Six Ways to Increase Enrollments at an Extended Campus

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Abstract

This is a "best practices" article focused on sharing six new academic scheduling strategies recently employed by the BYU Salt Lake Center to optimize course offerings and increase enrollments. These strategies are generalizable to other academic programs that help extend academic programs at a distance, including online courses. The Center is an extended campus in Salt Lake City, Utah situated 46 miles to the north of the main campus of Brigham Young University in Provo, Utah. The distance between the flagship university and its Center pose unique challenges in relation to course and enrollment optimization. Some of these strategies are made possible with the help of new software tools recently licensed by the university to help mine "big course and enrollment data" (current and historical) of a large university with 30,000 students.

Introduction

This is a “best practices” article focused on sharing new academic scheduling strategies recently employed by the BYU Salt Lake Center—an extended campus associated with Brigham Young University in Provo, Utah—to better optimize course offerings, facility space, and undergraduate enrollments. Over the past five years the Center’s director (and one of the authors of this article), Scott L. Howell and colleagues, sought to attract and serve (or impact) more matriculated students from the main campus, and non-matriculated students admitted to the Center only. When he first joined the Center the primary strategy for scheduling courses from semester to semester was to replicate or “rollover” course offerings from the semester one year previous. For example, fall semester of the previous year was the schedule template for the fall semester in the next year, subject to a few tweaks. While this rollover of course offerings from year to year served the Center well for many years the senior administration recommended the Center seek ways to better utilize the facility, and also reverse a gradual decline in enrollments at the Center in the years following its relocation in 2007 to its current site.

The authors will share six guiding questions, any of which, if considered at other institutions, will help optimize their academic schedule, increase enrollments, and better serve students. The six questions, or strategies, also referred to as predictive variables, are 1) how can we best use main campus enrollments to predict which courses to offer at the extended campus? 2) How can we best use the waitlist for courses offered on the main campus to inform course offerings at the extended campus? 3) How can we apply the Amazon principle of “customers who bought this item also bought…” to predict which courses to offer in tandem? 4) When is the best time to cancel a low-enrolling course? 5) What is the best day, and time of day, to offer courses? and 6) Which courses do the students really want to take, and when?

Background and Context

The BYU Salt Lake Center was established in Salt Lake City, Utah, in 1959, as an extension of the main Brigham Young University campus located 40 miles south in Provo, Utah. The Center has occupied five different facilities within the city over the years and is presently situated in the heart of downtown Salt Lake City near the headquarters of its sponsoring institution, The Church of Jesus Christ of Latter-day Saints.

The BYU Salt Lake Center occupies three floors of a five-story building which includes 1 auditorium (110 seats), 27 classrooms (35 to 70 seats), along with a small library, student service area, testing center, and some administrative offices. In all, the Center utilizes approximately 67,500 square feet. It also hosts the university's executive masters programs in business and public administration.

Mission

The Center's mission is to especially serve nontraditional students who work, or whose families live, in Salt Lake City, but still desire to receive an education from Brigham Young University (BYU). It also serves the more traditional students who find it more convenient to their lifestyle to enroll in courses once a week and longer course meeting times during the evening hours -- the signature course model at the Salt Lake Center. In the past year the administration of the Division of Continuing Education (DCE), which administers and oversees the Salt Lake Center on behalf of the university, encouraged the director of the Center to offer more day classes and otherwise find ways to better optimize the space utilization of the Center facility.

Enrollment Numbers

The typical enrollment at the Salt Lake Center is about 1,000 matriculated students enrolling in, on average, 1.5 courses each semester, and about 200 non-matriculated students enrolling, on average, in about 3.5 courses each semester for just over 2,000 total enrollments each semester. It is the offering of more course sections during the day as well as the introduction of new academic scheduling strategies, along with a general surge of more applications at the university -- up about 10 percent -- that resulted for the first time in five years, a significant increase in annual enrollment numbers of 27 percent.

Constraints

The BYU Salt Lake Center is subject to several constraints, including financial, pedagogical, and instructor availability. The Center is required to remain financially self-sustaining--it receives no financial appropriation from the main campus or the LDS Church. As a result, the Center is required to fund operations using only the tuition paid by the students while also subject to the annual tuition schedule for students, and honorarium rate schedule for instructors, set and approved each year by the university. Because tuition dollars are the exclusive revenue source of the Center it is critical for the Center's administrators to do everything possible to maximize enrollments by optimizing course offerings and academic schedule. As such, it was determined by the Center accountant, Steven S. Christensen, (the lead author of this article), that each course enroll at least five students, or else be cancelled. (The average class size for courses at the BYU Salt Lake Center hovers around 15 students).

