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Smart Growth: Running the Academy by the Numbers

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Understanding Your Current Practice: Diagnostic Questions

The following questions are designed to guide members in evaluating their current activities. These categories should be used to spotlight tactics that map to institutional challenges.

Removing Scheduling Bottlenecks	Yes	No
1. Does the registrar track seat utilization in addition to room utilization?	❏	❏
2. Does the registrar track utilization during prime time (the busiest time on the schedule)?	❏	❏
3. Can the registrar break out utilization by room type?	❏	❏
4. Has the institution identified specific room sizes that are bottlenecks (i.e., greater than 80 percent utilization)?	❏	❏
5. Do all general classrooms meet the same minimum technology standard?	❏	❏
6. Are standard meeting patterns (block scheduling) enforced?	❏	❏
7. Are there limits on the percentage of classes that each department can schedule during prime time?	❏	❏
8. Has the institution taken steps to reduce unnecessary activities in bottleneck spaces?	❏	❏
9. Are there plans to reduce (or eliminate) the percentage of classrooms "owned" by individual departments?	❏	❏

If you answered "no" to any of the above questions, please turn to:

Consolidating Unnecessary Sections		
1. Does the institution analyze how close to the cap each section is (the section enrollment ratio)?	❏	❏
2. Has the registrar calculated the number of underenrolled sections that could be consolidated without pushing enrollment in the remaining sections over the cap (i.e., statistically unnecessary sections or section-reduction candidates)?	❏	❏
3. Has the institution set explicit criteria for cancelling underenrolled courses?	❏	❏
4. Has the registrar identified unnecessary sections scheduled during prime time?	❏	❏
5. Has the registrar identified unnecessary sections scheduled in bottleneck spaces?	❏	❏
6. Have the provost and deans reviewed section reduction candidates to identify those that could generate the greatest cost savings or capacity increase?	❏	❏
7. Does the registrar use historical enrollment data to predict student demand for each course?	❏	❏
8. Can the registrar leverage degree maps to predict demand for courses in the coming term?	❏	❏
9. Does the institution have clear criteria to decide in advance when to add sections to overenrolled courses?	❏	❏

If you answered "no" to any of the above questions, please turn to

Reducing Nonessential Credits

1. Has the institution identified the choke point courses whose capacity limits enrollment in an entire program? ❏ ❏

2. Has the institution identified "super seniors" with more than 120 percent of credits required for a degree? ❏ ❏

3. Do advisors automatically register students for required courses? ❏ ❏

4. Do advisors limit registration for super seniors to required courses? ❏ ❏

5. Has the institution restricted the number of majors and minors that students can take? ❏ ❏

6. Has the institution set limits on when students must declare a major and how late they can add or change a major? ❏ ❏

7. Does the registrar give lower priority to students registering to repeat a course? ❏ ❏

8. Are students required to obtain formal approval before registering to repeat a course? ❏ ❏

If you answered "no" to any of the above questions, please turn to

Top Lessons from the Study

The Smart Growth Imperative

- **An era of diminished resources.** The current economic recession has changed the economic context in which colleges and universities operate. A rising chorus of politicians and pundits express their exasperation at continued cost increases in higher education and threaten more accountability through performance-based funding and increased transparency. Even more importantly (and urgently), state budget cuts, declining family incomes and home equity, and weak annual giving have forced year after year of budget cuts at institutions both public and private, large and small. Few expect a return to the days of steadily increasing resources with few strings attached.

- **Cuts will be necessary, but not sufficient.** The obvious response is to cut—administrative costs, low-enrollment programs, non-required courses, contingent faculty. Cost cutting will no doubt continue, but on its own, it cannot solve the problem. Most of the costs at colleges and universities are essentially fixed, particularly faculty and facilities. Moreover, all higher education institutions aspire to do more, not less. No one believes that they can "cut their way to greatness." In fact, most educators see a zero-sum game in which cost cutting inevitably harms both student access and educational quality.

- **Growth as a cost reduction strategy.** A strategy of reduced ambitions is neither palatable nor practicable at the vast majority of institutions. It is very difficult for any organization, particularly a college or university, to migrate from a high cost structure to a low cost structure. The only way to rebalance the cost and revenue equation, therefore, and to ensure a sustainable financial future is to grow revenues while holding costs flat—essentially "growing into" your existing cost structure.

