# *Improving Retention and Enrollment Forecasting in Part-Time Programs*

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## INTRODUCTION

This article describes a model that can be used to analyze student enrollment data and can give insights for improving retention of part-time students and refining institutional budgeting and planning efforts.

Adult higher-education programs are often challenged in that part-time students take courses less reliably than full-time students. For many institutions, part-time adult students are also less likely to graduate and complete a credential program. Much has been written about how to improve part-time adult student retention, but much less has been done to predict students most at risk of dropping out. Studies that have explored the likelihood of dropping out have tended to focus on student characteristics such as race, sex, income, and prior achievements such as grades or scores on entrance exams. The model presented in this article is unique in that it "de-cohortizes" student enrollment data and then uses students' own enrollments as a predictor of future enrollments.

The benefits of such a model are twofold. First, students' past enrollments are, in fact, predictive of future enrollments. Second, insofar as students' enrollment patterns are constantly changing each quarter, the predictive power of the model increases over time for each student. Such is not the case for models that examine only student characteristics, most of which do not change throughout the course of a student's academic career.

By improving its ability to predict students' enrollments and course-taking patterns, an institution will be better able to identify students most at risk of dropping out and can create more effective strategies to retain those students, thus increasing its student completion and graduation rates as well as tuition revenue. Additionally, effective projection of enrollments can help in estimating future revenue and capacity needs, making budgeting and planning processes more effective and accurate.

## THE MODEL AT NORTHWESTERN UNIVERSITY SCHOOL OF CONTINUING STUDIES

*De-cohortizing data*

Northwestern University School of Continuing Studies (SCS) offers part-time degree and non-degree programs primarily to adult learners. To improve retention and planning, SCS has developed and begun using an enrollment-forecasting model that consists of two parts. The first part is what SCS calls "de-cohortization" of student data. Many institutions group students' enrollment data by cohort, defined by the term (e.g., fall quarter, winter quarter, etc.) in which the student began taking classes. At SCS, where students can take courses in the fall, winter, spring, and summer quarters, we know that students reliably take courses in fall, winter, and spring, and we see a significant decrease in summer.

This information is useful for "seasonal" planning. For instance, SCS schedules many fewer courses in summer than in fall, winter, and spring. (SCS has conducted sufficient analysis to conclude that the summer decrease in enrollments is not due to the limited schedule itself.)

De-cohortization, however, allows SCS to analyze all student enrollment data relative to each student's starting point rather than relative to seasonality. Table 1 shows how a sample of four students' enrollment data is de-cohortized. Rather than track seasonal quarters in which enrollments occur, Table 1 depicts chronological quarters in which enrollments occur; that is, Student A took two courses in his first quarter, two in his second quarter, zero in his third quarter, one in his fourth quarter, and zero in his fifth quarter.

| ID | Admit Quarter | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 | Quarter 5 |
|---|---|---|---|---|---|---|
| Student A | Fall 2005 | 2 | 2 | 0 | 1 | 0 |
| Student B | Fall 2007 | 0 | 1 | 1 | 1 | 1 |
| Student C | Spring 2009 | 2 | 3 | 3 | 0 | 1 |
| Student D | Winter 2010 | 2 | 2 | 1 | 0 | 2 |

*Table 1: Sample of de-cohortized student enrollment data.*

De-cohortizing enrollment data shows the likelihood of any given student's enrollment in any given quarter, relative to that student's first quarter. Analytically, it is also beneficial to consider one large group of students to identify common enrollment patterns that aid in prediction.

Figure 1 shows the percentage of eligible students that enroll at SCS in each quarter of one of its Professional Master's Degree Programs ("PMDP"), based on PMDP's de-cohortized data. Graduation from PMDP requires completing 11 courses; students are allowed five years, or 20 quarters, to complete the program. As Figure 1 shows, almost 91 percent of students enroll in their first quarter after admission, while just over 81 percent enroll in their second and third quarters, dropping to 71 percent in the fourth quarter.