While it stands to reason that smaller classes are appealing to students because of the closer interaction with the instructor and fellow students, there must still be a critical mass for financial considerations, and, in some instances, for pedagogical purposes, especially when group work, inter-student interaction, and presentations are essential to learning outcomes. In those cases, even greater course enrollments are required.

In the past, the Center sought to offer the same portfolio of courses they offered from the year before, with the hope that each course would reach the minimum number of enrollments by the first day of the semester. If, after the first day of class, the minimum number of enrollments was not met the course was cancelled. This became problematic for a number of reasons, but two especially. First, the cancellations occurred after the first day of class leaving students in cancelled classes little time to find another section of the same course. Second, the instructor who had arranged their personal schedule to teach this course and spent considerable time preparing to teach the same was now, rather suddenly, left with no course and fewer options on such short notice.

The BYU Salt Lake Center employs only adjunct faculty to teach its courses. This constraint causes a limited pool of potential faculty in regard to teaching availability since so many of those available already work full time at another job or teach at other local universities and colleges. Historically, the Center has enjoyed success in employing recently retired faculty from the BYU main campus. However, in recent years, certain requirements in the Affordable Care Act (ACA) caused the university to discourage use of recently retired instructors by the Center, a significant source of the qualified adjunct faculty pool, while at the same time the administration has encouraged better optimization of the Center. Hence, a more aggressive recruiting effort of new adjunct instructors, under the direction of academic departments who approve all new instructors, is required to accomplish the expectation of better optimizing utilization of the BYU Salt Lake Center through more strategic academic scheduling.

Purpose

The purpose of this study is to share those best practices emerging at the BYU Salt Lake Center to introduce scheduling strategies (predictive variables) whereby the Salt Lake Center will optimize enrollments, better utilize its facility, and make better-informed decisions about when to cancel courses. The fluidity of enrollments each semester and term require the model to remain flexible, and sensitive, to the ever-changing demand for different courses by students. These interventions will encourage more students to attend the Salt Lake Center, enroll in more courses than they otherwise would, and better utilize the facility.

Literature Review

A primary challenge for university administrators is determining which courses to offer, at what times (and in which places), and which instructors are authorized and available to teach at these desirable times. This calls for an algorithm or model. Unfortunately, those solutions addressed in the literature primarily focus on the use of algorithms to optimize schedules of preexisting courses -- not the selection of courses to start with (See Al-Betar & Khader, 2010, Ceschia, Di Gaspero, & Schaerf, 2012 and MirHassani & Habibi, 2011).

While the literature does give several recommendations related to timetable course scheduling, the literature does not specifically address which courses should even be included in the algorithm. The authors posit that prior to selecting an algorithm for schedule optimization, the administrators must determine which courses are even offered at the extended campus. After conducting a literature review that yielded nothing specific to the selection of course offerings from the main campus for an extended campus, though some peripheral but not-very-helpful research from within the corporate sector was identified, the authors consulted the university's subject librarian who validated this conclusion that little or nothing was written on this subject matter. With this paucity of literature the administrators (and authors) chose to identify, on their own, those strategies that are most successful in accomplishing the purposes of the Center. A discussion of these strategies or predictive variables follows within the context of guiding questions.

Guiding Questions

How can we best use main campus enrollments to predict which courses to offer at the extended campus?

This variable seeks to determine the number of enrollments the Salt Lake Center might anticipate for a given course based on the number of enrollments in the same course on the main campus. It is assumed the classes offered at the Center are a sample of the true population of all classes offered on the main campus. The sample mean percentage was derived by taking a weighted average of the percentage of enrollments in all classes offered at the Salt Lake Center over the past five years and then compared to the corresponding classes offered on the main campus. This was done using a confidence interval or band based on the sample mean and standard deviation by semester and term and reported for this year (2015) in Table 1.