- **The wrong kind of growth.** The past decade saw many institutions pursuing growth, but typically in an ad hoc and self-defeating way. Enrollment increased and programs proliferated with little thought to the impact on costs and quality. This "build-to-grow" approach added new courses, new programs, new faculty, new departments, new administrative offices, and new facilities even faster than it added students, ratcheting up fixed costs and specialized capacity and creating diseconomies of scale.

- **How big should I be?** Now many are pursuing what might be called a "smart growth" strategy—targeted expansion based on a thorough analysis of capacity, costs, and student demand. The specific challenges differ across different segments of higher education:

  - Most public universities are struggling to maintain access while state support has been slashed.

  - Research universities (public and private) must also find ways to support the enormous expenses of graduate education and a world-class research enterprise.

  - Smaller private colleges are finding it increasingly difficult to maintain a sustainable level of enrollment without engaging in a financial aid arms race.

  - Community colleges, founded on the mission of open access, are beginning to recognize that they simply do not have the resources to serve all of their potential students.

- **Different problems, similar questions.** Despite these differences, all institutions are asking the same basic questions: Which programs should I grow? What kinds of students should I recruit? How many students can I accommodate within my existing facilities? What is the right size for my institution to be financially sustainable? Colleges and universities need to find ways to increase the capacity for growth and innovation without expensive investments in new facilities and faculty.

- **Breaking the iron triangle.** Institutions pursing a smart growth strategy have found that it is in fact possible to break out of the "iron triangle" of cost, access, and quality. Their experiences demonstrate that data on capacity and utilization can better guide the allocation of scarce resources, identifying areas in which to cut back without impacting students, as well as areas that require additional investment to meet student needs.

- **A new level of rigor.** Colleges and universities were able to tolerate a certain level of inefficiency in resource allocation when funding was more plentiful. But just like other industries with high fixed costs (such as airlines, electrical utilities, telecommunications providers), higher education will need to develop sophisticated scheduling tools and complex pricing models to maximize utilization of expensive capacity.

- **Avoiding polarizing battles on campus**. At many institutions, the search for greater efficiency has led to highly charged battles over increasing class sizes, raising faculty workloads, and even cutting entire academic programs. Others, however, have found that it is possible to significantly expand effective capacity without abandoning quality standards set by the faculty (such as section caps or faculty workload policies).

- **Efficiency not an end in itself.** In an era of constrained resources, institutions need to make difficult trade-offs between competing goods. Data on capacity, utilization, and productivity can help identify underused resources that could be reallocated to higher priority activities. As one provost put it at one of our meetings, "Universities are inefficient in many ways. Some of those inefficiencies are intentional (because they are pedagogically or socially valuable), but many are unintentional." Addressing the unintentional inefficiencies allows administrators to find resources to invest in furthering the mission.

- **Beyond the bottom line.** Many faculty are concerned that any attempt to quantify quality, measure productivity, or examine the costs of research or instruction, will inevitably lead to administrative decisions based on corporate rather than academic values. The most effective colleges and universities recognize that these metrics are meant to inform academic decisions, not to dictate them. Ultimately, these calculations should illuminate the trade-offs that institutions with finite resources face in trying to meet their ever-expanding missions.

Maximizing Space Utilization

- **Hidden capacity.** Many campuses believe that they are at capacity, and daily experiences often support this view—classrooms are hard to find at peak times, students struggle to get into the courses they need to graduate on time, popular majors turn students away, and new program launches are delayed for lack of space. National data, however, indicate that this feeling of overcrowding is to some extent a mirage.

  – On average, classrooms are used only 40 percent of available hours (over a 60-hour scheduling week).

  – Even when classrooms are in use, only about 60 percent of the seats are typically used.

  – And section sizes are often well below enrollment caps. Only 26 percent of sections are at least 80 percent full.

  While utilization rates of 100 percent are impossible to achieve (in fact, anything over 80 percent is inadvisable), the vast majority of campuses are well below this practical maximum.

- **Bottlenecks the real problem.** The problem, therefore, is not an absolute lack of capacity but rather a misallocation of resources. High-demand classrooms, busy times of day, or popular courses are oversubscribed, frustrating students and faculty. Typical bottlenecks include specific-size classrooms, high tech classrooms, centrally located classrooms, and any classroom during prime time (typically 10 am to 2 pm Monday through Thursday). As one consultant put it, "When academics say, 'I am out of space,' what they really mean is, 'I cannot get technology-equipped classrooms during prime time.'" This distinction is critical; the only solution to the first problem is to build more space, while the second problem can be solved by better scheduling high-demand rooms. Space bottlenecks appear as a lack of capacity when really they are a failure to match supply to demand.

