a quick numerical comparison of the "typical" times to effect for each of the course. A smaller median time indicates a smaller dropping out or shifting time. Findings reveal that the median survival time of BS Computer Engineering, BS Electrical Engineering, and BS Mechanical Engineering is four semesters. This means that median dropout time for students under this courses is be four semesters. That is most students under this course decide to drop out or shift during the period. This is probably because, several major subject under this

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allied engineering courses are being offered during the period. Meanwhile, BS Civil Engineering has the longest median survival time with five semesters. This finding reveals that Civil engineering students have a longer retention rate compared to other four engineering course. Moreover, BS Architecture has the lowest median survival time with only three semesters. This finding is in support with the figure 5 as shown below, that several students tend to drop out during their 3rd semester of study. Lastly, the overall median survival time for the Engineering programs was four semesters.

Table 5. Comparison of the Median Survival Time by Engineering Courses

Course	Median Survival Time	95% Confidence Interval		Overall Comparison[a]	P - value
		LL	UL		
BS Architecture	3	2.57	3.43		
BS Computer Engineering	4	2.63	5.37		
BS Electrical Engineering	4	2.46	5.54	**3.932***	**0.047**
BS Civil Engineering	5	3.99	6.01		
BS Mechanical Engineering	4	1.88	6.12		
Overall	**4**	**3.31**	**4.69**		

[a]Log Rank (Mantel-Cox), Significant at 5%

Overall comparison on the difference in the median survival time (time to drop out or shift) between the engineering programs is also shown on table 6. Log Rank (Mantel – Cox) was used to test the overall difference. Findings show the overall comparison of median survival time is highly significant ($\chi^2 = 3.932$, $p = .047$) across all course in the Engineering courses. This finding provides concrete evidence that the retention rate among these courses vary significantly.

The survival function is a chronologically ordered plot of survival probabilities over time that illustrates a cumulative summary of the proportion of students who have not graduated. Cumulative survival function of the five engineering programs is shown in Figure 5.

As shown in figure 5, all courses have an observed drop out at the beginning of the study period. Moreover, a consistent drop of probability can be observed from the start of the study until the 10th semester – period. At this point, degree completion was already observed. In addition, a big drop of survival function on the 3rd semester can also be noted for the BS Architecture. This 3rd semester period indicates the highest number of dropout among Architecture students. In addition, BS Architecture do not have any recorded degree completion over twelve semesters as shown in figure 5.

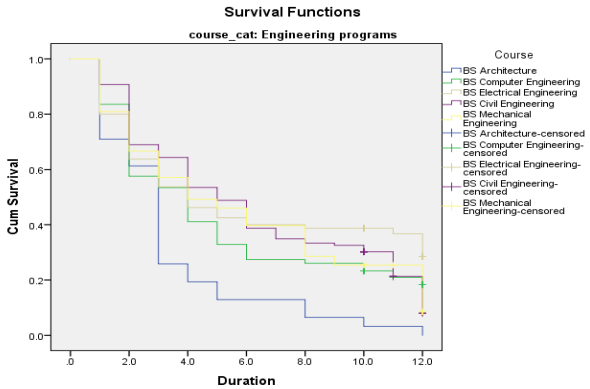

Figure 5. Cumulative Survival Function of Engineering Programs

Table 6 provides the summary on the number of dropout or shiftee and graduates for the Non – Engineering degree programs. Out of the total 484 students enrolled during SY 2010 – 2011, only 104 or 21.50% completed their degree. Of these numbers, 30 were from the BS Information technology, 44 from the two Education courses, 15 from AB English and only 7 graduates from the BS Mathematics. BS information Technology earned the highest dropout rate with about 90% of its total enrollees while courses in BS Mathematics and AB English shared a roughly 76% dropout rate. Moreover, Education courses had about 50% of its total enrollees either dropped out out or shifted, or graduated during the period.

Table 6. Summary on Student Retention by Profile Variable among Non – Engineering Programs

Profile Variable	N	Drop - out/Shifted		Graduates	
		f	%	f	%
Course					
BS Mathematics	30	23	76.7	7	23.3
Bachelor of Secondary Education	45	22	48.9	23	51.1
Bachelor of Elementary Education	56	27	48.2	29	51.8
AB English	60	45	75.0	15	25.0
BS Information Technology	293	263	89.80	30	10.20
Sex					
Male	202	162	80.20	40	19.80
Female	282	218	77.30	64	22.70
Overall	**484**	**380**	**78.50**	**104**	**21.50**

On the sex of the student, males showed a higher dropout rate compared to female with about 3% difference. On the hand, female students have a higher number graduate with 64 students compared to males who only have 40. This is because Education courses are predominantly dominated by female students which also have the highest number of graduates.

