BEST PRACTICES IN COURSE SCHEDULING

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In the following report, Hanover Research examines course scheduling practices and policies for undergraduate students at four-year institutions in the United States. This report reviews the extant literature on course scheduling in higher education, and explores the protocols in place at several public institutions.

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EXECUTIVE SUMMARY AND KEY FINDINGS

INTRODUCTION

Course scheduling is an integral part of institutional administration, yet little research exists that examines scheduling as a key factor in broader governance and strategic planning. However, experts posit that course scheduling "is tied integrally to two of an institution's most expensive resources – facilities and faculty."[1] Courses that are under-enrolled, for example, create wasted space and unnecessary spending, while over-enrolled classes suggest that institutions are poorly managing their course catalogs.[2] As described by the Registrar at Purdue University, "the primary goal of academic scheduling is to develop class times that maximize the chance for students to develop workable schedules in order to make progress towards degree."[3] Thus, colleges and universities that can effectively schedule classes can achieve better academic and institutional efficiencies.

To that end, this report examines course scheduling in higher education. It focuses on policies and procedures at the undergraduate level among other four-year institutions in the United States. The purpose of this report is to provide higher education institutions with best practices and exemplary models of course scheduling that have been shown to increase operational efficiency and improve stakeholder experiences. Hanover Research (Hanover) presents this research in two sections:

- **Section I: Course Scheduling in Higher Education** reviews the extant literature on course scheduling practices. This section examines the ways that course scheduling can affect students and institutions, and provides some alternative approaches to developing course schedules.
- **Section II: Institutional Case Profiles** explores how other institutions structure their course catalogs. After a brief review of policies at selected public institutions, this section provides an in-depth examination of scheduling practices and policies at three universities recognized as having innovative and effective schedules.

[1] Opidee, I. "Staying on the College Grid." *University Business*, December 2014. https://www.universitybusiness.com/article/staying-college-grid
[2] Ibid.
[3] "Class Scheduling." Purdue University. http://www.purdue.edu/registrar/faculty/scheduling/class_scheduling.html

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KEY FINDINGS

- **Course scheduling plays an important role in broader institutional effectiveness.** Effective scheduling, for example, can boost student retention rates and reduce time to graduation. Similarly, institutions can reduce costs by limiting the number of under-enrolled courses. Thus, course scheduling needs to consider both student preferences and institutional capacity.
- **It is no longer sufficient to simply carry over the same (or similar) schedules from term to term.** Institutions that ignore changes in student demographics or evolving student preferences—and instead rely on "just-in-time" scheduling—threaten student and institutional success. Colleges and universities that do not regularly re-examine their course catalogs are "operating blind," yet most institutions (40 percent) only begin planning schedules one term ahead of time.
- **Institutions need to collect, manage, and analyze data relating to course scheduling, such as seat-fill rates, enrollment caps, and space utilization.** These data, in turn, should be interpreted and inform course scheduling in future terms. For example, knowing which courses fill too soon—or which ones are under-filled—can help determine how to schedule those classes in the future. However, only a few institutions comprehensively track performance metrics with regard to the course catalog, often leading to a disconnect between students' course needs and actual offerings.
- **Dedicated schedule refinement teams can ensure that course scheduling, classroom scheduling, and other scheduling considerations are coordinated sufficiently.** These dedicated scheduling personnel can be responsible for tracking and analyzing enrollment data, as well as working with academic departments to make sure that all space is being used as efficiently as possible. For example, at the University of Iowa, the Registrar's classroom scheduling unit determines classroom assignments based on efficient classroom utilization, technology or equipment needs, and historical student data.
- **Most students today are predominately interested in flexible scheduling options.** Because many students rely on degree audits or other scheduling platforms to remain on track, they seek (and can support) more flexibility. The rise and convenience of online courses further contributes to the desire for flexible scheduling options.
    - **An increasingly common way to offer additional flexibility is to design accelerated terms.** A traditional semester is roughly 15 weeks long; however, accelerated terms normally last between seven and eight weeks, such that students can complete two "mini" terms (or "mini-mesters") within the same timeframe. Condensing courses into these accelerated terms can help working students minimize the possibility of outside roadblocks interfering with course completion.

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- **Late-start courses are another option for ensuring that students can enroll in courses that they need to graduate.** These courses begin several weeks into the term. In traditional schedules, students who enroll in misaligned courses are forced to transfer into a class that has already met several times. Late-start classes provide an option for students to find the right fit without starting at a disadvantage.

- **Commuter and part-time students in particular can stand to benefit from this flexibility and data-driven scheduling.** To address their needs, institutions are encouraged to consider business hours and align schedules to accommodate traditional working schedules (e.g., start evening classes at 6:00pm rather than 5:00pm). Similarly, matching course demographics with schedules can help encourage high seat-fill ratios – for instance, if institutions notice that one particular program attracts a lot of parents, they may consider scheduling courses during the day in order to avoid conflicts with children's school schedule.
- **Courses that are scheduled two times per week are most consistently linked with positive student outcomes.** In one study, students enrolled in an Intermediate Accounting class in one of three different schedules: one time per week; two times per week; and three times per week. Students in the Monday/Wednesday/Friday section were significantly less successful than their peers. Similarly, community college students who attended Algebra class once per week were outperformed by their peers in twice-weekly sections. Although the associations are modest, the data support sessions that convene two times a week.

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SECTION I: COURSE SCHEDULING IN HIGHER EDUCATION

In this section, Hanover explores course scheduling in higher education. Specifically, this section examines how scheduling can be an important factor in broader student success and presents some alternative and innovative strategies for scheduling courses.

THE IMPORTANCE OF COURSE SCHEDULING

Course schedules can impact a wide range of institutional outcomes, including student satisfaction, graduation rates and time to graduation, and university expenditures. For example, in a 2012 national student satisfaction survey, respondents indicated that course availability was a top concern, especially for nontraditional students (e.g., over 25 years of age and those who are employed full-time).[4] Similarly, **university administrators regularly note that "managing the schedule with students' needs in mind is critical for retention** […] we have to be sure we [are] not causing a student to have to miss a semester or not take a full load because of when these classes are offered."[5]

Given the importance that scheduling can have on how students, faculty, and administrators make decisions, it becomes essential that course catalogs reflect student and institutional needs. For instance, more than one-third of entry-level courses at four-year, public universities are over-enrolled, suggesting that the availability of these courses needs to be expanded.[6] However, institutions of higher education seemingly do not regularly re-examine course schedules to reflect changes in student demand or institutional capacities. As such, "enrollment changes, changes in student demographics, and the demands of curriculum pathways all require adjustments to the schedule, so the roll-forward method creates inefficiencies and misalignment with student and curriculum demand."[7]

Several factors can influence how institutions schedule courses. In their survey of over 700 undergraduate colleges and universities, the American Association of Collegiate Registrars and Admissions Officers (AACRAO) found that the most popular factors in the overall scheduling process included **faculty availability** (90.7 percent), **time block popularity** (76.5 percent), and **courses scheduled at the same time from year to year** (71.4 percent) (Figure 1.1).[8] Notably, the least-influential factor in scheduling for undergraduate students is "driven

[4] "2012 National Research Report: National Student Satisfaction and Priorities Report." Noel-Levitz, 2012. p.9. https://www.ruffalonl.com/documents/shared/Papers_and_Research/2012/2012_Student_Satisfaction_Report.pdf

[5] Opidee, Op. cit. Emphasis added.

[6] Smith, A.A. "Fixing Capacity With Better Class Scheduling." *Inside Higher Ed*, October 2016. https://www.insidehighered.com/news/2016/10/28/capacity-problems-plaguing-colleges-may-be-due-poor-scheduling

[7] Ibid.

[8] "Class Scheduling (aka Timetabling) Practices and Technology." American Association of Collegiate Registrars and Admissions Officers, September 2016. p.7. http://www.aacrao.org/docs/default-source/surveyresults/aacrao-sept-2016-class-scheduling-practices-60-second-survey-report.pdf?sfvrsn=2

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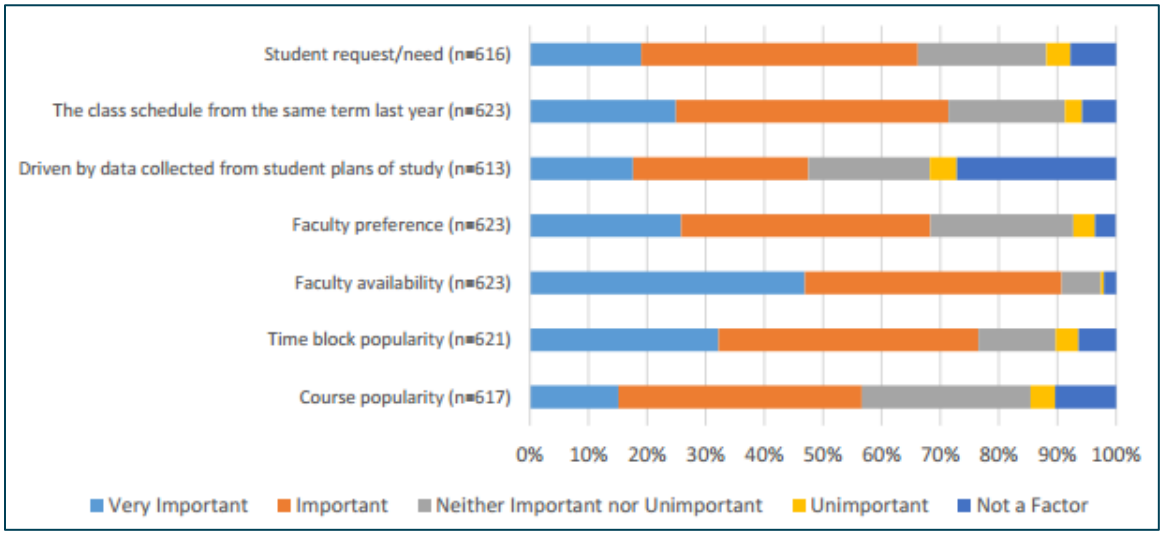
by data collected from student plans of study," **suggesting that relatively few institutions consider student data and plans of study when making course scheduling decisions**.[9]

Figure 1.1: Importance of Various Factors in Undergraduate Course Scheduling Process



Source: American Association of Collegiate Registrars and Admissions Officers[10]

Relying on traditional metrics to develop course catalogs—such as consistency across terms or time block popularity—ignores many of the central changes in higher education in recent years. Indeed, "with the growth of distance education and changes in student demographics, the traditional class schedule, when a class meets two or three times a week, may no longer be what students want or need to meet their educational goals."[11] For example, the most common timeframe for scheduling classes appears to be one academic term in advance, although a sizable portion of institutions (22 percent) plan for the next term's schedule *less than* one academic term in advance (Figure 1.2). The AACRAO labels this "just-in-time scheduling," which offers students little option for planning their coursework in advance.[12]

Importantly, this "just-in-time" scheduling practice reflects the outdated way of devising course schedules that often has negative consequences for students. New Mexico State University, for instance, used to schedule courses in this way and based much of the decision making on faculty preferences. According to the university's Assistant Registrar, this meant that "the institution was basically operating blind when it came to course scheduling."[13] Experts in the field today are encouraging colleges and universities to use enrollment data to prioritize course planning and scheduling ahead of time, rather than waiting for the term (or