- **The bottom line.** Significant increases in capacity (10 to 40 percent) can be achieved at most institutions without building new classrooms, increasing faculty course loads, or increasing sections beyond existing caps.

- **The limits to efficiency.** While most institutions would agree they could do a better job of matching classroom assignments to student and faculty needs, a number of factors limit the potential for efficiency gains.

  – Many classrooms are highly specialized, making it difficult or impossible to schedule most classes in them and limiting their overall utilization.

  – Avoiding student schedule conflicts requires offering more sections than might be necessary.

  – Typical class sizes change over time at a different rate than the actual sizes of classrooms, leading to a mismatch.

  – Students drop and add courses after the term starts and classrooms have already been assigned.

- **Managing scarce resources.** Despite the fact that demand for certain types of spaces exceeds the supply, few institutions effectively ration bottleneck spaces. Instead they typically allocate space based on tradition or institutional politics.

  – Class schedules are rolled over from the previous like semester with minimal changes.

  – Maximum section sizes are based on tradition or broad policy rather than the specific pedagogical needs of the course.

  – Classrooms are often assigned based on faculty preferences for a specific room rather than an attempt to match the section size to the room size.

- **Focusing on the wrong metric.** Unfortunately, the most common space metric (one required by many state higher education boards) is average classroom utilization, which divides the number of hours a room is used by the number of hours in a standard week. Averaging over all classrooms causes two problems. First, it misses the choke points that prevent students and faculty from accessing the rooms, times, and courses they want. And second, it focuses administrative attention on bringing up the average, rather than accommodating student demand.

- **Working with, rather than against, faculty.** Many institutions focus on increasing usage of the classrooms (or times) with the lowest utilization (typically those that are "owned" by individual departments, rooms in poor repair or lacking in technology, and any room early in the morning or on Fridays). A better approach is to focus on relieving choke points—those rooms, time periods, or courses with more demand than capacity. The choke points are the true limits to growth, yet they can often be relieved through better scheduling rather than expensive investments in new capacity.

Optimizing Section Assignments

- **Section assignments determine classroom and faculty utilization**. Section caps are set by departments to ensure that sections do not exceed a pedagogically appropriate size. At many campuses, setting the proper caps is a subject of great debate, and yet the vast majority of sections never come close to reaching this maximum. Better matching sections to actual student demand can free up significant classroom and faculty capacity without violating quality standards.

- **Identify statistically unnecessary sections.** A simple calculation can identify sections that could potentially be consolidated, freeing up both classroom space and faculty teaching capacity. Most institutions will find that many courses offer a number of sections that are at less than full capacity. In many cases, the number of sections in the course can be reduced, accommodating all students with a smaller number of section offerings and without going over the faculty-determined section cap.

- **A surprisingly large opportunity.** A calculation at one large public research university found that almost one-third of all the sections they offered were statistically unnecessary, including more than 25 percent of sections offered during prime time and 15 percent of sections offered in bottleneck spaces.

- **Setting modest targets.** Cancelling all of the statistically unnecessary sections is neither practical nor advisable, but focusing on unnecessary sections scheduled for bottleneck times or spaces is an easy way to free up capacity in high-demand rooms. Kent State University ultimately cancelled less than a third of all of the sections in the College of Business with a fill rate of less than 75 percent, but it still achieved significant cost savings.

- **Avoiding battles about section size and course load.** Critical to the success of the approach at Kent State was that the decision on the proper maximum size for a given section was still set by the faculty. Rather than fight about the right maximum size, the faculty determine section caps and the provost's office just tracks how well they are doing at filling up sections to that maximum. The extra capacity Kent State identified also enabled it to grow enrollment without increasing faculty workloads.

- **Freeing up instructional capacity.** Reducing the number of sections taught reduces the need for instructors. At institutions with significant adjunct populations, this can often lead to immediate savings. At smaller schools or schools where most courses are taught by tenured or tenure track faculty, savings are harder to realize. Freeing up faculty time will not necessarily make it possible to reassign them to teach other subjects, especially in the case of small departments.

- **Predicting student demand.** Calculating section reduction candidates depends critically on estimates of student demand for each course. Currently most institutions simply roll over section caps from term to term with little attempt to estimate the number of students who will actually enroll. A handful of institutions have begun to develop more sophisticated approaches to predicting course-level demand, leveraging historical data and using degree maps to predict student course needs for the coming term.