Table 1. Sample Mean and Standard Deviation

	Fall	Winter	Spring	Summer
Sample Mean	3.48%	2.94%	10.08%	7.55%
Standard Deviation	7.78%	5.29%	8.68%	7.39%
Margin of Error	1.34%	.98%	2.43%	2.32%

It was of interest to the researchers to observe the wide variances in these percentages across semesters/terms. If a course (and all of its sections) on the main campus enrolled 1,000 students, then this variable would predict the BYU Salt Lake Center would enroll 33 students during fall semester; 29 enrollments during winter semester; 100 enrollments during spring term; and 75 enrollments during summer term.

To validate this approach this predictive variable was applied to a sample of current courses offered at the Salt Lake Center this fall semester to see if the current enrollments fit within the predicted range (see Table 2). With the exception of only one course the current enrollments fit within the range and in the one course exception the current enrollments missed the upper end of the range by only two enrollments.

Table 2. Confidence Interval and Expected Enrollments

Courses Offered in Salt Lake	Main Campus Enrollments	95% Confidence Interval Expected Enrollments		Actual Salt Lake Enrollments
American Heritage	2690	58	130	95
Statistics 121	2664	66	121	85
Writing 150	1285	28	62	56
Book of Mormon	1047	26	47	49
New Testament	1546	38	70	47

This variable is also being used to identify those courses on the main campus not currently offered at the BYU Salt Lake Center which most likely would enroll the most students if added to the course portfolio. Already, the Director of the Center has entered into conversations with the respective academic departments of those courses identified by this predictive variable and listed in Table 3. (Although the confidence interval sometimes produces a large range of possible enrollments the analysis still offers valuable information as the Salt Lake Center tries to identify additional courses that would serve those students attending the Center.)

Table 3. Courses With the Highest Potential for Enrollments

Courses	Main Campus Enrollments	Predicted Range of Enrollments at the Salt Lake Center (95% Confidence Interval)	
		Low	***High***
Finance 201	1245	27	60
Math 113	933	20	45
Business Career Preparation	532	12	26
Human Development 210	509	11	24
Intro to Film	462	10	22

How can we best use the waitlist for courses offered on the main campus to inform course offerings at the extended campus?

The university waitlist is a "big data" set maintained and reported by the Registrar's Office on the main campus. Once a course on the main campus reaches the seating capacity of the room or the ceiling established by the academic department for pedagogical reasons, e.g., English Classes are not to exceed 25 students, prospective students interested in this particular course section may place themselves on a "waiting list" for the course should openings arise. (This typically occurs whenever students enrolled in the course drop or the department finds a larger room to accommodate the excessive demand for the course.)

Whenever an opening arises in any course section with a waiting list, the first student on the list is automatically enrolled in the course. The Registrar's Office tracks the number of students on waitlists for all courses and the number who add or remove themselves from the waitlist during the past week and reports the same each week to interested parties until the add/drop deadline of each semester is reached. An example of a recent waitlist report in summary or dashboard form is shown in Exhibit A, and by courses in Exhibit B.

Exhibit A. Sample Waitlist Report

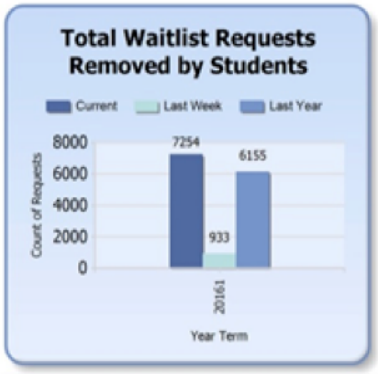


Exhibit B. Waitlist Report by Course

Waitlist Details

Year Term	Dept Name	Cat #	Num of Sections	Current Waitlist	Waitlist Requests	Added to Class	Waitlist Requests Removed	Waitlist Requests Expired
20161	A HTG	100	29	125	248	47	76	0
20161	ACC	200	3	96	127	19	12	0
20161	ACC	241	1	5	10	4	1	0
20161	ACC	305	1	3	5	0	2	0
20161	ACC	310	5	123	208	39	46	0
20161	ACC	522	2	7	8	0	1	0
20161	ACC	525	1	2	2	0	0	0
20161	ACC	542	1	0	6	0	0	6
20161	ACC	550	2	11	16	3	2	0
20161	ACC	555	1	2	15	10	3	0
20161	ACC	556	1	2	12	9	1	0
20161	ACC	560	1	0	3	1	2	0
20161	ACC	563	1	4	7	0	3	0
20161	ACC	566	2	12	24	9	3	0
20161	AM ST	304	1	2	2	0	0	0
20161	ANTHR	101	8	10	19	3	6	0
20161	ANTHR	150	1	6	6	0	0	0

The initial idea was to use the waitlist as a way to measure demand for courses on the main campus and use this information to predict which courses would meet or exceed the minimum enrollment requirement at the Center. The assumption was that a course with a large number of students on the waitlist would predict increased enrollments for the corresponding course if offered at the Center. A correlation using historical waitlist data and Salt Lake Center enrollments led to a coefficient of 0.36. Although positive, this correlation coefficient does not indicate as strong a link between waitlist students and enrollments at the Center as desired.