[9] Ibid.
[10] Image taken from: Ibid.
[11] Kelly, R. "Scheduling Courses for Flexibility and Student Success." *Faculty Focus*, August 2008. https://www.facultyfocus.com/articles/trends-in-higher-education-scheduling-courses-for-flexibility-and-student-success/
[12] "Class Scheduling (aka Timetabling) Practices and Technology," Op. cit., p.8.
[13] Mills-Senn, P. "Flex Your College's Courses." *University Business*, February 2016. https://www.universitybusiness.com/article/flex-your-colleges-courses

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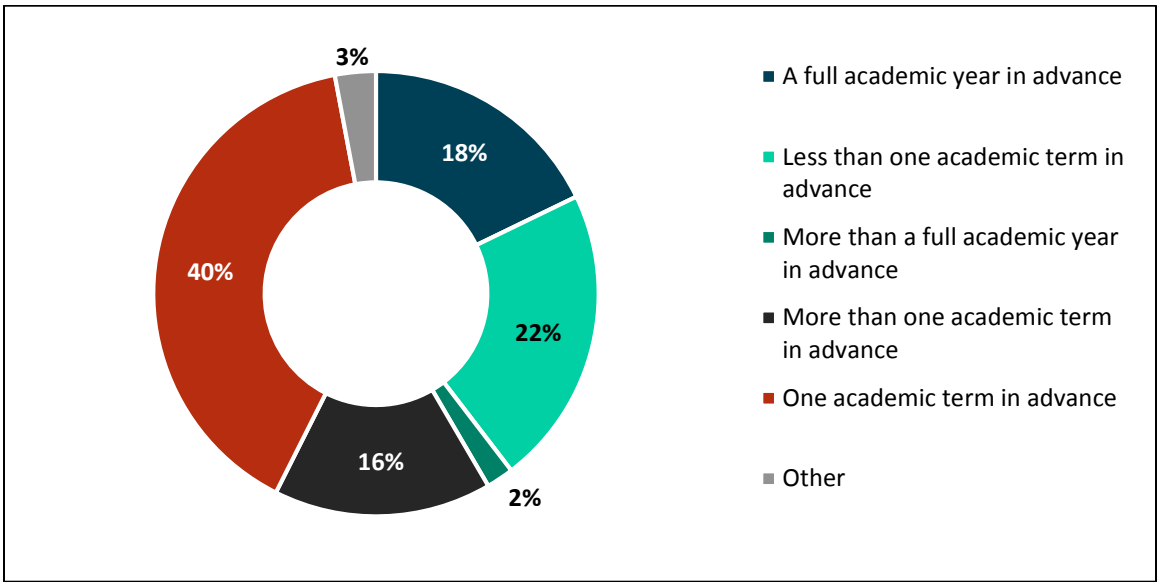
less) before students are required to sign up for classes. Administrators similarly argue that "scheduling cannot be a 'one-and-done.' Each term is different and requires a different approach that should be based on student demand, not on what was offered in the past."[14]

Figure 1.2: Advance Scheduling Time for Most Classes



Source: American Association of Collegiate Registrars and Admissions Officers[15]

Institutions that have redefined their course scheduling protocols have improved operational outcomes in as little as one year. At Stark State College in Ohio, after the student population doubled over a five-year period, administrators closely examined how course schedules could contribute to greater efficiencies. After one year, "because they were offering more courses at the times students wanted and so students increased the amount of credits they took," Stark State College saved $2 million in instruction costs and increased tuition yields by over $1 million.[16] This highlights how institutions of higher education can leverage course schedules as a strategic planning priority. Some other key ways to facilitate a more efficient course scheduling apparatus include:

- When analyzing patterns in course scheduling, look back several years rather than just one semester;
- Hire adjuncts only after you know that full-time faculty have reached their full workload;
- Be aware of where faculty members' time is going – not just teaching time but also advising, committee work, and research time;
- Distribute courses more evenly across the full day's schedule;

[14] Ibid.
[15] Adapted from: "Class Scheduling (aka Timetabling) Practices and Technology," Op. cit., p.9.
[16] Smith, Op. cit.

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- Make the enforcement of standardized course times a priority;
- Consider using technology to help centralize and automate scheduling functions;
- Manage the course schedule with degree requirements and other needs of students in mind; and
- Look to funding academic area budgets based on course registration.[17]

Some of these considerations are explored in additional detail in the remainder of this section.

EFFECTS ON STUDENT OUTCOMES

As shown in Figure 1.3, there is a limited research pool of empirical evidence that explores the possible links between student outcomes and course scheduling in higher education. Much of the research that does exist, moreover, typically investigates how schedules affect elementary and secondary students, rather than university enrollees. For example, a recent study found that middle school students score higher on math and English tests if those subjects are taught in the morning.[18] Nonetheless, **course scheduling does appear to have an effect—albeit modest—on some aspects of postsecondary student performance.**

Figure 1.3: Overview of Research-Based Studies Examining the Impact of Scheduling in Higher Education

AUTHOR(S)	STUDY	KEY OUTCOMES
Watson (2016)*[19]	The Relationship of Course Scheduling on Community College Student Pass Rates, Persistence Rates, and Retention Rates	▪ Researcher examined the effects of a two-day per week format on student outcomes ▪ There is a significant, positive relationship between course scheduling and pass rates ▪ However, no relationship was found between course scheduling and persistence or retention rates
Carrington (2010)[20]	The Impact of Course Scheduling on Student Success in Intermediate Accounting	▪ Researcher examined the effects of scheduling on student outcomes: one-, two-, and three-days-per-week over a traditional semester as well as a compressed four-week summer session ▪ A significant association between course schedule and student performance is found to exist ▪ Students in three-days-per-week sections were significantly less successful; no differences were found among other schedules

[17] Bullet points taken verbatim from: Opidee, Op. cit.
[18] "How Class Schedules Impact Student Success." Learning Liftoff, January 2017. http://www.learningliftoff.com/how-class-schedules-impact-student-success/#.WUlDd2jyvb0
[19] Watson, M. "The Relationship of Course Scheduling on Community College Student Pass Rates, Persistence Rates, and Retention Rates." Doctoral Dissertation, Texas Tech University, December 2016. https://ttu-ir.tdl.org/ttu-ir/bitstream/handle/2346/72298/WATSON-DISSERTATION-2016.pdf?sequence=1&isAllowed=y
[20] Carrington, L.G. "The Impact of Course Scheduling on Student Success in Intermediate Accounting." *American Journal of Business Education*, 3:4, April 2010. http://files.eric.ed.gov/fulltext/EJ1060320.pdf

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AUTHOR(S)	STUDY	KEY OUTCOMES
Gallo and Odu (2009)[21]	Examining the Relationship Between Class Scheduling and Student Achievement in College Algebra	▪ Researcher examined the effects of scheduling on student outcomes: one-, two-, and three-days-per-week over a traditional semester ▪ One-day-per-week section students consistently scored the lowest on unit tests and final exams
Dills and Hernandez-Julian (2008)[22]	Course Scheduling and Academic Performance	▪ Researchers examined the effect of time of day and frequency of class meeting to determine link between schedule and performance using over 105,000 grades from Clemson University students ▪ Students perform better in classes that meet later in the day (0.024 grade points per hour; small effect size) and more often during the week ▪ Thus, students perform best in Tuesday/Thursday and Monday/ Wednesday afternoon classes

Source: Hanover Research Analysis
*Dissertation

Overall, courses that are scheduled twice per week appear to be most consistently associated with positive student outcomes. For instance, Carrington found that students enrolled in Intermediate Accounting courses that met three times per week were significantly less successful than their peers in once- or twice-weekly sections (Figure 1.4). The author hypothesized that the 50-minute sections in three-times-a-week courses may be insufficient to master core accounting concepts, and the frequency of meetings may further discourage students from practicing new skills between meetings.[23] Likewise, Gallo and Odu concluded that Algebra students at two-year institutions who only met once per week scored the lowest on unit tests and final exams compared to their peers in two- and three-day-per-week sessions. It should be noted, however, that the once-weekly sections only met on Saturday morning, perhaps contributing to the lower achievement scores. The authors concluded that "massed practice" course spacing (i.e., meeting on a one-day-per-week basis) is not as beneficial as "distributed" or "spaced practice" courses (i.e., meeting two or three times per week).[24]

Finally, in a study using data from over 105,000 students from Clemson University, Dills and Hernandez-Julian found that students perform best in Tuesday/Thursday or Monday/ Wednesday courses that meet in the afternoon. However, if institutions do offer courses that meet three times per week, students generally perform better in the morning.[25] These empirical studies confirm that there is an association between course schedules and student

[21] Gallo, M.A. and M. Odu. "Examining the Relationship Between Class Scheduling and Student Achievement in College Algebra." *Community College Review*, 36:4, April 2009. Accessed via ProQuest.
[22] Dills, A.K. and R. Hernandez-Julian. "Course Scheduling and Academic Performance." *Economics of Education Review*, 27, 2008. https://teensneedsleep.files.wordpress.com/2011/03/dills-course-scheduling-and-academic-performance.pdf
[23] Carrington, Op. cit., p.59.
[24] Gallo and Odu, Op. cit., p.319.
[25] Dills and Hernandez-Julian, Op. cit., p.653.

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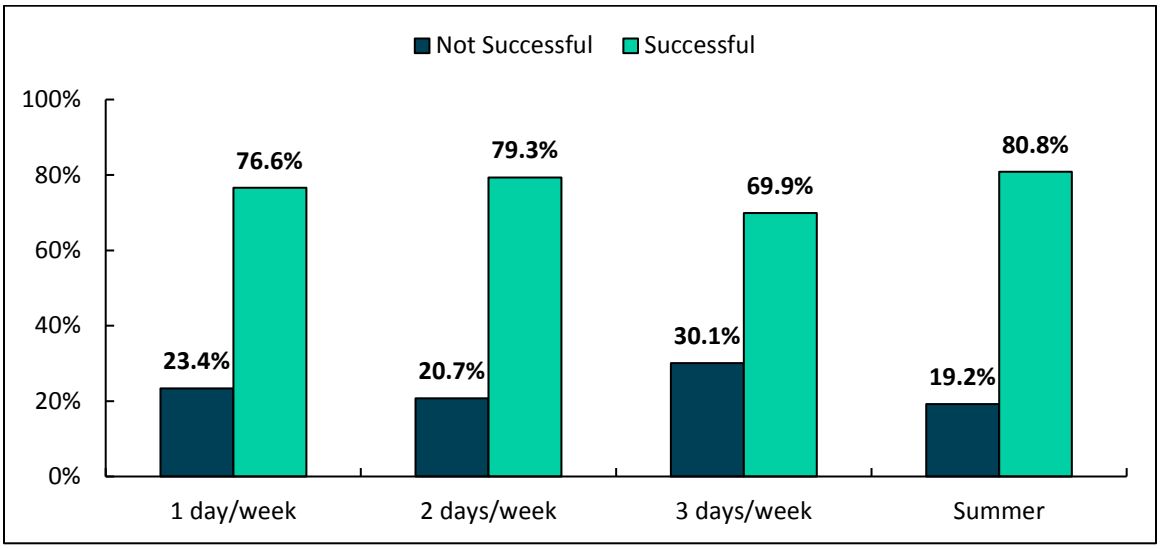
outcomes, and that, "given the pressure to change times and schedules, obtaining reliable estimates of their effect is not only interesting but essential for institutions of higher education to meet their goals."[26]

Figure 1.4: Course Success Rates by Schedule (*p=0.011)*



Source: Carrington; "The Impact of Course Scheduling on Student Success in Intermediate Accounting"[27]

BOTTLENECKING AND PATHWAYS TO GRADUATION

In higher education, the term "bottleneck" refers to any barrier that all students need to overcome to progress along the pathway to graduation. These can include educational credentials, test scores, or any other university-wide requirements, such as broad-based introductory or general education courses.[28] These bottlenecks can cause students and institutions to incur additional costs and delay degree completion.[29] One of the primary bottlenecks is high-enrollment, lower-division undergraduate courses that are often the most difficult for institutions to administer and for students to pass through. Three primary reasons contribute to these difficulties:

- **Cost:** Large enrollments necessitate additional instructors and classroom space, straining faculty capacity and instructional resources.
- **Access:** Many of these courses create bottlenecks in the curriculum, particularly as required prerequisites are accompanied by waitlists and high failure rates.