- **Adding sections to meet demand.** Better forecasts of course demand not only surface lack of demand for some sections but can also indicate which sections are likely to be oversubscribed. These "addition candidates" would require additional sections to meet student demand, forcing administrators to make decisions about when to add capacity and when to turn students away from a popular course.

Reducing Nonessential Credits

- **Another capacity limiter.** Minimizing the number of unused seats can significantly increase capacity, but this assumes, that most students follow an efficient path to their degree. At many institutions, however, students take an excessive number of credits, they repeat courses multiple times, and they take more credits than are required for a degree—essentially taking up capacity in courses that could be used by other students. Even allowing for a certain degree of exploration and changes in degree plans, having a significant number of students who complete 20 to 50 percent more credits than required increases costs and reduces capacity.

- **Keeping students on the efficient path.** Guiding students to the right courses and preventing them from taking excessive courses off their degree path can significantly increase capacity at institutions facing tight limits on enrollment. Automatically registering students for required courses is one of the simplest and most effective approaches to ensuring that students get access to the courses that they need, without preventing others from doing the same. Restricting students' ability to repeat courses multiple times, change or add majors late in their career, and register for non-required courses can also reduce unnecessary credits.

- **Creating capacity to expand access.** The Graduation Initiative at California State University-Northridge reduced the number of "super seniors" (students who take significantly more credits than are required to graduate) by 25 percent over just two years, and the number of repeated courses by almost 43 percent, representing significant avoided costs and increased capacity. More important than any imputed cost savings were two outcomes linked directly to Northridge's mission. Helping super seniors graduate more quickly rapidly boosted their six-year graduation rate, and it also allowed them to admit more new students while holding overall enrollment (and overall costs) constant.

Moving Beyond the Current Constraints

- **The limits of the current paradigm.** The approaches described in this report assume that seats in classes are the critical factor limiting instructional capacity. The traditional education model reinforces this belief, measuring student learning in terms of credit hours (essentially, seat hours). Innovative new pedagogical approaches, however, offer the possibility of rethinking instructional models with potentially disruptive impact on capacity limitations. Some have suggested that concerns about classroom scheduling, limits on section sizes, and capacity in bottleneck courses will go away as more institutions adopt new scale-based pedagogies.

- **Rethinking the classroom.** While the large lecture/small seminar model still dominates traditional higher education, other approaches are rapidly gaining popularity. Examples include:
    - New classroom designs that blend lecture, discussion, and practical work in a single space.
    - Hybrid and fully online courses that reduce the number of physical class meetings, replacing them with online interaction.
    - Course redesigns that allow students to follow self-paced modules with the support of tutors.
    - Assessments that award credit for demonstrated competencies rather than seat time.

- **For-profits pioneering the most efficient (and controversial) techniques.** For-profit universities have been the most likely to adopt radical approaches to maximizing instructional capacity and minimizing instructional costs. Most have no tenured faculty with the vast majority of instructors paid by the course or even by the number of students in a course. They have centralized curriculum planning and course design with instructors delivering content developed by others. Many have few or no permanent facilities and simply lease space as needed, and their curriculum involves a constantly changing mix of programs targeted to current market demand. While this extreme model is unattractive to most traditional colleges and universities, the for-profits do offer a laboratory for testing the impact of these approaches on costs, capacity, and quality of instruction.

- **Returning to the question: how big should I be?** The financial pressures of the downturn have forced many institutions to reexamine the economic implications of their pedagogical models (including setting section sizes, assigning instructors, and structuring curriculum). Finding a financially sustainable enrollment size is not simply a matter of finding a number that balances costs and revenues. It may require a deeper consideration of the types of students that your institution serves and the different ways that you might serve them. The approaches offered in this report represent the low-hanging fruit—relatively straightforward ways to accommodate more students in the existing model. Moving to new pedagogical models opens up an entirely new range of options.

Education Advisory Board research has identified four basic levers for maximizing instructional capacity: scheduling classrooms, allocating instructors, structuring the curriculum, and redesigning pedagogy. They form a continuum with the more fundamental changes to instruction having a greater potential impact but also significantly greater challenges to implement.