Comparison of the Median survival time and overall comparison is shown in table 7. As shown in the table, courses in Information Technology and Mathematics shared the same median survival time

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with two semesters. This means that most students have dropped out, or shifted to another course during their first year. This can be attributed on the high number of enrollees for the BS Information Technology which provides a higher number of student that are at risk. Meanwhile, Education courses had the highest median survival time with 9 semesters indicating that the students enrolled in these courses tend to have longer retention rate and eventually completing their degrees. Moreover, AB English had a median survival time of 6 semesters or about three years of study. The overall median survival time of Non – engineering programs is about three semesters which is lower than the median survival time of the Engineering programs.

Overall comparison of the survival curves was highly significant (χ^2 = 28.248, p <0.001). This indicates that survival curves across all non – engineering courses differ significantly. This result is reflected in table 7 which provides the range of the median survival time from two to nine semesters.

Table 7. Comparison of the Median Survival Time by Non – Engineering Courses

Course	Median Survival Time	95% Confidence Interval		Overall Comparison[a]	P - value
		LL	UL		
BS Mathematics	2	0.00	4.30		
Bachelor of Secondary Education	9	.	.		
Bachelor of Elementary Education	9	.	.	**28.248****	**p<0.001**
AB English	6	5.06	6.94		
BS Information Technology	2	1.59	2.41		
Overall	**3**	**2.57**	**3.43**		

[a]Log Rank (Mantel-Cox), **Highly Significant

Figure 6 shows the survival function that provides chronological order plot of survival probabilities over the 12 – semester period. Moreover, the plot illustrates a cumulative longitudinal summary of the proportion of participants who have not experienced dropping out or shifting.

As seen in the figure 6, an abrupt drop of the survival curve can be observed for BS information and BS Mathematics during the first semester. In addition, a consistent drop in every semester can also be observed for the BS Information Technology. Moreover, Education courses had the highest survival curve with stationary drop 2nd semester until the 8th semester. Graduation was observed on the 8th semester as expected for a 4 – year course. Likewise, degree completion was also observed for courses BS Information Technology and BS Mathematics from period 10th and 12th semester.

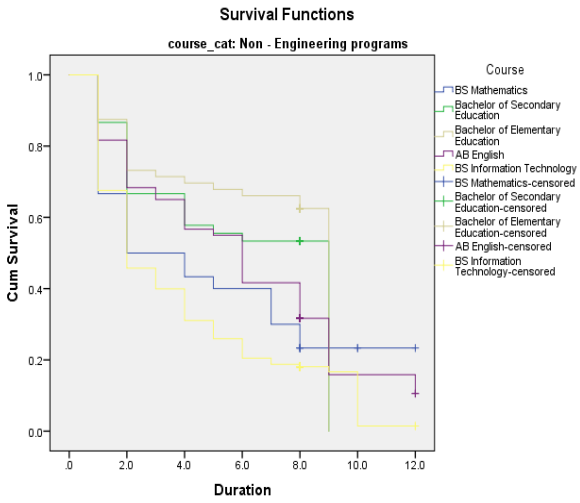

Figure 6. Cumulative Survival Function of Non – Engineering Programs

Hazard Model of Retention

The full model with the two predictors, sex and course was fitted to the drop out or shifted as shown in table 9 and 10, respectively. For the drop out or shifted model, any students who graduated during a given semester were treated as censored. Odds ratio are interpreted as conditional and not marginal; that is, the odds represent the conditional association for levels of a predictor given fixed levels of the other predictors. The coefficient estimates shown in tables 8 and 9 cannot be easily interpreted as given. Instead, we refer to the hazard ratios for each variable. The likelihood ratios that are given in traditional logistic regression models. However, instead of the term "likelihood" we use the term "hazard" to refer to the chance that student will drop or shift.

For the predictor course, since it is classified into several categories, we've used two different reference categories for the two model: BS Architecture for the Engineering programs and BS Information Technology for the Non – engineering programs.