[26] Dills and Hernandez-Julian, Op. cit., p.653.
[27] Adapted from: Carrington, Op. cit., p.56.
[28] Reeves, R.V. and Q. Karpilow. "The College Bottleneck in the American Opportunity Structure." The Brookings Institute, May 2014. https://www.brookings.edu/blog/social-mobility-memos/2014/05/08/the-college-bottleneck-in-the-american-opportunity-structure/
[29] "Removing Bottlenecks: Eliminating Barriers to Completion." Coalition of Urban Serving Universities and the Association of Public and Land-Grant Universities. p.1. http://www.aplu.org/library/removing-bottlenecks-eliminating-barriers-to-completion/File

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- **Quality:** Unbundling and redesigning the instructional model creates legitimate concerns about pedagogical rigor, particularly when success rates are already unsatisfactory.[30]

Per the Coalition for Urban Serving Universities and the Association of Public and Land-Grant Universities, academic bottlenecks can stem from a variety of specific access-related factors, many of which relate to course alignment and scheduling:

Figure 1.5: Common Scheduling-Related Causes of Academic Bottlenecks in Higher Education

Physical Space Limitations and Room Capacity

- Imagine restricting a learning experience to the size of a room. That is what happens when student enrollment in lab science courses, for example, are limited to accommodate the available lab space.

Courses with High DFW Rates

- D, F, and W refer to non-passing grades (i.e., drop, fail, and withdraw).
- These courses are generally used to serve a relatively large number of undergraduates and they have a high proportion of students who do not produce a successful academic outcome. Courses with high DFW contribute to high course repeat rates.
- As a result, enrollment in the courses fill up quickly as the number of students repeating courses overlap with new student enrollments, impacting course availability.

General Education Requirements

- Commonly called "gateway courses" or entry level courses, many students choose or are required to complete these courses to meet general education requirements, progress to upper level courses, or to enter a major area of study and fulfill degree completion requirements.

Faculty and Student Preferences

- Ironically, course availability on many college campuses are sometimes driven by the scheduling preferences of faculty and students, to have as few courses as possible scheduled on Fridays, or early morning, late afternoon and evening hours.

Specialization

- These are select courses that may be offered on an irregular basis or with a few, particular faculty members. More likely to occur in upper division required courses, specialization courses might only be taught by one faculty member or offered on an irregular, "need" basis, making it difficult for students to anticipate changes or plan schedules around so few choices.

Source: Coalition for Urban Serving Universities and the Association of Public and Land-Grant Universities[31]

[30] Bullet points taken verbatim from: "Online Course Prioritization Guide: 10 Strategies for Promoting Enrollment Growth and Student Success." Education Advisory Board. https://www.eab.com/research-and-insights/online-course-prioritization-guide/bottleneck-course-redesign

[31] Adapted from: "Removing Bottlenecks: Eliminating Barriers to Completion," Op. cit., pp.1–2.

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Bottleneck courses are important for institutions of higher education to address, because reducing bottlenecks generally results in significant cost savings for colleges and universities. These cost savings stem from better alignment between faculty, resources, and institutions, given that institutions will ideally begin offering courses based on student demand and capacity.[32] To realize these savings (and associated benefits to student retention and graduation rates), colleges and universities need to first identify the bottleneck courses appropriately:

- **Fill date:** High demand courses fill up quickly. Bottleneck can be recognized by monitoring when a course reaches maximum enrollment during the registration period.
- **Outcomes:** Monitor previous outcomes. An institution's operational definition will vary based on how the institution operates and how student enrollments are done. For example, bottlenecks may be the result of courses that enroll at least 60 to 100 undergraduates annually and have a DFW rate of 15 percent or higher.
- **Physical space usage:** Examine when and how academic space is allocated each semester, which courses are scheduled, in which spaces, at which times of the day, and how far in advance of registration.
- **Sequencing:** Properly sequence courses that are at the lower end of common, multi-course sequences, and/or courses required for all students in one or more medium to large majors.
- **Waitlist review:** Compare the number of students left on a course waitlist at the end of enrollment periods with the institutions capacity to add sessions or hire additional instructors.[33]

One solution that education consultants propose is that **university administrators should "target the institution's most challenging curricular bottlenecks for blended course redesign,** transitioning away from a traditional lecture-based model toward one that combines web-based content delivery with face-to-face interaction."[34] The Association of Public and Land-Grant Universities similarly recommends a course redesign for these larger bottleneck classes that underlines collaboration across the same courses or courses within a sequence to reduce dropout, failure, and withdrawal rates.[35] Figure 1.6 shows other strategies for resolving bottleneck courses by leveraging course scheduling and institutional policies to help students select and pass appropriate classes.

[32] Ibid., p.2.
[33] Bullet points taken verbatim from: Ibid., pp.3–4.
[34] "Online Course Prioritization Guide: 10 Strategies for Promoting Enrollment Growth and Student Success," Op. cit. Emphasis added.
[35] "Removing Bottlenecks: Eliminating Barriers to Completion," Op. cit., p.4.

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Figure 1.6: Strategies for Resolving Bottleneck Courses

High DFW Rates	Scheduling	Policies and Practices
•Faculty professional development •Different pedagogical approaches •Utilize learning assistants •Create bridge programs •Examine course placement testing systems •Remedial education or integrating remedial modules in courses •Integrate early alert systems •Hire teaching specialists/ instructors for gateway courses •Optimal utilization of technology (e.g., learning management systems)	•Closely monitor course fill dates and waitlists, particularly for high-priority courses; provide additional sections when able •Establish a proactive model for funding high-demand course additions •Establish regulations for course and classroom scheduling to maximize classroom use •Provide and encourage more online and hybrid courses, or Saturday classes •Partner with nearby institutions for students to fulfill course requirements	•Leverage advisors and/or software platforms to ensure students are aware of the wider range of courses and program options available to complete General Education and major requirements •Require/encourage students to change majors early on if key milestones are not met •Establish policies for the number of times a student may attempt a course

Source: Coalition for Urban Serving Universities and the Association of Public and Land-Grant Universities[36]

When determining whether efforts to reduce course bottlenecks have been effective, colleges and universities can monitor various scheduling metrics. For example, a reduction in the DFW rate for a course, an increase in the enrollment cap for a course, or a reduction in instructional cost per student in a course can all point to shrinking bottlenecks.[37]

INSTITUTIONAL EFFECTIVENESS AND EFFICIENCY

In a report considering data from over 100 colleges and universities, Ad Astra Information Systems revealed several key metrics that can help other institutions of higher education benchmark their offerings and course catalogs relative to others across the country. **Of note, only a few institutions "comprehensively manage the course schedule or track related performance metrics."**[38] In general, this results in institutions demonstrating an imbalance between the seats offered and the seats needed for many courses across the schedule.

Indeed, only 32 percent of college and university courses are considered "balanced," meaning that the number of seats offered generally matches the number of seats filled (Figure 1.7). On the other hand, 41 percent of courses are under-utilized and 25 percent are over-enrolled, meaning that institutions are not managing their course catalogs efficiently.[39] Per Ad Astra,

[36] Adapted from: Ibid.
[37] "Online Course Prioritization Guide: 10 Strategies for Promoting Enrollment Growth and Student Success," Op. cit.
[38] "The 2016 Higher Education Scheduling Index Report." Ad Astra Information Systems, July 2016. p.7. Emphasis added. https://www.aais.com/wp-content/uploads/2015/08/The-2016-Higher-Education-Scheduling-Index-FINAL.pdf
[39] Ibid.

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these imbalances create "a problem that needlessly drives up cost for the student, threatens the financial sustainability of some campuses, and wastes instructional capacity to support enrollments."[40]

Figure 1.7: Course Offering Indicators from Higher Education Scheduling Index, 2016

Measure	Description	Average
Enrollment	Average value of the enrollment (census) per section for the term	22
Enrollment Cap	Average value of the maximum enrollment per section for the term	29
Enrollment Ratio	Overall fill rate for course offerings	77%
Balanced Course Ratio	The percentage of unique courses offered that are balanced with student need	32%
Under-Utilized Course Ratio	The percentage of unique courses offered that are an inefficient use of faculty and classroom resources because they are under-enrolled	41%
Overloaded Course Ratio	The percentage of unique courses offered that are difficult for students to register for because they have a high enrollment ratio	25%
Addition Candidates	The percentage of total sections in a schedule that could potentially be added to the schedule based on sufficient student demand to justify one or more additional sections	4%
Efficiency Candidates	The percentage of total sections/courses in a schedule that could potentially be removed based on insufficient demand	17%

Source: Ad Astra Information Systems[41]

Institutions also seem to inefficiently manage space and facilities regarding scheduling. For instance, most colleges and universities report that they are "out of space" across the campus yet "a typical classroom is in use less than half of the weekly instructional hours […] and is only 62 percent full when in use" (Figure 1.8).[42]

Figure 1.8: Space Management Indicators from Higher Education Scheduling Index, 2016

Measure	Description	Average
Standard Week Hours	The number of hours in all the days/times that are available for scheduling academic sections	64
Primetime Hours	The most popular days/times for scheduling academic sections, where room utilization is often disproportionately high	25
Classroom Utilization Standard Week	The percentage of hours in a standard week (as defined by each institution's usage patterns) that a typical classroom is in use	46%

[40] "The 2015 Higher Education Scheduling Index Report." Ad Astra Information Systems, July 2015. p.10. http://www.aascu.org/corporatepartnership/AdAstra/HESIreport.pdf
[41] Adapted from: **"**The 2016 Higher Education Scheduling Index Report," Op. cit., p.5.
[42] Ibid., p.8.