Maximizing Instructional Capacity
Four Levers to Increase Enrollment, Minimize Costs, and Maintain Quality

Impact on Capacity

Pedagogy — Redesign courses around outcomes rather than seat time

Curriculum — Reduce nonessential credits

Instructors — Consolidate unnecessary sections

Classrooms — Remove scheduling bottlenecks

Challenge to Implement
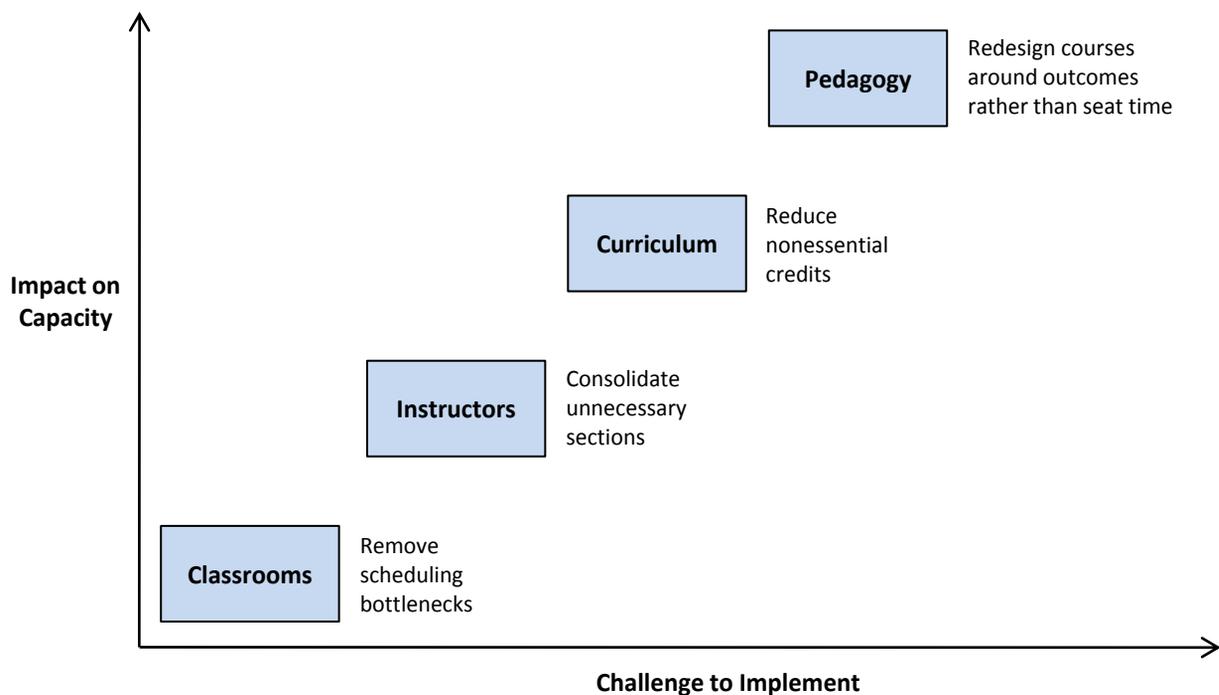
Source: Education Advisory Board interviews and analysis.

At the highest level, colleges and universities have four ways to adjust the level of resources required for instruction. Classrooms are perhaps the most basic physical limit on instructional capacity. Better scheduling of classrooms, particularly by removing scheduling bottlenecks, can accommodate more students without expensive investments in new facilities. At most institutions, however, instructor time is the scarce resource. Consolidating underenrolled sections is one way to increase the number of students in each section without exceeding agreed-upon enrollment caps.

The curriculum itself, general education requirements and major requirements, also sets instructional capacity. Changes to curriculum can have significant impacts on the number of credits required to reach a degree and how quickly students are able to obtain them. Finally, changes to fundamental pedagogical approaches—how education is delivered—have the greatest potential to impact instructional capacity, though they are also among the most difficult to change. This report reviews the most effective approaches in the first three categories. Innovative pedagogical approaches will be considered in another report. The chart on the following pages provides a broad overview of all four levers.

Forty Approaches to Maximizing Instructional Productivity

CLASSROOMS	INSTRUCTORS
Build Optimal Class Schedules	Match Section Offerings to Student Demand

COMMON INEFFICIENCIES

• Classrooms sit empty much of the time (esp. Fridays, early mornings, summers) • Even when used, rooms are rarely full • Certain types of rooms (size or technology) are in short supply • Certain times of day are over-scheduled	• Most sections well below enrollment cap • Many faculty teaching less than standard load • Tenure-stream faculty teach smaller, upper-division courses • Non-tenure-steam faculty teach larger, lower-division courses

UNDERLYING CAUSES

• Schedules rolled over from term to term with little adjustment • Sections assigned to rooms based on faculty preference rather than class size	• Number of sections offered set without regard to past student demand • Load counts courses, not student credit hours • Course releases granted inconsistently