Table 8. Variables Included in the Cox's Proportional Hazard Model for Engineering Programs

Variable	B	Wald	Sig.	Odds Ratio
Sex	-0.23	2.491	0.114	0.794
Course[a]				
BS Computer Engineering	**-0.55**	**6.03***	**0.014**	**0.577**
BS Electrical Engineering	**-0.92**	**16.08***	**p<0.001**	**0.396**

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BS Civil Engineering	-0.69	11.34*	0.001	0.497
BS Mechanical Engineering	-0.65	7.977**	0.005	0.524

Note: [a] Reference course is BS Architecture, *Significant at 1%

Table 9 presents the full model for Engineering programs for students who dropped out or shifted for any given semester and did not return during the time frame being studied8. The parameter estimates show that the sex of the student was not a significant predictor of student's retention. However, course plays a vital role in the student retention as it is significant in the model of the Engineering. BS Computer Engineering students have a hazard of dropping/shifting 0.795 times smaller than BS Architecture. Equivalently, they can be said that a student enrolled in BS Computer Engineering have a smaller hazard of dropping/shifting in each semester than BS Architecture students. Similarly, student enrolled in BS Electrical Engineering, BS Civil Engineering, and BS have a hazard of dropping or shifting in each semester of 0.396, 0.497, and .524 times smaller than BS Architecture. These figures provide a clear evidence that the BS Architecture have a higher students' hazard of dropping/shifting than the four engineering courses.

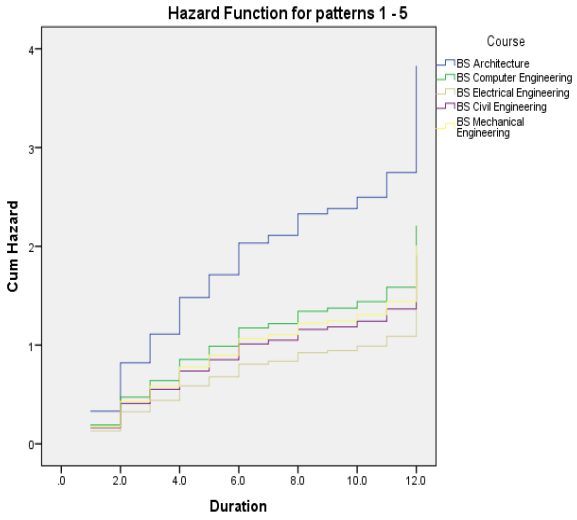

Figure 7. Cumulative Hazard Function of Engineering Programs

Figure 4 provides a basic hazard curve which display the cumulative model-predicted of student with potential to drop – out or shift to another course over the twelve-semester period. As seen in the figure, BS Architecture has the highest hazard curve among all five-year degree programs which indicates that students under this course have a higher potential of dropping/shifting. Meanwhile, hazard curves of BS Computer Engineering, BS Electrical Engineering, BS Mechanical Engineering, and BS Civil Engineering follows stationarity in the duration. Furthermore, compared to four courses in Engineering programs, BS Electrical Engineering have the lowest hazard curve which indicates a lower number of drop – outs during the six – year coverage of the study.

Table 9 provides the estimates of coefficient for the Non – Engineering programs. Similar with result of the previous model, sex of a student was also found to be not a significant predictor of student retention. This finding support the study in which he found out that student's gender plays no significant role in his or her obtainment of a STEM degree [11].

Using BS Information Technology as reference course, all courses under the College of Arts and Education were found to be statistically significant in the model. Of these courses, Bachelor of Elementary of Education showed the conditional odds of dropping or shifting of 0.399 times smaller than BS Information Technology. This implies that student enrolled in Bachelor of Elementary Education had 60.1% lower hazard of dropping or shifting in each semester than students who were enrolled in BS information Technology. Similarly, hazard of dropping or shifting in each semester were 55.8 percent smaller for Bachelor of Secondary Education and 33.8 percent smaller for AB English.