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MEASURE	DESCRIPTION	AVERAGE
Classroom Utilization Primetime	The percentage of hours in the primetime subset of a standard week that a typical classroom is in use	67%
Seat Fill Utilization – Enrollment	The percentage of seats in use (based on enrollment) in a classroom when it is scheduled	62%
Seat Fill Utilization – Enrollment Cap	The percentage of seats in use (based on section enrollment caps) in a classroom when it is scheduled	81%
Off-Grid Utilization	The percentage of scheduling using non-standard meeting patterns during primetime hours	42%
Off-Grid Waste	The percentage of capacity wasted by scheduling non-standard meeting patterns during primetime hours	14%

Source: Ad Astra Information Systems[43]

The space management indicators, which largely show that institutions are *not* effectively utilizing their existing spaces and facilities, underline the need for colleges and universities to balance students' course access with broader campus efficiencies. For example,

> […] institutions with growing enrollment can creatively overcome constrained space and faculty resources through efficient scheduling. Since budget restrictions preclude new space and new faculty lines, these institutions must continue to focus on class fill rates and capacity strategies to maximize resource utilization.[44]

Importantly, "success in these areas is frequently inversely correlated (i.e., efficient institutions tend to have lower course access, and vice versa)."[45] **This suggests that higher education institutions should consider fluctuations in enrollment from year to year and adjust enrollment caps accordingly.** As concluded by Ad Astra, "enrollments change faster than schedules on many campuses, leading to a disconnect between students' course needs and offerings in those schedules."[46]

To overcome some of these common challenges, **it is important that college and university registrars use student enrollment data to influence scheduling decisions.** Indeed, collecting, analyzing, and knowing student course enrollment data is central to effective scheduling.[47] For example, knowing which courses fill too soon, which ones are under-filled, which ones have a waiting list, and which ones are offered only in the fall or spring can help determine how to schedule those classes. As experienced by New Mexico State University, "these limitations resulted in some students waiting a term to get a required course or signing up for classes just to maintain their credit loads."[48]

[43] Adapted from: Ibid., p.6.
[44] Ibid., p.12.
[45] Ibid., p.9.
[46] Ibid., p.10.
[47] "The 2015 Higher Education Scheduling Index Report," Op. cit.
[48] Kelly, Op. cit.

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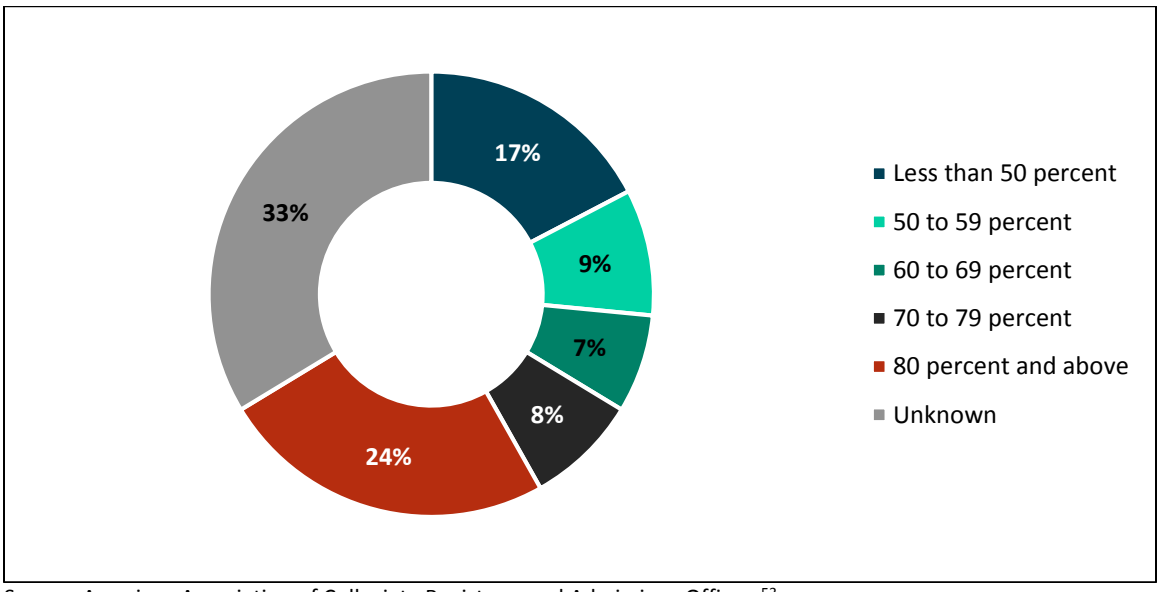
One strategy for ensuring that colleges and universities are offering courses that are of interest to students (both in terms of content and scheduling) is to implement **enterprise resources planning systems**, which can "better anticipate which courses [institutions] will need."[49] According to one institutional administrator who uses a planning system, "we can generate, for example, three-year rolling enrollment reports and put them in the hands of department chairs and curriculum coordinators so they [are] not relying on partial information or misinformation, but actual statistical information to show the registration pattern."[50]

Relatedly, roughly one-quarter of colleges and universities offer a student scheduled planning solution, and many more indicated that they planned to acquire one within a year. These solutions include systems that are built into the SIS, College Scheduler, and Visual Schedule Builder platforms.[51] Most institutions that offer these services anticipate that the overall student experience will improve, and many believe that student scheduled planning solutions will increase the number of students who register for courses on-time and thus improve time to degree and graduation rates.[52] However, only 24 percent of institutions report very high usage rates for these systems (Figure 1.9), suggesting that there needs to be dedicated marketing and training to encourage students to take advantage of the platforms.

Figure 1.9: Percentage of Students Who Use the Student Schedule Planning Tool



Source: American Association of Collegiate Registrars and Admissions Officers[53]

[49] Ibid.
[50] Ibid.
[51] "Class Scheduling (aka Timetabling) Practices and Technology," Op. cit., p.14.
[52] Ibid., p.15.
[53] Adapted from: Ibid.

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ALTERNATIVE SCHEDULING MODELS

A primary concern among today's postsecondary students regarding scheduling revolves around flexibility. In the past, scheduling technology did not easily allow for much variation in how classes were offered, and faculty wanted to contribute to the scheduling process. However, in the current higher education landscape, "degree audits keep students on target as they choose courses each semester. Students can choose multiple session lengths for in-person and online classes – fitting more instruction into a single semester."[54] Indeed, "when it comes to course schedules, students' main concern is whether a course is offered when they need it. If it is not available on campus when they need it, students have the option of taking it at another institution either in person or online."[55]

Because of this, traditional course schedules that rigidly meet two or three times per week may not meet the needs of many of today's postsecondary students. Instead, online, hybrid, and accelerated courses, for example, offer "greater flexibility and can improve student learning and retention."[56] This flexibility can be even more important for institutions with high enrollments of less traditional students such as commuter and/or part-time students. Institutions with high percentages of these nontraditional students should take into account the following, which consider many of their unique characteristics relative to traditional, residential students:

- Note business hours for working students and check local bus schedules for **scheduling factors that may impact a commuter or part-time student's ability to attend class or to be on time** (e.g., start evening classes at 6pm rather than 5pm).
- **Match course schedules to student demographics within particular disciplines** (e.g., if a lot of stay-at-home mothers are enrolled in education programs, consider scheduling most of that program's requirements between 9am and 3pm, which their children are in school).
- Consider offering an intensive three-week January term and **moving back the regular start** of the after-the-holiday classes to late January.[57]

Institutions of higher education are being urged to consider innovative approaches to better meet the needs of a more diverse student population, which increasingly includes working and commuting students alongside full-time students. For example, the Commission on the Future of Higher Education noted that too many "colleges and universities have not embraced opportunities to be entrepreneurial, from testing new methods of teaching and content delivery to meeting the increased demand for lifelong learning."[58] Some innovative strategies for delivering content and scheduling courses for nontraditional students include:

[54] Mills-Senn, Op. cit.
[55] Kelly, Op. cit.
[56] Ibid.
[57] Fusch, D. "Innovations in Course Scheduling that Support Student Success." *Higher Ed Impact*, June 2012. http://www.academicimpressions.com/news/innovations-course-scheduling-support-student-success
[58] "A Test of Leadership: Charting the Future of U.S. Higher Education." U.S. Department of Education, September 2006. p.4. https://www2.ed.gov/about/bdscomm/list/hiedfuture/reports/final-report.pdf

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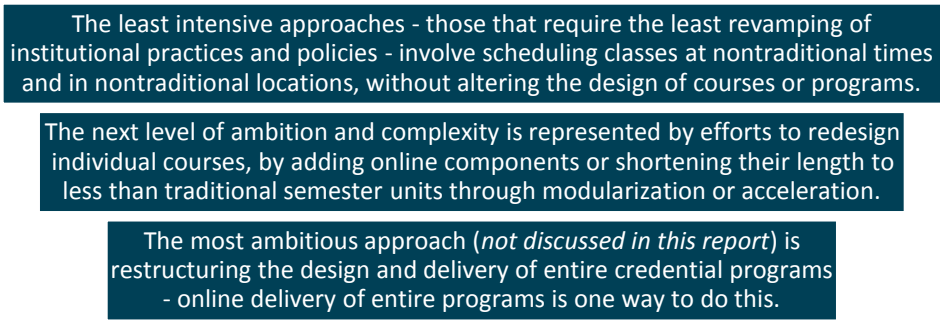
- Postsecondary institutions are increasingly offering more flexible schedules, such as weekend-only classes, accelerated vacation programs, online instruction, and critical support services during nontraditional hours;
- Some institutions offer multiple entry, exit, and re-entry points, including more frequent start times throughout the year;
- An area with great promise is shortening and modularizing curricula and offering interim credentials linked to career advancement; and
- Some community colleges are improving developmental education by offering basic-skills and English-language instruction in work-related contexts and occupations certificate programs.[59]

As stated by FutureWorks and Jobs for the Future, "postsecondary education providers […] are responding to market signals and developing a range of methods for increasing adult access to courses and accelerating time to degree."[60] The organizations note two levels of schedule redesign that are pertinent to the scope of this report:

Figure 1.10: Broad Approaches to Reconsider Content Delivery and Scheduling



Source: FutureWorks and Jobs for the Future[61]

Some of these approaches, along with others that commonly appear in the literature, are explored below.

ACCELERATED TERMS

Colleges and universities looking to reinvent their course scheduling are encouraged to look first at how they define course sessions. Across many institutions, a standard session is about 15 weeks, with courses offered Mondays through Fridays. However, "for many of today's adult students, the semester just does [not] cut it. It [is] too long. Work schedules and childcare obligations cannot be predicted. Campus is too far away […] Course length, class

[59] Bullet points taken verbatim from: Choitz, V. and H. Prince. "Flexible Learning Options for Adult Students." FutureWorks and Jobs for the Future, April 2008. p.7. http://www.jff.org/sites/default/files/publications/FlexibleLearning.pdf
[60] Ibid., p.9.
[61] Adapted from: Ibid.