POTENTIAL SOLUTIONS

1. Fix room codes to maximize schedulable rooms 2. Centralize scheduling for all general classrooms 3. Enforce standard time blocks 4. Mandate a certain percentage of off-peak courses for each department 5. Turn summer into a full term 6. Assign sections to rooms based on expected enrollment 7. Change room assignments after drop/add period 8. Cancel unnecessary sections in bottleneck spaces and times 9. Standardize instructional technology	10. Consolidate under-enrolled sections 11. Cancel low-enrollment courses 12. Evaluate course caps for pedagogical necessity 13. Reduce and standardize course releases 14. Exempt very small sections from load calculations 15. Measure teaching load by student credit hours rather than course load 16. Compensate faculty for larger classes 17. Reallocate faculty lines to programs with greatest demand 18. Increase teaching loads 19. Increase number of instruction-only staff on long-term contracts

CRITICAL TRADE-OFFS

• Tighter schedules more likely to create conflicts • Students might have to take courses at less convenient times • Faculty might not get rooms or times they prefer	• Many faculty believe larger classes are necessarily lower quality • Heavier teaching loads for tenure-stream faculty reduce time for scholarship • Increase in non-tenure-stream instructors seen as threat to quality

CURRICULUM	PEDAGOGY
Help Students Progress More Rapidly to Completion	Adopt Instructional Models That Supply Quality at Scale

• Students not able to get into required courses • Students take more courses than required for degree • Students repeat courses multiple times • Many majors have very low enrollment	• Most class time devoted to content delivery rather than interaction • Students sit through an entire course even if they only need one module • Instructors spend significant amounts of time grading basic assignments
• Students confused by too many choices of courses and majors • Degrees require too many credits • Difficult to transfer in credits	• Most faculty receive little pedagogical training, assume lecture model is best • Professional incentives rarely emphasize teaching performance

20. Reduce number of credits required for a degree 21. Offer extra sections of required courses during the summer or online 22. Limit course repeats 23. Use degree maps to advise students 24. Automatic preregistration for required courses 25. Create accelerated degree programs 26. Reduce number of low completer programs 27. Reduce elective offerings 28. Simplify general education offerings 29. Give credit for courses from other institutions through articulation agreements 30. Establish joint degree programs and shared online courses	31. Offer access to lectures online 32. Move some percentage of class sessions to online meeting 33. Redesign large introductory courses according to NCAT principles 34. Create modules that can be shared across courses 35. Create self-paced online tutorials 36. Implement learning analytics 37. Separate course design from course delivery 38. Integrate peer tutors and undergraduate teaching assistants 39. Award credit for passing competency exams 40. Offer massively open online courses

• Fewer majors and courses limit students' ability to explore • Fewer degree offerings may make it difficult to attract faculty in some fields • Transfer credits may not be equivalent	• New pedagogies require more effort and new kinds of skills from faculty • Many new approaches lead to increased class sizes and higher ratios of students to tenure-stream-faculty

I. The Smart Growth Imperative

The current economic recession has dominated the concerns of most academic administrators for the past four years. At first, many hoped that stopgap solutions would be sufficient, but worsening circumstances have required increasingly aggressive approaches to revenue expansion and cost savings. All institutions hope to avoid the most extreme measures, but it is likely that some will be forced to take more drastic action before the sector recovers.

Adjusting to the New Normal
The Recession Forces Colleges and Universities to Adapt Quickly

*Change in Real US GDP vs. Change in State Spending
on Higher Education (including ARRA funds)*
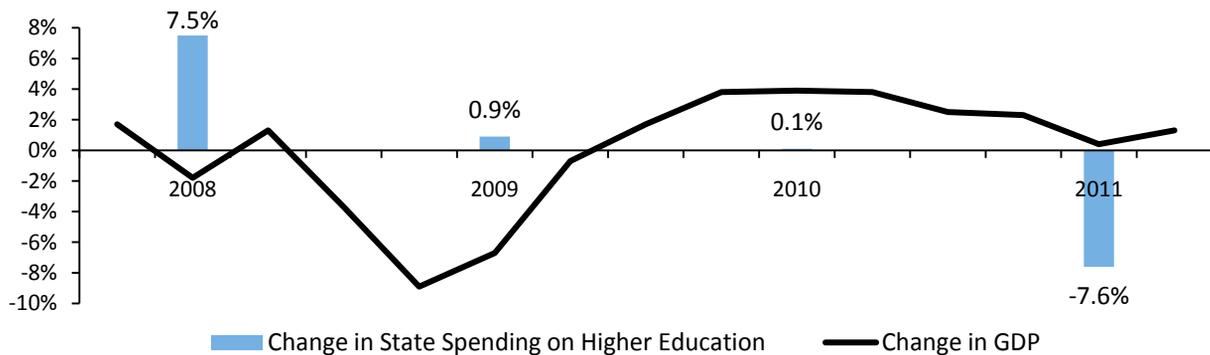
| Phase I:
Stopgap Solutions | Phase II:
Stabilization | Phase III:
Reorganization | Phase IV:
Nuclear Options |
|---|---|---|---|
| • Hiring and salary freezes
• Deferred maintenance
• Administrative cuts | • Tuition and fee increases
• Across the board cuts | • Program prioritization
• New online programs
• Departmental consolidation | • Financial exigency
• Tenured faculty layoffs
• Campus closures |