Additionally, the factors influencing waitlist totals were not as obvious as first considered and the assumption that a large waitlist predicted a successful offering at the Salt Lake Center was not always correct. It is likely that other factors are at play and that confounding variables exist. For example, the majority of classes offered at the BYU Salt Lake Center are general education classes which target freshman and sophomore students and it is possible this student demographic is less likely to travel from the main campus to the Center.

Although the predictive abilities of the waitlist are still uncertain and somewhat unreliable, it still serves well to illustrate enrollment trends across campus. It may especially be useful when adding a class near the beginning of the semester. The waitlist will not always provide an accurate prediction of how many enrollments to expect, but on an aggregated level it may expose trends that merit further consideration not only for the current semester but for the semester a year out. Further tests are necessary and will be performed in the coming terms and semesters to confirm the predictability of the waitlist.

How can we apply the Amazon principle of "customers who bought this item also bought…" to predict which courses to offer in tandem?

This variable is based on the Amazon principle of "you might also like" or "customers who bought this item also bought (Harris, 2013)." The variable is derived by analyzing which classes students usually take in tandem to other courses, and as part of a grouping of courses. This more sophisticated scheduling was just made possible since the Center began offering day courses too. In the past, most of the courses at the Center were all offered at the same times (typically 5:15 pm) and so even if a student desired to enroll in another course it probably wasn't possible since that course was also offered at the same time as the other one. Since one of the aims of the Salt Lake Center is to strategically schedule courses and to encourage students to take "just one more class" while at the Center, it makes sense to schedule courses in such a way that students may enroll in them "back to back" since the "on top of each other" is mutually exclusive to other courses. This variable is very useful in revealing which classes students are most likely to take together and then package them together for students.

In Table 4 another "big data" report reveals that if a student at BYU enrolls in MATH 110 they are most likely to also enroll in Rel A 121 or WRTG 150 as companion courses, and even more so in the fall semester than in the winter semester. (The first column in the table lists the companion courses in descending order for MATH 110 during fall semester and in the second column lists the companion courses for MATH 110 during winter semester.) This information suggests that MATH 110, and either REL A 121 or WRTG 150, be offered in tandem to MATH 110.