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schedules, meeting venues, online components – colleges now tweak them all to marry convenience and speed."[62] Some alternatives to a standard session include:

- Offering **accelerated terms**, typically around eight weeks in length, such that students can enroll in two "mini terms" that remain equivalent in terms of objectives, learning outcomes and credits as the traditional alternatives.
- Reexamining **weekly meet times**, which often schedule classes on either a Monday/ Wednesday/Friday schedule or a Tuesday/Thursday schedule. In a survey at Volunteer State Community College, administrators found that students preferred Tuesday/Thursday classes, with a free fifth day of the week. The institutions recently switched to a Monday/Wednesday and Tuesday/Thursday schedule exclusively.[63]

Accelerated course scheduling in particular—in other words, "more meetings per week for fewer weeks"—can be beneficial for students who may be underprepared or very busy by helping to streamline the process and minimize the possibility of outside roadblocks. Indeed, "when you accelerate [a] course from 15 weeks to 12, eight, or six weeks, there [is] less of a chance for life to get in the way of that course."[64] Moreover, research suggests that students in accelerated courses or terms receive instruction that is comparable to standard college coursework, and that roughly 70 percent of students in these accelerated formats "demonstrated learning rated as satisfactory or above by faculty experts."[65]

Northeastern University, for example, uses full- and half-term scheduling at the College of Professional Studies to ensure that course schedules align with students' needs. Indeed, the institution "typically splits the traditional semester in half for about 300 for-credit courses, which are offered eight times a year."[66] Northeastern offers a variety of start dates and term lengths:

- **Fall Undergraduate**
  - September 4, 2017 – 7.5 and 15 week classes
  - October 25, 2017 – 7.5 week classes
- **Fall Graduate**
  - September 18, 2017 – 6 and 12 week classes
  - October 30, 2017 – 6 week classes[67]

[62] Simon, C.C. "The Weeklong Semester." *The New York Times*, November 2007. http://www.nytimes.com/2007/11/04/education/edlife/continuing-ed.html
[63] Bullet points adapted from: Mills-Senn, Op. cit.
[64] Kelly, Op. cit.
[65] Wlodkowski, R.J. "Evaluating the Quality of Accelerated Courses." American Educational Research Association, April 2005. p.1. http://www.raymondwlodkowski.com/Materials/EvaluatingQuality.pdf
[66] Simon, Op. cit.
[67] Bullet points adapted from: "Class Registration." College of Professional Studies, Northeastern University. http://www.cps.neu.edu/class-registration/

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As shown in Figure 1.11, the schedule at Northeastern is aligned between the full- and half-semester terms, meaning that the full semester and first half semester start on the same day, and the full semester and the second half semester end on the same day. Half-semester courses are offered in a variety of subjects, such as General Chemistry, Principles of Taxation, Lab for Biology, and others, as well as in various formats like traditional and blended.[68]

Figure 1.11: Undergraduate Fall 2017 Semester Calendars by Term Length at Northwestern University's College of Professional Studies

Item	Date(s)	Item	Date(s)
Full Fall Semester		**First-Half Fall Semester**	
Labor Day observed, no classes	Mon., Sept. 4	Labor Day observed, no classes	Mon., Sept. 4
First day of classes	Tues., Sept. 5	First day of classes	Tues., Sept. 5
Registration period	June 19 – Sept. 4	Registration period	June 19 – Sept. 4
Late registration period	Sept. 5 – Sept. 18	Late registration period	Sept. 5 – Sept. 11
Last day to withdraw *without* a "W"	Mon., Sept. 18	Last day to withdraw *without* a "W"	Mon., Sept. 18
Columbus Day observed, no classes	Mon., Oct. 9	Columbus Day observed, no classes	Mon., Oct. 9
Veterans' Day, no classes	Sat., Nov. 11	Last day to withdraw *with* a "W"	Sun., Oct. 22
Thanksgiving recess	Nov. 22 – Nov. 26	Fall first-half semester ends	Tues., Oct. 24
Last day to withdraw *with* a "W"	Sun., Dec. 10	**Second-Half Fall Semester**	
Full Fall semester ends	Sat., Dec. 16	First day of classes	Wed., Oct. 25
		Registration period	June 19 – Oct. 24
		Late registration period	Oct. 25 – Oct. 31
		Last day to withdraw *without* a "W"	Tues., Nov. 7
		Veterans' Day, no classes	Sat., Nov. 11
		Thanksgiving recess	Nov. 22 – Nov. 26
		Last day to withdraw *with* a "W"	Wed., Dec. 13
		Fall second-half semester ends	Sat., Dec. 16

Source: Northwestern University[69]

[68] "Course Search." College of Professional Studies, Northeastern University. http://www.cps.neu.edu/ci.php/courses/search

[69] Adapted from: "Academic Calendars." College of Professional Studies, Northeastern University. http://www.cps.neu.edu/class-registration/registration-calendar.php#fallsmst2017

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LATE-START COURSES

One option to help students ensure that they are enrolled in the appropriate course is to offer **late-start courses for core curriculum requirements.** These late-start courses begin several weeks into the term, and help institutions identify students who are underprepared for particular courses and "need to switch to a different one. The problem most students in this position face is that by the time they realize this, it is too late to secure a place in another course they need and get a successful start in that course."[70] This scheduling option is particularly beneficial for students who are only enrolled in 12 credits, and whose full-time status would be affected by dropping a course. Experts posit that "one option is for these students to switch from the course in which they are having problems into one which would count productively towards their degree goal. Since a few weeks of the semester have already passed, joining a course in progress puts the student at a disadvantage. A late-start course […] is an ideal choice."[71] The Director of Academic Advising and Retention Services at Miami University's Hamilton campus provides an anecdotal example of the benefits of late-start courses:

> […] consider a student who is registered for Algebra II, and realizes two or three weeks into the term that they will need to refresh Algebra I in order to succeed in the course. An institution with an Algebra I section that begins in the fourth week of the term will be in the best position to help this student…continue to progress toward graduation, rather than just adding electives that term.[72]

SAME-TERM BRIDGE COURSES

Same-term bridge courses can serve to help colleges and universities address the needs of underprepared students "on the front end." These courses typically run for two or three weeks prior to the start of term, and are "designed specifically for students who placed as almost college-ready but who could use a quick, intense brush-up in key areas."[73] Same-term bridge courses serve as an alternative to more traditional bridge courses that are offered over the summer – in these more standard models, either students have to apply and pay separately for the summer term options, or they have to enroll in the courses during the fall term and replace other classes that may count toward their degrees. At Miami University, administrators note two key benefits:

- Courses are counted toward the course load for the fall term which has benefits as far as tuition calculations and financial aid; and
- When the students begin the regular fall courses, they can attend with their peers and with their own cohort, which boosts retention.[74]

[70] Fusch, Op. cit.
[71] Sukhatme, U. "'Triple Play' Aims to Improve Retention and Graduation Rates." *The Chronicle of Higher Education*, July 2014. http://www.chronicle.com/blogs/letters/triple-play-aims-to-improve-retention-and-graduation-rates/
[72] Fusch, Op. cit.
[73] Ibid.
[74] Bullet points adapted from: Ibid.

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SECTION II: INSTITUTIONAL CASE PROFILES

In this section, Hanover reviews the course scheduling practices in place at selected public institutions across the United States. After a high-level examination of scheduling policies at selected institutions, this section then provides several in-depth profiles of exemplary and/ or innovative practices.

OVERVIEW OF SCHEDULE PRACTICES AT SELECTED PUBLIC INSTITUTIONS

Overall, there is limited publicly accessible information available about course scheduling. As seen in Figure 2.1, selected institutions only provide basic information about scheduling and the course catalog, without going into detail about how their schedules are structured or implemented. Later in this section, the in-depth profiles of exemplary course schedules provide additional details regarding best practices and innovative policies.

Among the selected institutions, however, some basic similarities emerge based on available information. Unsurprising, the registrar's office is largely responsible for creating the course catalog and scheduling classes. At the University of California-Riverside, for instance, the Office of the Registrar takes a "leadership role in the accurate and efficient management of data in the primary functional areas of the office: registration, student academic records, *course and classroom scheduling*, *classroom utilization*, publications productions, and data distribution."[75] Likewise, George State University operates an Office of Classroom Scheduling within the Office of the Registrar to oversee these functions.[76] In this way, the registrar is responsible for collecting and interpreting enrollment and class utilization data to (ideally) inform future course catalogs.

To this end, **each of the examined institutions employs dedicated personnel for scheduling.** This ranges from the broad position of Associate Registrar of Enrollment and Registration Services Center at Georgia State University to more dedicated positions at Indiana University-Purdue University-Indianapolis like the Associate Registrar of Course Enrollment and Record Management, the Manger of Enrollment Systems, the Class Data Coordinator, and the Facilities Coordinator. This suggests that institutions maintain staff that are dedicated predominately to course scheduling, providing additional capacity for these colleges and universities to effectively collect and leverage enrollment and usage data during scheduling.

[75] "About Us." Office of the Registrar, University of California-Riverside. http://registrar.ucr.edu/registrar/help-desk/about-us.html

[76] "Reservation Guidelines." Office of the Registrar, Georgia State University. http://registrar.gsu.edu/classroom-reservations/reservation-guidelines/

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Figure 2.1: Key Characteristics of Scheduling Framework at Selected Institutions

Institution	Location	Primary Scheduling Office	Primary Scheduling Personnel	Degree Planning Tool/ Platform	Nontraditional Course Offerings		
					Weekend	*Online**	*Evening*
Georgia State University	Atlanta, GA	**Enrollment Services**	▪ Associate Registrar – Enrollment and Registration Services Center	Panther Access to Web Services (PAWS)	--	✓	✓
Indiana University-Purdue University-Indianapolis	Indianapolis, IN	**Office of the Registrar**	▪ Associate Registrar – Course, Enrollment, and Record Management ▪ Manager, Enrollment Systems ▪ Class Data Coordinator ▪ Facilities Coordinator	My Planner	--	✓	✓
University of Akron	Akron, OH	**Office of the University Registrar**	▪ Director of Campus Planning and Space Utilization (Capital Planning and Facilitates Management) ▪ Scheduling staff ▪ Degree Progress Report staff	Degree Auditing Report System	✓	✓	✓
University of California-Riverside	Riverside, CA	**The Office of the Registrar**	▪ Assistant Registrar – Scheduling, Courses, and Degree Audit ▪ Scheduling Analyst ▪ Academic Scheduling Assistant	R'Web – Term Plan	--	✓	✓
University of Central Florida	Orlando, FL	**Registrar's Office**	▪ University Registrar ▪ Program Assistant, Scheduling ▪ Facilities Scheduler	mySchedule Builder	✓	--	✓

Source: Institutional Websites
*Note that this refers to online courses that are designed for on-campus students.

IN-DEPTH PROFILES

In the remainder of this section, Hanover provides a closer review of course scheduling practices and policies in place at other institutions. These institutions are recognized in the literature as implementing particularly innovative or effective scheduling frameworks.

The City University of New York

The City University of New York (CUNY) is a large public institution located predominately in New York City that operates 25 different campuses across the city's five boroughs. Across

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degree plans—ranging from two-year degrees to doctoral programs—CUNY enrolls more than 200,000 students. According to the University, "CUNY colleges offer a seemingly infinite array of academic programs taught by award-winning faculty, as well as sports, internships, scholarships, and community service opportunities."[77]

Office of the University Registrar and Campus Registrars

The central Office of the University Registrar (OUR) at CUNY serves as a resource for the individual campus registrars, and works at the system level to ensure that University policies are equitable and consistent across the campuses. OUR is also responsible for assessing the performance of the individual campuses to ensure that CUNY remains "in the forefront of quality customer service, successful deployment of technology, and effective leadership."[78] However, for the most part, **campus registrars and their staff are responsible for making the primary scheduling policies and decisions at their individual colleges.**

Structured Scheduling

CUNY is recognized by Complete College America—a national research, advocacy, and technical assistance organization that works to help more people earn college degrees and close the attainment gaps for traditionally underrepresented populations [79] —as implementing an exemplar model of **structured schedules**. According to the organization, structured schedules "help working students balance jobs and school by using structured scheduling of classes to add predictability to their busy lives."[80] In particular, CUNY maintains an Accelerated Study in Associate Programs (ASAP) initiative that embodies structured scheduling.