Source: U.S. Bureau of Economic Analysis; Grapevine;
Education Advisory Board interviews and analysis.

The recession that began in December of 2007 continues to shape the environment for higher education in the United States. The recovery has been slow, with unemployment reaching levels not seen in decades and home equity remaining well below its earlier peak. State budgets in particular have struggled to adjust to falling tax revenues. Growth in state funding for higher education slowed almost to zero in 2010, and fell by nearly 8 percent in 2011, with some states seeing much deeper cuts.

When the recession first began, it was unclear how prolonged or deep the impact would be. Most institutions moved to temporarily reduce spending—freezing hiring and salary increases, deferring maintenance, and making cuts to administrative staff. As it became clear that superficial cuts would not be sufficient, many attempted to stabilize their finances by increasing tuition and making deeper across-the-board cuts. For some, those changes have been sufficient, but for others, a more aggressive reorganization has been necessary. Many have launched program prioritization processes, ranking all academic programs and cutting or consolidating those at the bottom. Others are pursuing new kinds of revenue by rapidly expanding their online options. Even with these adjustments, the outlook for many public universities and for the most tuition-dependent privates is still uncertain. Few have progressed to the so-called "nuclear options"—declaring financial exigency, laying off tenured faculty, or closing entire campuses, but many believe the funding environment will get worse before it gets better.

Caught between outside reformers pushing for productivity increases and internal resistance from faculty defending traditional notions of academic quality, administrators have little practical guidance on how to answer high stakes operational questions that require balancing a range of competing goods.

The Administrator's Dilemma
Navigating an Appropriate Path Between Two Extremes

The Productivity Agenda

Faculty Resistance

| More Low Cost Degrees | Pragmatic Academic Decisions | Quality at Any Cost |

✓ Increase degree production

✓ Reduce cost per degree

✓ Discontinue low-completer programs

✓ Increase faculty workload

✓ Expand class sizes

✓ Link degrees to workforce needs

- *How large should our enrollment be?*
- *What new programs should we launch?*
- *Which programs should we cut back?*
- *What is the right maximum section size?*
- *How many adjuncts should we use?*
- *Which departments should get positions?*

"Productivity means asking faculty to do more with less."

"Producing degrees is not the same thing as producing Toyotas. Educated people aren't widgets."

"We can't just keep shoehorning more and more students into a faculty member's classroom. At some point, that begins to affect academic quality."

"How can you call yourself a university if you don't have a philosophy program?"

Source: Rob Jenkins, "The 'Productivity' Slippery Slope," *Chronicle of Higher Education* (May 18, 2011); Education Advisory Board interviews and analysis.

A growing chorus of politicians and pundits has coalesced around an agenda to pressure colleges and universities to produce more degrees at lower cost. Responding to the perception that higher education has grown bloated and the fiscal demands of state governments that want more trained workers but less spending on higher education, the "productivity agenda" emphasizes a handful of simple metrics—graduation rates, cost per degree, return on investment—as the ultimate measure of the value of higher education. In a number of cases, state governors have proposed expanding class sizes, increasing faculty workloads, and eliminating small academic programs while dismissing other aspects of mission or concerns about academic quality.

On the other side, many faculty have dug in their heels, perceiving a threat to the very essence of the university. They deny the applicability of concepts like productivity to education and resist any attempts to quantify learning or the value of education, often painting administrators as pawns of a neoliberal agenda. Administrators, for their part, must make difficult decisions about how to preserve and enhance their institutions in the face of unprecedented pressures. Yet they often lack the data and tools they need to make decisions, for example, about how much to grow enrollment, which new programs to launch, how to balance pedagogical and financial needs, and how to allocate scarce resources across different departments.