Table 9. Variables Included in the Cox's Proportional Hazard Model for Non - Engineering Programs

Variable	B	Wald	Sig.	Odds Ratio
Sex	-0.05	0.18	0.671	0.956
Course[a]				
BS Mathematics	-.28	1.66	.197	.755
Bachelor of Sec. Education	-.82	13.35*	.000	.442
Bachelor of Elem. Education	-.918	19.92*	.000	.399
AB English	-.412	6.34*	.012	.662

Note: [a] Reference course is BS Information Technology, **Significant at 1%, *Significant at 5%

Unsurprisingly, BS Mathematics was found to be not significant to the model. This implies that the hazard of dropping or shifting is the same with the BS Information Technology. This might be because these two courses belong to the same college (College of Computing) and there are commonalities with subject taken by the students.

Figure 5 displays the cumulative hazard curves of the non – engineering programs over a twelve – semester period. The plot of the hazard curves for each covariate pattern gives a visual representation of the effect of each course. As seen in the figure, three different patterns of hazard curves can be observed. Education courses tend to have the lowest

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and steady cumulative hazard curve while the BS Information Technology have the highest hazard curve as shown in the figure. This indicates that student enrolled in BS Information technology tend to have a higher risk of dropping or shifting compared to two education courses. Meanwhile, BS mathematics and AB English shares almost the same hazard curve which provides us the idea that the rate of dropping and shifting on both courses do not vary over the six – year duration of the study.

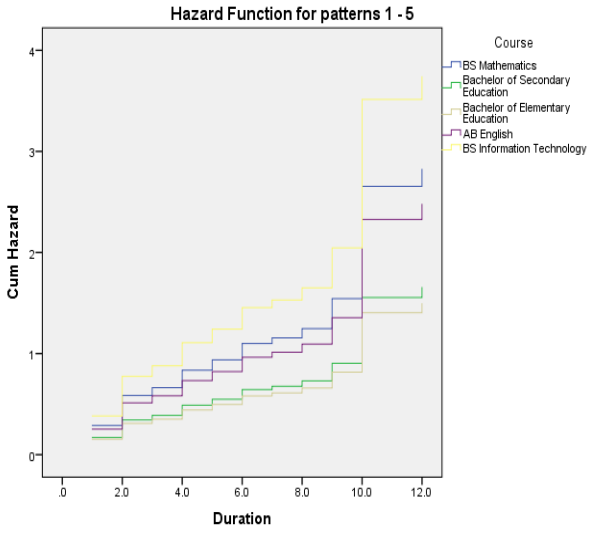

Figure 8. Cumulative Hazard Function of Non - Engineering Programs

IV. CONCLUSION & RECOMMENDATIONS

This study shed light on the retention rate of the student for Engineering and Non – Engineering degree programs. Based on the findings, the researchers arrived at the following conclusions:

1. Findings revealed that there is a high percentage of dropping out or shifting. There is also a low degree completion rate over the 6 – year coverage of the study. Moreover, rate of dropout and degree completion for Engineering and Non – engineering degree programs is almost the same. The first two semesters have the highest number of drop – outs/shifters and thus considered to be the most critical stage for students' retention.

2. For Engineering programs, BS Architecture had the lowest median survival time while BS Civil Engineering had the longest. For non – engineering programs, Information Technology and Mathematics shared the same median survival time and was the lowest among all programs while Education earned the longest median survival time. Lastly, there was a highly significant difference in the median survival time across courses.

3. Findings revealed that the sex of the student was not a significant predictor of student retention. However, we found out that course plays a significant role on the students' retention.

Based upon the results of this study, the following recommendations were formulated:

1. A better understanding of the causes of dropout and shifting behavior could facilitate the development of retention and graduation interventions.

2. Administrators must also be cognizant of the differences in dropout rates and timing based upon residency for a 5 – year and 4 – year courses. In addition, to encourage decrease in the dropout rate, the University should increase the tools provided to students to manage failure.

1. 3. As course becomes a more important indicator of success and access to resources, college students need to better understand the impediments to completing their degree. For the future research on graduation behaviors, it should be conducted using survival analysis at the institutional level, the level at which it is most likely that student retention can be influenced. Likewise, a longer time duration for future study should also be taken into consideration. This is to have a cross sectional analysis on the different time periods of event to have a better evaluation and understanding on student's retention.

Various variables can also be examined aside from course and sex such as economic status and financial grants with its relation to student's retention and time to degree completion. To follow through with the study, qualitative research design should be done to broaden and deepen the scope of the research and to be able to know the different factors and reasons on why students drop out, or shift, or unsuccessfully graduate on time aside from demographic variables not just on institutional level but on a personal level as well.

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