ASAP is a unique program that helps students earn their associate's degrees within three years and provides a wide range of personal, academic, and financial supports (e.g., career counseling, tutoring, tuition waivers, etc.). Importantly, **ASAP offers "special class scheduling options to ensure that ASAP students get the classes they need, are in classes with other ASAP students, and attend classes in convenient blocks of time** to accommodate their work schedules."[81] This structured scheduling is part of ASAP's broader mission to create and maintain pathways that support academic momentum (Figure 2.2) such as block-scheduled first-year courses, promoting full-time enrollment, and coursework offered during nontraditional terms (i.e., summer and winter). Through this schedule framework, ASAP students enjoy a graduation rate that is double that of their peers in other programs (53 percent compared to 24 percent).[82]

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[77] "About." City University of New York. http://www2.cuny.edu/about/

[78] "About Us." University Registrar, City University of New York. http://www2.cuny.edu/about/administration/offices/registrar/about-us/

[79] "Our Work." Complete College America. http://completecollege.org/about-cca/

[80] "The Game Changers." Complete College America. http://completecollege.org/the-game-changers/

[81] "ASAP Accelerated Study in Associate Programs." City University of New York. Emphasis added. http://www1.cuny.edu/sites/asap/

[82] "Significant Increase in Associate Degree Graduation Rates: CUNY Accelerated Study in Associate Programs (ASAP)." City University of New York, March 2017. p.1. http://www1.cuny.edu/sites/asap/wp-content/uploads/sites/8/2017/03/ASAP_Program_Overview_Web.pdf

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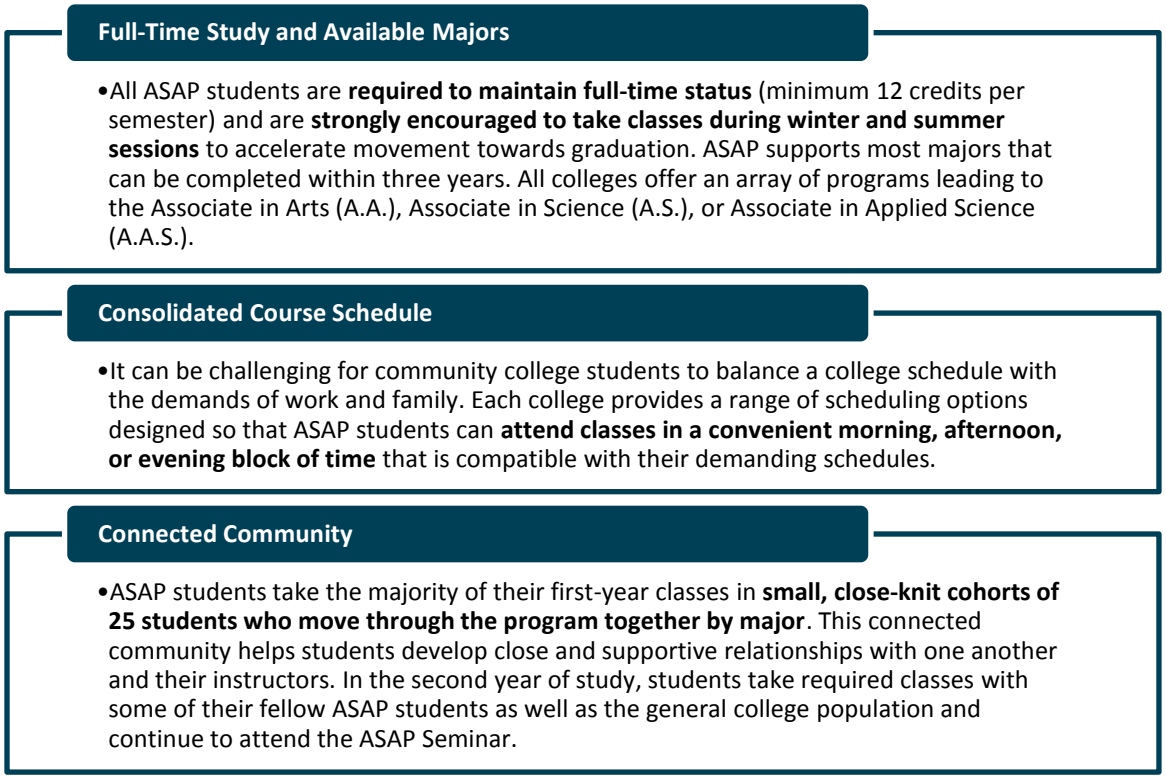
Figure 2.2: Key Components of ASAP's Scheduling Framework at CUNY



Source: City University of New York[83]

For example, students are enrolled in block schedules based on their preferred time of day. The morning block, for instance, runs from 8:00am to 12:00pm from Monday to Friday. Additionally, students are grouped in cohorts by major, which allows ASAP participants to attend classes at the same time from day to day with the same people.[84] Complete College America studied CUNY's model, and based on their observations and the overall success of the ASAP program, developed the following key considerations and best practices:

- **Full-time enrollment should be emphasized.** Full-time students are much more likely to graduate. Use a structured schedule to enable more students to go full time by designing five-day-a-week structures in morning or afternoon blocks.
- **Structured scheduling should be combined with whole program choices.** Structured scheduling is easiest to accomplish when it is used in whole programs of study. Students make one choice—their program of study—and then colleges make the decision about the necessary sequence of courses. The colleges then block the required course sequences in coherent, connected schedules.

[83] Adapted from: "ASAP At A Glance." City University of New York. http://www1.cuny.edu/sites/asap/about/asap-at-a-glance/

[84] "Best Practices: Structured Schedules." Complete College America. http://completecollege.org/strategies/#stratHolderStructScheduling

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- **Fifteen credits per semester.** To finish on time, full-time enrollment should mean 15 credits per semester. The five-day structure of well-designed block schedules makes accomplishing this much more possible.
- **Student cohorts boost success.** When students in the same program of study move from course to course on the same schedule five days a week, working groups and learning communities of students commonly form. These informal alliances provide vital student-to-student support and a strong sense of connectedness to faculty and institutions.[85]

ASAP's structured schedule thus facilitates full-time study among a group of students who may otherwise enroll on a part-time (or inconsistent full-time) basis. Because full-time study has been shown to have benefits in terms of graduation rates, engagement levels, and faculty relationships, institutions may consider implementing structured scheduling for the first semesters of a student's time in college (e.g., for core university or major requirements).[86]

Degree Mapping

As mentioned above, ASAP's support structure is intended to **help students build academic momentum.** This is part of a broader institutional priority to get all students to enroll in 15 credits per semester (or 30 credits per year) – this effort varies by campus from simple pop-up windows during course registration for all students who enroll in 12 credits (e.g., College of Staten Island) to dedicated information campaigns and associated templates for showing students how they can graduate in four years (e.g., John Jay College's *Finish-in-Four* effort).[87]

Part of CUNY's effort to build and maintain academic momentum is to create degree maps, which are "semester-by-semester plans for all majors in a given college for full-time and part-time courses of study. These can be static documents that simply lay out the curricula of each major by semester, or they can be interactive, online tools to understand the courses and time needed to complete degrees."[88] The goal of this initiative is to make the pathway to graduation as clear as possible for all students by explicitly indicating how degree elements such as core curriculum, major requirements, and prerequisite coursework all fit together. **Degree mapping will also help facilitate the creation of structured schedules outside of solely the ASAP program.**[89]

The Office of Advising at CUNY's Hunter College, for example, is in the process of collaborating with all the college's academic departments to develop degree maps, which will "contain

[85] Bullet points adapted from: "Structured Schedules." Complete College America. http://completecollege.org/the-game-changers/#clickBoxOrange
[86] Waiwaiole, E. "Students Who Go to College Full-Time are More Likely to Graduate." *USA Today College*, May 2017. http://college.usatoday.com/2017/05/16/students-who-go-to-college-full-time-are-more-likely-to-graduate/
[87] "The Connected University: CUNY Master Plan 2016-2020." City University of New York. p.51. http://www2.cuny.edu/wp-content/uploads/sites/4/page-assets/blog/cuny_reusable_comp/master-plan/CUNY_Master_Plan_15-FINAL.pdf
[88] Ibid., p.52.
[89] Ibid.

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suggested courses to follow and complete, term-by-term, and make it easier to understand how to graduate in four years with [a] major."[90] Hunter College states that, currently, the degree maps serve as frameworks for degree completion, rather than required sequences:

> Degree Maps are a tool to assist you and your advisor with planning your academic path to graduation. Use this important tool with the program of study information for your major (found in the Hunter Catalog) and Degree Works (student degree audit system) to discuss your academic plan and course selections with your advisor. It [is] important to note that each student's specific program of study could, and probably will, look different. **You need to customize the Degree Map to fit your situation.**[91]

Given the breadth of courses offered across CUNY's campuses (more than 36,000 each year), degree mapping aims to help students better take advantage of these offerings. Students are encouraged to take classes at campuses other than their home campus across CUNY – this helps when courses are unavailable or full at the home campus or other campuses are hosting renowned guest lecturers, for example.[92] In short, degree maps ensure that students have a path to graduation in four years and that institutions can promote their full catalog of courses.

UNIVERSITY OF IOWA

The University of Iowa (UIowa) is a large flagship institute located in Iowa City, Iowa. The University enrolls roughly 24,476 undergraduate students across 11 colleges, along with an additional 8,858 graduate, professional, and post-graduate students. UIowa boasts a 16-to-one student-to-faculty ratio, despite its matriculation size, and most courses (78 percent) enroll fewer than 30 students.[93]

OFFICE OF THE REGISTRAR AND SCHEDULE REFINEMENT TEAMS

The Office of the Registrar at UIowa oversees the institution's course catalog and scheduling apparatus, including dedicated personnel for graduation analyses, the general course catalog, and classroom scheduling.[94] The Office asserts that "selecting the appropriate courses to enroll in is a vital component to ensuring student success at the University of Iowa […] Students should view the General Catalog for degree requirements for all colleges, departments, and schools."[95]

As shown in Figure 2.3, **the Office of the Registrar begins planning for the subsequent term almost one year in advance.** For the Fall 2017 term—which begins on August 21, 2017—faculty and administrators needed to have submitted course approval forms to the Office by November 2016. Further, students could begin planning their upcoming schedules as early as

[90] "Degree Maps." Hunter College. http://www.hunter.cuny.edu/advising/my-academic-path/major-maps-1
[91] Ibid. Emphasis added.
[92] "The Connected University: CUNY Master Plan 2016-2020," Op. cit., p.53.
[93] "About the University of Iowa." University of Iowa. https://uiowa.edu/homepage/about-university-iowa
[94] "Contact." Office of the Registrar, University of Iowa. https://registrar.uiowa.edu/contact
[95] "Courses & Exam Information." Office of the Registrar, University of Iowa. https://registrar.uiowa.edu/courses-exam-information

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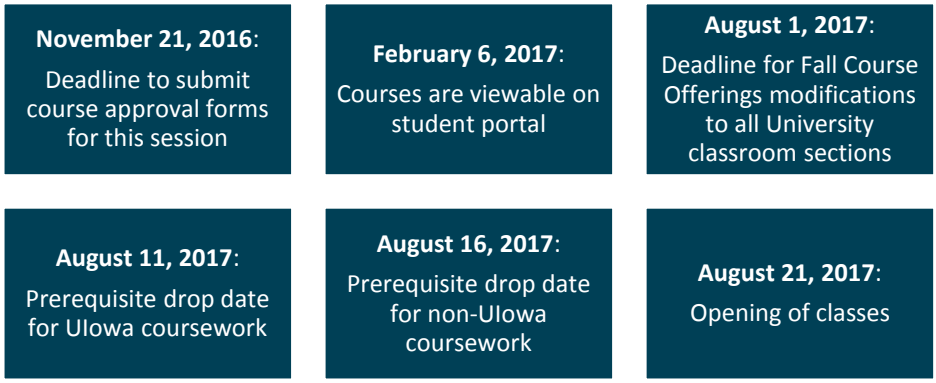
February 6, 2017 – seven months before the start of the next term.[96] This provides ample time for student to meet with academic advisors and ensure that their schedules align with their needs and the University's capacities.