Table 4. Companion Courses Example

Companion Courses for MATH 110

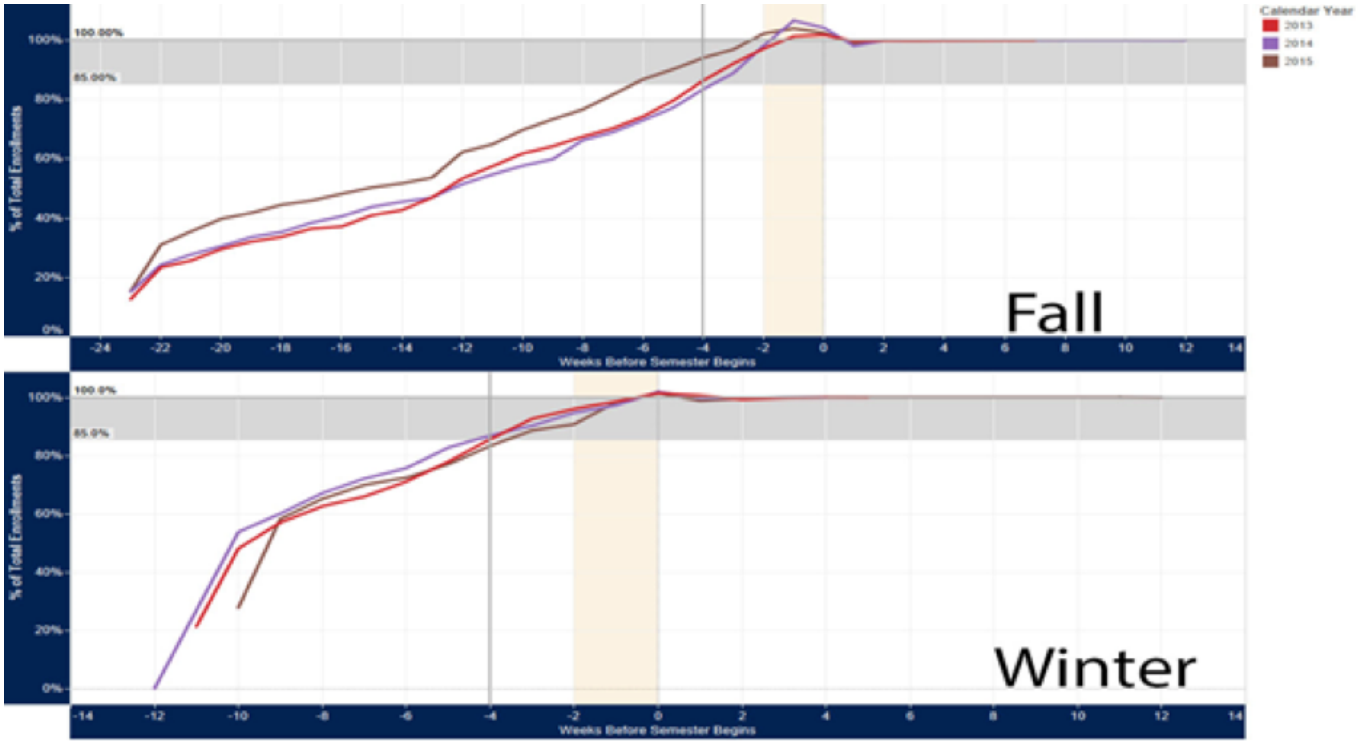
Companion Course Name	Year Term 20145	20141
REL A 121	127	46
WRTG 150	69	39
REL A 211	63	37
A HTG 100	48	24
BIO 100	46	30
ECON 110	45	29
REL C 324	42	30
CHEM 105	36	24
REL C 234	36	21

When is the best time to cancel a low-enrolling course?

This variable specifically addresses the problem of ensuring minimum course enrollments and when to decide if the class should carry or be cancelled? Historically all course offerings were carried to the first day of the semester and all decisions about either carrying or canceling the course were made on the first days of class. Analyzing the historical enrollment trends for each semester helped the administrative team discover that these decisions may be made much earlier since enrollment levels stabilized weeks before the first day of classes.

For example, courses offered during fall semester typically reach their ultimate enrollment numbers nearly three weeks before the start of the semester. Although there are a few more enrollments leading up to the first day of class these are usually offset by students dropping the class during the first week of school. Exhibit C is a sample of the report generated by "big data" software recently licensed by the university that tracks enrollments in relation to the start of the semester. The report, which includes three years of enrollment data, demonstrates a consistent and predictable build-up of enrollments over the weeks leading up to the first day of the semester and informs the Center on when "enrollments" sufficiently leveled off and when it is best to make final cancel/carry decisions.

Exhibit C. Total Enrollments Leading up to Semester Start



What is the best day, and time of day, to offer courses?

Historically, most courses at the Salt Lake Center are offered in the evening hours with courses beginning at 5:00 pm and 7:45 pm. These hours are considered convenient for many of the adjunct instructors who work other jobs during the day and for the many students who prefer evening classes after a busy day on the main campus, at work, etc. However, additional factors, including direction from the senior administration, recommend the Center begin experimenting with expanded offerings throughout the day and better utilize the facility.

The demand for classes on the main campus during the later morning hours is the greatest. Why wouldn't this high demand carry over into the morning hours of the BYU Salt Lake Center? Also, non-matriculated students just admitted to the BYU Salt Lake Center show greater interest in day rather than evening classes. Only 30 percent of these Salt-Lake-only students enrolled in evening classes. The preferences of the two groups should be considered independently.

There is also a multiplicity effect in assigning courses to time periods. For example, a popular course offered during a popular time will result in more enrollments than a popular course offered during an unpopular time. Further analysis and data collection related to this predictive variable of course scheduling by time will be performed in the coming semesters/terms.

Which courses do the students really want to take, and when?