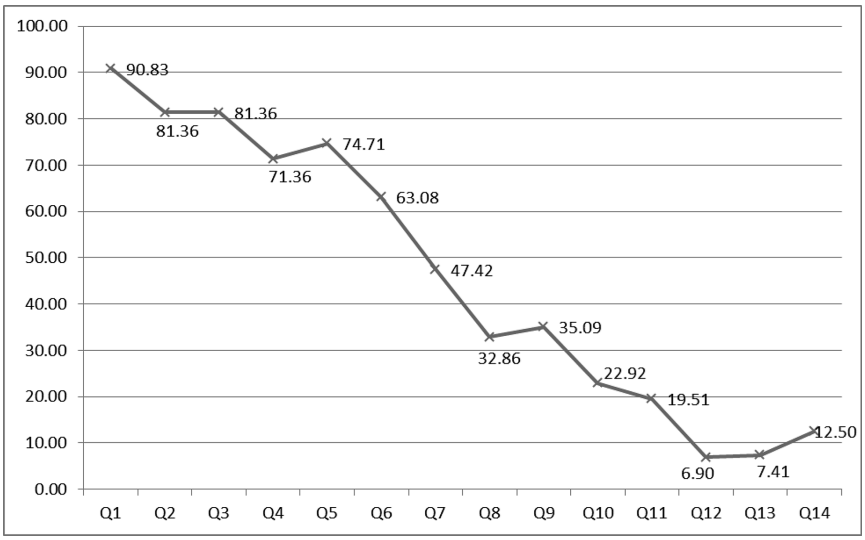


*Figure 1: Percentage of eligible students enrolling in a selected quarter for PMDP.*[1]

Unsurprisingly, the longer students are in the program, the less likely they are to re-enroll for courses. SCS has found that the most motivated

students tend to complete the program quickly, thus leaving less motivated students to be counted in the latter quarters.[2]

In this particular program, it is of interest that almost 75 percent of students in their fifth quarter take at least one course while only 33 percent of students take at least one course in their eighth quarter. This drop is quite significant; in fact, relative to SCS' other master's programs, the fifth-quarter percentage is highest for PMDP, while its eighth-quarter's percentage is lowest.

Through such analysis SCS can significantly enhance the effectiveness and efficiency of its retention strategy. While the analysis does not answer the question of why these enrollment patterns exist or what SCS can do—if anything—to prevent this trend, it does illustrate a potential problem that would not otherwise be easily observed. Only when a problem is identified can it be addressed. Here, SCS has identified students' fifth quarter in PMDP as an important and potential high-risk point in students' academic careers, after which enrollment declines precipitously.

Why does this enrollment drop occur? There are numerous hypotheses. As earlier described, perhaps the most motivated students complete the program quickly, leaving the less motivated students as an increasing proportion of the remaining student body. It is also possible that students become less motivated to complete a program the longer they are in it. Or it may be that students who use this program for professional advancement find that a year's worth of courses is just as valuable as a degree, so they drop out after one year. Although the reasons may not be clear, SCS can use the de-cohortized trends to explore whether anything can be done to incentivize student enrollments throughout the second year and beyond. Simple data-collection techniques such as student surveys, focus groups, and informal conversation during advising appointments can inform our investigation.

To be clear, in order to use de-cohortized data to improve retention strategies, follow-up strategies must be implemented to understand why the revealed trends occur and what, if anything, can be done to reverse them.

However, even in the absence of knowing why these enrollment patterns exist and how to alter them, de-cohortization allows for greater accuracy in enrollment planning and forecasting. At any given point, SCS can calculate each student's amount of time in the program and use the above probabilities to predict the expected enrollments in a particular quarter. This can be used, for instance, to more accurately estimate the number and type

of classes that should be scheduled, allowing SCS to maximize students' opportunities to progress through the curriculum and also permitting SCS to make the most efficient use of its resources.

In sum, de-cohortization is a very simple modification to databases and records that track enrollments by seasonal quarter. It is applicable to any multi-quarter program at any institution that tracks student enrollments. While de-cohortization can be implemented for any size program, past enrollment data are more likely to be predictive of future enrollment patterns for larger programs.

*A probabilistic enrollment model*

De-cohortization also facilitates the use of a probability-based enrollment model, in which students' past enrollment patterns are used to predict future enrollments.

In the SCS model, a student's enrollment in a given quarter is correlated to whether she enrolled in the quarter immediately prior. For each quarter, we create a transition matrix—a way of representing the historical likelihood that a student enrolls in that quarter—using historical enrollment data for all students in the program. For instance, a sample transition matrix is:

| | | **Quarter 6** | | |
|---|---|---|---|---|
| | | E | U | G |
| **Quarter 5** | E | .59 | .16 | .25 |
| | U | .29 | .71 | 0 |
| | G | 0 | 0 | 1 |

Here, E, U, and G stand for enrolled, unenrolled, and graduated, respectively. In this example, the top row shows that any student who took a course in her fifth quarter has a 59 percent chance of enrolling in her sixth quarter, a 16 percent chance of not enrolling in her sixth quarter, and a 25 percent of having graduated after her fifth quarter. The middle row means that a student who did not enroll in her fifth quarter has a 29 percent chance of enrolling in her sixth quarter, a 71 percent chance of not enrolling in her sixth quarter and a 0 percent of graduating in her sixth quarter. The last row simply says that a student who has graduated in her fifth quarter has no chance of enrolling or not enrolling in their sixth quarter, but rather always remains graduated.