Figure 2.3: Academic Scheduling Calendar, Fall 2017 Session



Source: University of Iowa[97]

As mentioned above, UIowa maintains a dedicated team that manages classroom scheduling that is largely responsible for putting together the course catalog. This team "manages classroom assignments through a commercial software package that includes an optimization algorithm that they leverage effectively."[98] Despite this dedicated team, Ad Astra found that only a small proportion of UIowa's courses are overloaded (i.e., over 95 percent full) and student demand seems to necessitate additional sections.[99] To resolve these deficiencies, **UIowa should create a schedule refinement team to review course demand and enrollment data.** Per Ad Astra, this team should consist of representatives from the Provost's office, Registrar's office, and individual academic units. Ideally, the institution could merge this team with the existing classroom scheduling unit to "increase the coordination of their processes, goals, and policies. Course scheduling and room scheduling are inherently interdependent activities which are rarely coordinated sufficiently."[100] This more comprehensive schedule refinement team would help the University:

- **Meet enrollment needs with finite faculty and space.** Unneeded offerings and late cancellations superficially limit capacity of academic space. Additionally, a false belief of being "out of space" keeps many institutions from adding offerings that they know students need.
- **Set term goals and policies.** Following a change management system that includes celebration of a student-focused scheduling approach and related wins.

[96] "Academic Calendar." Office of the Registrar, University of Iowa. https://registrar.uiowa.edu/academic-calendar#!fall-2017
[97] Adapted from: Ibid.
[98] "Tier Project Findings: University of Iowa." Ad Astra Information Systems, October 2015. p.10. http://www.iowaregents.edu/media/cms/adastra102215-pdf2A86B04B.pdf
[99] Ibid., p.7.
[100] Ibid., p.10.

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- **Integrate historical course demand analysis with student pathways and/or student-specific progress through degree rules.** This forward-looking assessment of students' course needs is an effective way to enhance the existing historical schedule analysis to better predict changes based on enrollment shifts, degree rule/prerequisite changes, and student preferences.[101]

Relatively minor adjustments in course schedules—such as slight increases in enrollment caps for high-demand courses or rescheduling room assignments to take advantage of primetime utilization—can be identified by such a team.

TIME-BLOCK SCHEDULING

UIowa recently implemented a standardized time-block model for scheduling all courses, primarily to help alleviate some fiscal challenges that the University has been experiencing. According to the Office of the Registrar, "following standard set scheduling patterns with compatible start and ending times, the overall schedule fits together with less conflict in a consistent and equitable manner."[102] The new policies—which were established by the classroom scheduling team and approved by the Provost—apply to all colleges and departments that use university classrooms (e.g., Liberal Arts and Sciences, Education). Overall, the institutions implemented time-block scheduling because:

> Use of scheduling regulations permits efficient exercise of available classroom space as well as provides an orderly framework for instructional planning to reduce course concentration. **Use of standard time blocks also allow students greater flexibility** and opportunity in scheduling classes offered by different departments or colleges.[103]

The time blocks allow UIowa to standardize the general class assignments and time sequences to facilitate consistency between terms, as well as help students manage and schedule their course load. This model is also useful in helping the institution utilize all classrooms across the campus. As Ad Astra found, UIowa's "generally assigned classrooms" are used almost three times as much as the "departmentally owned classrooms," and that these owned spaces "make up 39 percent of the classroom inventory and significantly limit effective enrollment capacity and the ability to meet students' course needs."[104] **Time-block scheduling offers one solution to this problem by centrally overseeing and assigning general purpose classrooms and centrally managing all other class spaces.** Other benefits to this new system, as espoused by UIowa, include:

[101] Bullet points taken verbatim from: Ibid.
[102] "Standardized Time-Block Model." Office of the Registrar, University of Iowa. https://registrar.uiowa.edu/standardized-time-block-model
[103] Ibid. Emphasis added.
[104] "Tier Project Findings: University of Iowa," Op. cit., p.7.

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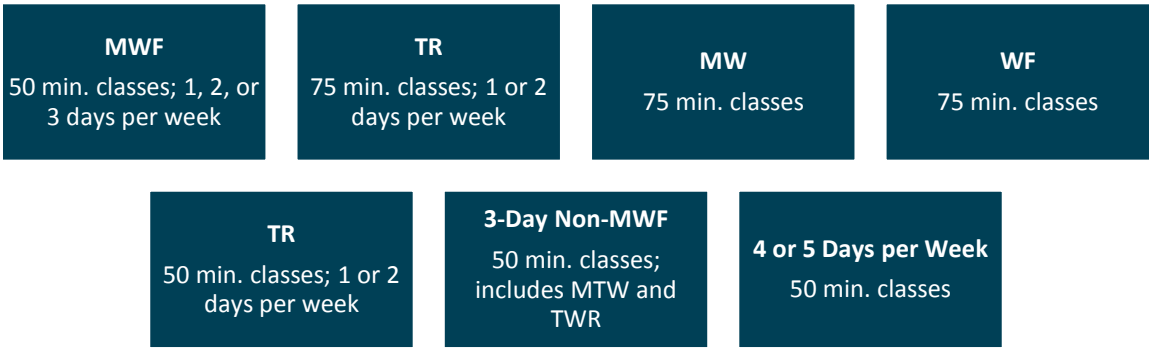
- Standardized evening class times reduce class scheduling overlaps and number of classroom facilities required, allowing for reduced energy consumption in academic buildings;
- Expands standard class time options for course offerings to maximize registration opportunities for both traditional and nontraditional students in both daytime and evening sessions;
- Raises university classroom utilization efficiencies for continued enrollment increases;
- 7:30am MWF class time slot was identified with 10 percent utilization of the university classroom capacity – time slot remains available by departmental request;
- 8:30am MWF becomes *new* official start time across all university classrooms;
- Additional TTh class time slot (12:30-1:45pm) offers new scheduling option within the coveted "primetime" – as a result, provides opportunities for expanded growth with addition of 221 new class time periods requiring no additional building funds to create classroom space; and
- TTh class start times will now begin on either the hour or half-hour by increasing TTh class pass times to 15 minutes – doing so provides more intuitive class schedules for students and faculty.[105]

Thus, the time-block model allows UIowa departments to input courses in regular time slots. These blocks can meet in various combinations, depending on the course requirements and department needs or resources. For example, courses can meet three times a week for 50 minutes (e.g., Monday/Wednesday/Friday; Monday/Tuesday/Wednesday; or Tuesday/ Wednesday/Thursday) or two times a week for 75 minutes (Figure 2.4). Appendix A provides the full time-block schedule.

Figure 2.4: Class Meeting Time Options at UIowa



Source: University of Iowa
*Note that "R" refers to Thursday.

[105] Bullet points adapted from: "Standardized Time-Block Model," Op. cit.

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CLASSROOM SCHEDULING AND CLASS ALLOCATIONS

As discussed above, the classroom scheduling unit plays a major role within the Office of the Registrar and in developing the course catalog at UIowa. The newly-centralized team is responsible for scheduling the use of classrooms (e.g., lecture halls, discussion rooms, seminar rooms, etc.) for regular courses, as well as special events throughout the year. Notably, classroom scheduling relies on "computerized scheduling which **determines classroom assignments based on efficient classroom utilization, technology needs, and departmental building preferences, whenever possible."**[106] This computerized scheduling software is provided by Ad Astra (Astra Schedule 7) and the tools "provide multiple ways to view information about activities, classrooms, and resources across the University Classroom pool quickly and easily."[107]

Effective July 2017, the University completed an audit of all classroom and instructional spaces across the campus. As a result, all instructional spaces are now under the purview of the classroom scheduling team and additional "scheduling strategies are being implemented by the Office of the Provost to increase collaboration, better match teaching pedagogy with instructional space, improve campus-wide academic facility utilization, and optimize the use of instructional spaces across the campus ***through centralization***." [108] To facilitate this centralized scheduling team and apparatus, UIowa redesigned classroom spaces according to three new categories: university classroom, programmed classroom, and specialty space (Figure 2.5).

Importantly, all departments are expected to use their own specific classroom spaces for 30 hours per week *before* requesting the use of university-wide classroom space. The classroom scheduling team at UIowa reports all classroom utilization statistics to the Provost, and departments with underutilized classroom spaces may be required to repurpose that unused space for other departments.[109] Moreover, courses that do not meet 60 percent enrollment of available seats will often be reassigned to smaller spaces by the Office of the Registrar, regardless of departmental affiliation (pending instances where the classroom assignment is dependent on particular seating arrangements or equipment).[110]

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[106] "Classroom Scheduling." Office of the Registrar, University of Iowa. https://registrar.uiowa.edu/classroom-scheduling

[107] "Ad Astra 7.5 User Guide." University of Iowa. p.1. https://classrooms.uiowa.edu/sites/classrooms.uiowa.edu/files/wysiwyg_uploads/ad_astra_7.5.15_user_guide_revision_030617.pdf

[108] "TIER Classroom Initiative." Office of the Registrar, University of Iowa. Emphasis added. https://registrar.uiowa.edu/tier-classroom-initiative

[109] "Fall and Spring – Policies and Procedures." Office of the Registrar, University of Iowa. https://registrar.uiowa.edu/fall-and-spring-policies-and-procedures

[110] Ibid.

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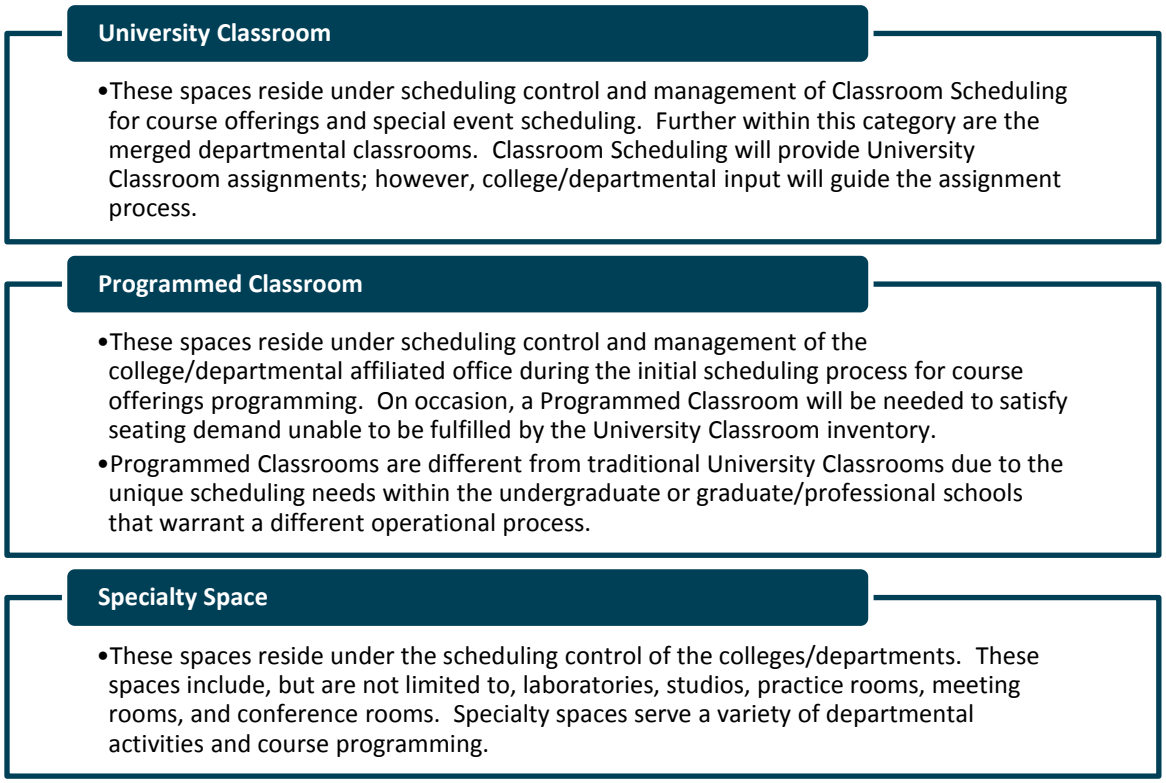
Figure 2.5: Instructional Space Categories at UIowa