Very few sources that specifically address enrollment optimization at an extended campus exist; however, there are papers written about related topics such as preference-based scheduling. For example, a paper by Dr. Sampson (2003) explains the theory of preference-based conference scheduling for conferences that offer multiple sessions simultaneously. This involves the possibility of creating a customer-satisfaction objective function where those attending the conference are defined as the customers. The goal is to then satisfy participant preferences by creating a schedule that allows participants to attend sessions for which they have the highest preference.

Another paper by Sampson specifically addresses class scheduling for an MBA program. The administration at the Darden Graduate School of Business Administration of the University of Virginia determined that an important component of education quality was allowing students to enroll in their preferred courses. Following their system, no class times are assigned until all students have made their requests for classes. A schedule is then created to simultaneously meet class-size and facility constraints, taking into consideration faculty and student preferences (Sampson, et. al. 1995).

A related problem is that of scheduling examinations. For this problem, a set of exams is assigned to time periods so as to avoid schedule conflicts for students. A survey by Schaerf (1999) offers insight into both the exam and course scheduling problems and discusses approaches common to both.

Although the BYU Salt Lake Center is unable to observe distinct preferences for all potential enrollments, it is important to incorporate student preferences whenever possible. The most practical way to do this is by surveying students currently enrolled and optimizing the future academic schedule to their preferences. It is anticipated this approach will lead to greater understanding about how scheduling classes at the Salt Lake Center will also make it more attractive to other students. A survey instrument will be designed and administered in the near future. The results of the survey, once analyzed, are expected to better inform the Center's administration about student preferences related to course offerings and scheduling.

Discussion and Future Consideration

Using these six strategies to make course selection and scheduling decisions has resulted in encouraging but premature and uncertain results. It is becoming more apparent which courses (and number of sections of those courses) will most succeed at the BYU Salt Lake Center and serve the most students and best utilize the space. Also, consideration for identifying which classes not previously offered at the Center is now approached with a greater degree of confidence and is taking on a more scientific approach. Using new tools to analyze big data sets in an educational setting of distance and continuing educators is proving most helpful.

The Salt Lake Center is starting to operate more efficiently and cater more generally and specifically to student (and instructor) preferences. Instead of following a best-guess approach for scheduling and staffing decisions, new best practices are being introduced and integrated into the work process to more fully realize the Center's mission and satisfy senior administrators' vision for the BYU Salt Lake Center.

With this improved efficiency, students are better able to enjoy the benefits of the Center. As mentioned before, an important component of educational quality is allowing students to enroll in the courses they most need at times that best fit their busy schedules. These preferences may not always be obvious or observable, but implementing these strategies will enable the administrators at the Center to better predict student preferences and meet student needs.

Additionally, these strategies may prove useful by sister departments within the Division of Continuing Education and hopefully beyond Brigham Young University and the BYU Salt Lake Center itself. Although the model is still not complete these strategies provide a basis for further experimentation, research, and application.

At the time of this writing, students are enrolling in courses for the winter 2016 semester which begins in early January. Once the winter 2016 add/drop deadline has passed an analysis of the enrollments, using these six predictive variables, will be further conducted. The authors intend to report these findings, and any refinements they make to the predictive variables, any new discoveries of additional variables, as well as the emerging model that brings all of these variables together. Finally, four unique semester/term models (fall, winter, spring, and summer) will merit further consideration and development to best assist Center administration in scheduling course offerings and scheduling by semester/term since each semester/term has its unique characteristics, both on the main campus as well as at the BYU Salt Lake Center.

Conclusion

This is a best practices article focused on sharing six academic scheduling strategies recently employed by the BYU Salt Lake Center to optimize course offerings, space utilization, and enrollments at its facility. While enrollments increased significantly this first year of starting to employ these strategies it is too early to determine causal and long-term effect, especially since not all strategies were fully deployed and other environmental factors existed. The recent acquisition of "big data" software and analytics makes possible analysis not previously possible. Six predictive variables were identified and determined to help predict (with at least some degree of accuracy) course demands and enrollments so

as to more fully utilize the facility: 1) flagship campus enrollments, 2) waitlist data, 3) companion course data, 4) extended campus enrollment timing, 5) course scheduling, and 6) student preferences. These strategies are generalizable to other academic programs that help extend academic programs at a distance, including online courses. Further experience and experimentation with these predictive variables will occur in future semesters and terms. Finally, the authors make a call for others to share their best practices, research, and results with this learning community.

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