SCS creates a transition matrix for every transition period (e.g., from quarter 1 to quarter 2, from quarter 2 to quarter 3, etc.), thus establishing

a set of predicted student-enrollment behaviors on a quarterly basis. Over time, as the data accumulate, we expect that the patterns that the model suggests will have greater reliability.

Using these transition matrices, SCS has learned that students who enroll in any given quarter are likely to enroll in the following quarter (with the caveat that summer quarter enrollment tends to be lower, independent of students' prior enrollment patterns). However, these transition matrices reveal that the impact of a student's non-enrollment in any given quarter may be quite significant and increasingly fatal to a student's successful completion of a program. As Figure 2 reveals, the likelihood that PMDP students will enroll in a quarter following one in which they did not enroll is quite low.[3]

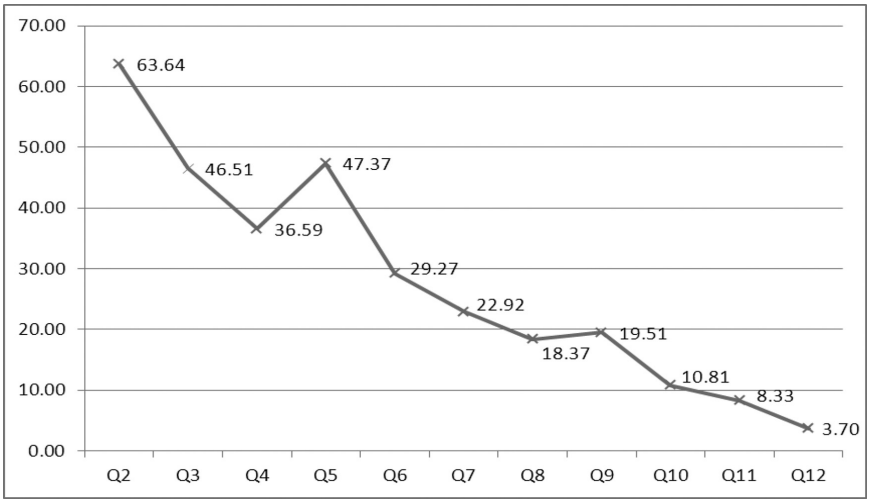


*Figure 2: Probability of PMDP student enrolling if they did not enroll in prior quarter.*

For instance, if a student does not enroll in her second quarter, she has only a 47 percent chance of enrolling in her third quarter. Importantly, the longer the student is in the program, the more difficult it becomes to re-engage the student after a quarter of non-enrollment.

The attendant risk, of course, is that students stop taking classes altogether. Using the information provided by the transition matrices, SCS can estimate this probability with increased precision. As Figure 3 shows, a single quarter of non-enrollment is related to a non-trivial likelihood that the student will never enroll in another PMDP class. For instance, a student who does not enroll in quarter five has a 25 percent chance of never taking another class. For comparison's sake, Figure 3 also shows the probabilities of non-enrollment in a second professional master's program at SCS.

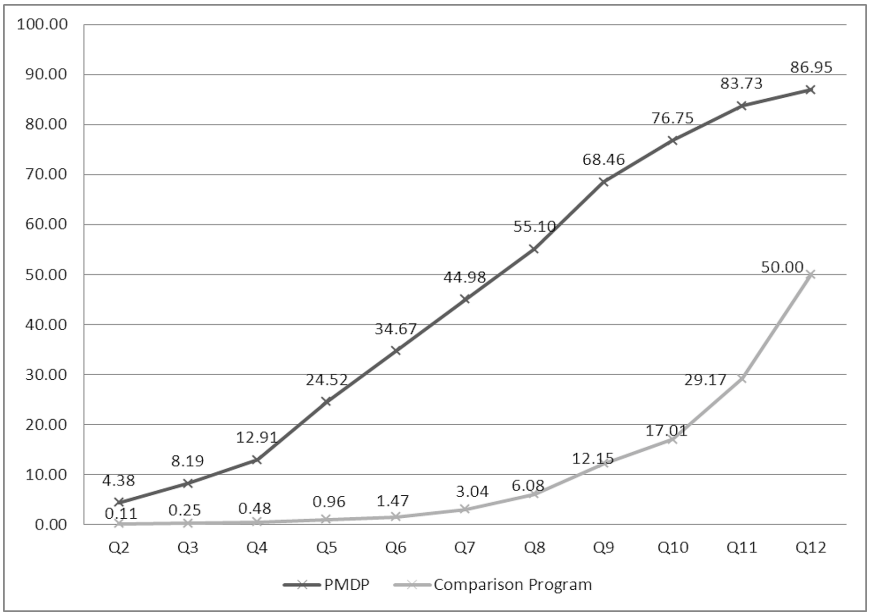


*Figure 3: Probability an eligible student will not enroll in any future quarter if she does not enroll in a particular quarter for PMDP and Comparison Program.*

Figure 3 reveals two extremely important points. First, by triangulating these results for PMDP with those in Figure 1, SCS believes that the fourth and fifth quarters represent a crucial time in PMDP students' academic careers. Not only are students much less likely to enroll in a course after approximately one year, each quarter of non-enrollment increases the likelihood that a student will never take another course by approximately 10-15 percent.