Source: University of Iowa[111]

UNIVERSITY OF TEXAS EL PASO

The University of Texas El Paso (UTEP) is a research institution located in El Paso, Texas that is the only doctoral university in the United States to enroll a predominately Mexican-American student population. UTEP enrolls almost 24,000 students across 72 undergraduate programs, 74 master's programs, and 21 doctoral programs. Notably, the University established the El Paso Collaborative for Academic Excellence to serve as an articulated PreK-16 initiative with participating school districts, community colleges, and businesses.[112]

REGISTRATION AND RECORDS OFFICE, ENROLLMENT SERVICES

Generally, the Office of the Registrar at UTEP is responsible for "publishing the class schedule, maintaining the academic calendar, and scheduling classrooms."[113] Unlike UIowa, UTEP does not begin preparing the course catalog for the upcoming term until the preceding semester. As shown in Figure 2.6, the final course schedule for Fall and Summer 2017 was not finalized and open to students until March 2017 – suggesting that students may not have as much time to plan their coursework as at other institutions.

[111] Adapted from: "Instructional Space Categories." University of Iowa. https://classrooms.uiowa.edu/instructional-space-categories
[112] "About UTEP." University of Texas El Paso. https://www.utep.edu/about/about-utep.html
[113] "Office of the Registrar." University of Texas El Paso. http://academics.utep.edu/Default.aspx?alias=academics.utep.edu/registrar

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Figure 2.6: Academic Scheduling Calendar, Summer/Fall 2017 Session

Source: University of Texas El Paso[114]

The Registration and Records Office finalizes all classroom assignments, thus playing an integral role in overall course scheduling. It does so by maintaining a central database of all the classroom space on campus (however, the Office notes that "the Registration and Records Scheduling Office is not responsible for the maintenance and upkeep of the rooms").[115] The Office keeps track of seat capacity, room type (e.g., classroom, auditorium, lab, etc.), and resources in each room so that faculty and administrators who request the rooms for courses are placed in spaces that meet their needs. Figure 2.7, presented on the following page, shows a sample of this central database at two buildings at UTEP.

[114] Adapted from: "Class Scheduling Resources." Registrations and Records Office, University of Texas El Paso. http://academics.utep.edu/Default.aspx?tabid=60168

[115] Accessed from: "Registration and Records Scheduling Rooms." Registrations and Records Office, University of Texas El Paso. http://academics.utep.edu/Default.aspx?tabid=60168

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Figure 2.7: Space Characteristics at Select Buildings

Room Number	Max. Seats	Room Type	PC	Laptop Ready	Lab-Comp. Room	Doc Camera	Microphone	Whiteboard	Chalkboard	Movable Chairs	Fixed Chairs	Excellent Wireless	Plugs	Notes
Bell Hall														
130A	30	Classroom	✓	✓		✓		✓		✓				Standard tablet desks; Overhead
143	40	Classroom	✓	✓		✓		✓	✓	✓				Standard tablet desks
Business Administration Building														
301	55	Classroom	✓	✓		✓			✓	✓		✓		DVD/VHS, Standard tablet desks
302	62	Classroom	✓	✓		✓			✓	✓		✓		DVD/VHS, Standard tablet desks
304	48	Classroom	✓	✓		✓			✓	✓				DVD/VHS, Standard tablet desks
309	145	Auditorium	✓	✓		✓			✓		✓	✓		DVD/VHS, Seating-Auditorium with tablet
312	80	Auditorium	✓	✓		✓			✓		✓	✓		DVD/VHS, Seating-Auditorium with long tables
323	110	Auditorium	✓	✓		✓			✓		✓	✓		DVD/VHS, Seating-Auditorium with tablet
318	80	Auditorium	✓	✓		✓			✓		✓	✓	50%	DVD/VHS, Seating-Auditorium with tables and chairs
319	80	Auditorium	✓	✓		✓			✓		✓	✓	50%	DVD/VHS, Seating-Auditorium with tables and chairs
321	48	Classroom	✓	✓		✓			✓	✓				DVD/VHS, Standard tablet desks
323	100	Auditorium	✓	✓		✓			✓		✓	✓		DVD/VHS, Seating-Auditorium with tablet

Source: University of Texas El Paso[116]

Time-Block Scheduling

UTEP uses a time-block model to schedule courses across standard meeting times. The Registration and Records Office specifically notes four key considerations to keep in mind regarding this scheduling scheme:

- Classes should use standard time blocks, as listed, in order to maximize space resources on campus;

[116] Adapted from: Ibid.

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- Afternoon lab courses may be offered at times other than those indicated;
- Only Upper Division and Graduate courses may meet once per week; and
- Requests for alternative time periods must be submitted in advance to the Scheduling Office via a *Request to Offer Course at Non-Standard Time and/or Off-Campus* form.[117]

For undergraduate students, this means that typical courses either meet two days per week or three days per week. However, UTEP also operates Saturday classes for Upper Division undergraduates, as well as longer once-per-week courses.

Figure 2.8: Standard Course Meeting Times

Long Term Meeting Days & Times	
MWF	7:30 am – 8:20 am
MWF	8:30 am – 9:20 am
MWF	9:30 am – 10:20 am
MWF	10:30 am – 11:20 am
MWF	11:30 am – 12:20 pm
MWF	12:30 pm – 1:20 pm
MWF	1:30 pm – 2:20 pm
MWF	2:30 pm – 3:20 pm
MW or TR	7:30 am – 8:50 am
MW or TR	9:00 am – 10:20 am
MW or TR	10:30 am – 11:50 am
MW or TR	12:00 pm – 1:20 pm
MW or TR	1:30 pm – 2:50 pm
MW or TR	3:00 pm – 4:20 pm
MW or TR	4:30 pm – 5:50 pm
MW or TR	6:00 pm – 7:20 pm
MW or TR	7:30 pm – 8:50 pm
S	8:00 am – 10:50 am
S	11:00 am – 1:50 pm
S	2:00 pm – 4:50 pm
Upper Division & Graduate Evening Options (meets one day/week)	
M or T or W or R	6:00 pm – 8:50 pm
M or T or W or R	7:00 pm – 9:50 pm

Source: University of Texas El Paso[118]

The course schedule, as seen in Figure 2.8, largely differentiates between Monday/Wednesday/Friday classes and those that only meet twice per week; either Monday/Wednesday or Tuesday/ Thursday. Notably, UTEP's Saturday classes are longer, meeting for 170 minutes, similar to the evening classes reserved for Upper Division or Graduate students.[119] The move to this block scheduling format has been part of a larger University-wide initiative to review and modify courses as needed to align with best practices and to streamline student experiences. For example, the College of Health Sciences' strategic plan highlights the continued implementation of the block scheduling program as a key priority. The College of Health Sciences also intends to "continue to review and modify the undergraduate prerequisite courses to ensure they are complying with the latest research and evidence-based practices" and "review and modify as necessary [the] UTEP Knowledge and Clinical Competencies" to ensure that students not only are enrolling in courses efficiently, but that those courses align with industry standards.[120]

[117] Bullet points taken verbatim from: "Class Scheduling Resources," Op. cit.
[118] Image taken from: Ibid.
[119] Ibid.
[120] "Program Strategic Plan." College of Health Sciences, University of Texas El Paso. http://www.utep.edu/chs/slp/about/strategic-plan.html

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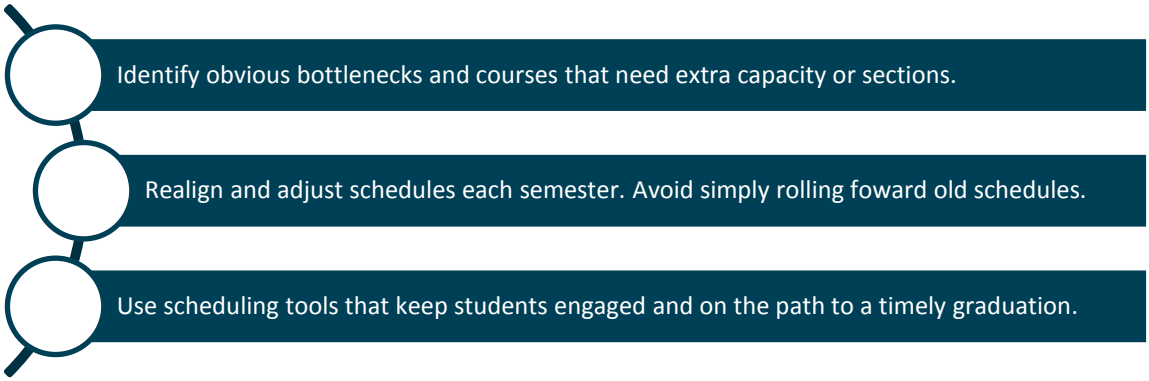
DATA-DRIVEN SCHEDULING

Finally, the move to block scheduling was in and of itself a part of a wider strategic initiative to introduce data-driven scheduling to UTEP. Like UIowa, UTEP uses Astra 7 scheduling technology to make scheduling decisions based on student enrollment patterns and space availability. The transition to dedicated scheduling based on data-driven decision making stemmed from the institution's increasing enrollment rates. According to the Senior Director of Enrollment, "We have a large and dynamic enrollment which is great, and we want to make sure we [are] making continuous improvements in accreditation measures. Like all great institutions, we [have] got to manage quality by looking at outcomes like completion rates and degrees awarded."[121]

A central priority for the course scheduling and enrollment teams at UTEP is to ensure that students can maintain a course load that is balanced and that they can move through quickly towards graduation. Through the Astra Schedule platform, the University has been better able to match the course catalog and schedule to student needs. Indeed, "the better visibility into enrollments, fill rates, sections, and primetime versus off-grid scheduling has created a shift in culture at UTEP."[122] The tools encourage administrators and faculty to consider both context and transparency when making scheduling decisions. Access to these data has helped UTEP administrators:

Figure 2.9: Key Outcomes of Using Enrollment Technology and Data to Make Scheduling Decisions



Source: Ad Astra Information Systems[123]

[121] "Improving Access and Increasing Degrees Awarded." Ad Astra Information Systems. p.1. https://www.aais.com/wp-content/uploads/2015/08/University-of-Texas-El-Paso.pdf
[122] Ibid., p.2.
[123] Adapted from: Ibid.

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APPENDIX A: TIME BLOCKS AT THE UNIVERSITY OF IOWA

This appendix presents the standardized time blocks recently implemented at UIowa.

Figure A.1: Fall and Spring Standardized Time Blocks

Source: University of Iowa[124]

[124] Adapted from: "Standardized Time-Block Model," Op. cit.

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