Therefore, SCS believes it is exceedingly important to ensure that PMDP students enroll in each quarter, specifically by working with those students who are approaching four and five quarters into their academic career. Alternatively, SCS could reach out to those students who choose not to enroll in some quarter, hoping to re-engage them for future quarters. However, given the above data, we feel that waiting to reach out to students who choose to not enroll may not be an effective retention strategy. Rather, SCS believes that its retention resources will be better invested by encouraging currently enrolled students—especially those nearing their fifth quarter—to continue their ongoing and consistent enrollment.

The second point to note is that not all programs merit identical retention strategies. As Figure 3 shows, non-enrollments in another SCS program

("Comparison Program") are of far less concern. In PMDP, not taking a course in the fifth quarter correlates to a 25 percent chance of never taking a course in the program again, increasing to 55 percent in the eighth quarter. In contrast, however, not taking a course in the fifth quarter of the Comparison Program correlates to only a 1 percent chance of never taking another course in the program, increasing only to 6 percent in quarter eight. That is, quarters of non-enrollment in PMDP are of much greater concern than in the Comparison Program. As such, preventing quarters of non-enrollment—while likely an effective strategy in PMDP—is likely not the appropriate strategy for students in the Comparison Program.

*Implementing the Model*

As described above, SCS enjoys two primary benefits from understanding student enrollment patterns. First, new types of retention strategies can be developed that target those students most at risk of dropping out. By examining why PMDP experiences significantly decreasing enrollments beginning in students' fifth quarter, SCS can develop a new retention strategy specifically to incentivize those students to continue taking courses. If, in about students' fifth quarter in a program, they simply begin to tire, it may be possible to incentivize them to continue to take courses by creating mandatory advising appointments, one-on-one meetings with faculty or industry professionals who speak to the value of a master's degree, and similar experiences that re-engage and re-energize students. Of course, myriad other explanations for these enrollment decreases are possible, each of which would dictate its own solution. Further, given that the above model describes a trend rather than explains the reason behind the trend, it remains entirely possible that the phenomena described here simply cannot be remedied with any intervention at all.

The value of these models and analyses for improved retention is significant. Ensuring that a part-time student remains enrolled or re-engaging a student after quarters of non-enrollment can be just as valuable to an institution—if not more so—than attracting a new student. Further, the above models and analyses are almost costless to build and implement. While the resultant retention strategies undoubtedly do require resources, in many cases these resources are far less than those regularly devoted to recruiting new students.

The second benefit to SCS is the increased accuracy of information for planning purposes. In the absence of the above model, SCS has had little ability to predict the likelihood of student enrollments in any given quarter or year. With this model, however, SCS can examine the amount of time each student has spent in her program and each student's enrollment history to predict the likelihood of enrollments for each student in upcoming quarters. SCS is now able to predict future enrollments through a formal model with clear rules.

Of course, there is no guarantee that creating a formal model yields greater predictive ability. That is, the mere capture and analysis of past enrollment data do not necessarily allow us to predict future enrollment behaviors. However, it is notable that the above models are constantly being improved with the addition of new enrollment data with each passing quarter.

The models presented in this article can be powerful and inform us of trends and issues that might otherwise go unseen. However, the strength of these models will always depend on the extent to which past enrollments predict future enrollments. And, while the models described herein can be used in almost any institution and for any program, it is incumbent upon each institution to apply these models and interpret their results appropriately. Institutions should not see these models as the only right tool for their retention and forecasting concerns. Rather, these models should be used and viewed as a tool that allows us to identify at-risk students, intervene appropriately, and forecast future enrollments for planning and budgetary purposes.

**ENDNOTES**

1. The percentage shown in the graph is a function only of the students eligible to take courses in that quarter. Thus, the declining percentages are not due to the fact that students complete the program.
2. Although de-cohortized, this graph still shows seasonal effects in the slight enrollment increases in quarters five and nine. This occurs because students disproportionately enter SCS in the fall quarter, meaning that their fourth and eighth quarters are disproportionately summer quarters (in which few students take courses) while their fifth and ninth quarters are disproportionately fall quarters (in which students are most likely to enroll). Therefore, we believe that these increases are simply due to the seasonality enrollment patterns described earlier.
3. As with Figure 1, these figures represent a proportion of eligible students and not those who graduated in the previous quarters.