The recession has accelerated the shift to increasing tuition dependence across all sectors of higher education. Declining state support and a slowdown in philanthropy paired with rapid enrollment growth have forced universities both public and private to look to student tuition as the source of revenue they can most easily grow by expanding enrollment and targeting new student populations.

Enrollment Becoming the Key Revenue Driver
Institutions Across the Spectrum Focused on Rightsizing Enrollment

Tuition Dependency Increased Across All Sectors

Net Tuition as a Percentage of Education and Related Costs, 1999 and 2009

Institution Type	1999	2009
Community Colleges	23.5%	32.3%
Public Master's	36.7%	48.7%
Public Research	38.4%	52.4%
Private Bachelor's	62.2%	70.0%
Private Research	69.7%	73.9%
Private Master's	81.9%	89.9%

Market-Driven Realities

- Raise tuition and fees where possible
- Grow enrollment where capacity exists
- Launch new programs in high demand areas
- Target nontraditional students

Source: Delta Cost Project, "Trends in College Spending 1999-2009" (Sep 2011); Education Advisory Board interviews and analysis.

Over the past decade, tuition dependence has increased dramatically, particularly at public universities. Even community colleges, the least dependent on student tuition, on average now cover almost one-third of their education and related costs in this manner. Public universities have now surpassed 50 percent tuition dependence, with some institutions at 70 percent or more. And private colleges and universities, long dependent on tuition, have become even more so, particularly in the private master's category.

This shift away from dependence on state and local funding or private philanthropy dramatically changes the context for administrative decisions on campus, even if it leaves the fundamental mission unchanged. Revenue, and therefore the ability to support the mission, now depends not only on the number of students enrolled but also the type of students enrolled. Many colleges and universities have responded by expanding enrollment and launching new programs to attract out-of-state, international, and professional students, who typically pay higher rates than in-state undergraduates. As a result, capacity management, new program launch, marketing, branding, and sophisticated tuition discounting have become critical competencies as institutions compete nationally and even globally for students.

Higher education in North America includes a diverse array of institutions with a wide range of missions and student populations. While the recession has impacted each sector in different ways, a common theme is the need for better analytical tools to measure capacity, costs, student demand, and revenues at the program level. These are the critical foundation for managing increasingly tuition-driven and resource-starved institutions.

Different Missions, Similar Analytical Needs
All Sectors Looking for Better Data on Costs, Capacity, Utilization, and Demand

Access-Focused Publics	*Research Universities*	*Smaller Private Colleges*	*Community Colleges*
Struggling to maintain access in the face of declining state support	Focused on improving quality and building world-class doctoral programs	Struggling to maintain enrollment without unsustainable discounting	Facing limits to open access as resources fail to support student demand
⬇	⬇	⬇	⬇
Which programs have capacity to add students?	How much will we need to invest to grow distinctive programs?	How can we align our programs with student demand?	Which programs can we afford to grow?

Critical Metrics Required

- Program Capacity
- Student Demand
- Program Costs
- Program Revenues

Source: Education Advisory Board interviews and analysis.

The differing missions and financial structures of colleges and universities have created unique stresses across different segments. Most public universities are struggling to maintain access while state support has been slashed. Research universities (public and private) must also find ways to support the enormous expenses of graduate education and a world-class research enterprise. Smaller private colleges are finding it increasingly difficult to maintain a sustainable level of enrollment without engaging in a financial aid arms race. And community colleges, founded on the mission of open access, are beginning to recognize that they simply do not have the resources to serve all of their potential students.

Across all sectors, colleges and universities are struggling to better manage costs and capacity. As they struggle to balance revenues and expenses, many are asking, "How big should we be?" The answer depends, first, on understanding how many students they can accommodate given existing faculty and facilities, and then, second, understanding the economic implications of growing specific academic programs.

For many institutions, enrollment growth is an important strategy for overcoming the resource challenges in the current financial environment. Others, however, fear that excessive or misguided growth might derail quality standards and actually harm their ability to fulfill their mission. They need a "smart growth" strategy that avoids the dangers of ad hoc or unplanned growth.

The Smart Growth Analogy
Lessons from Urban Planning

Smart Development

Residential   Residential / Retail   Office / Retail

Key Principles

⊘ Sprawling	✓ Balanced
⊘ Haphazard	✓ Efficient
⊘ Closed	✓ Accessible
⊘ Unsustainable	✓ Planned
⊘ Narrow	✓ Diverse
⊘ Top Down	✓ Socially Engaged
⊘ Generic	✓ Locally Distinct
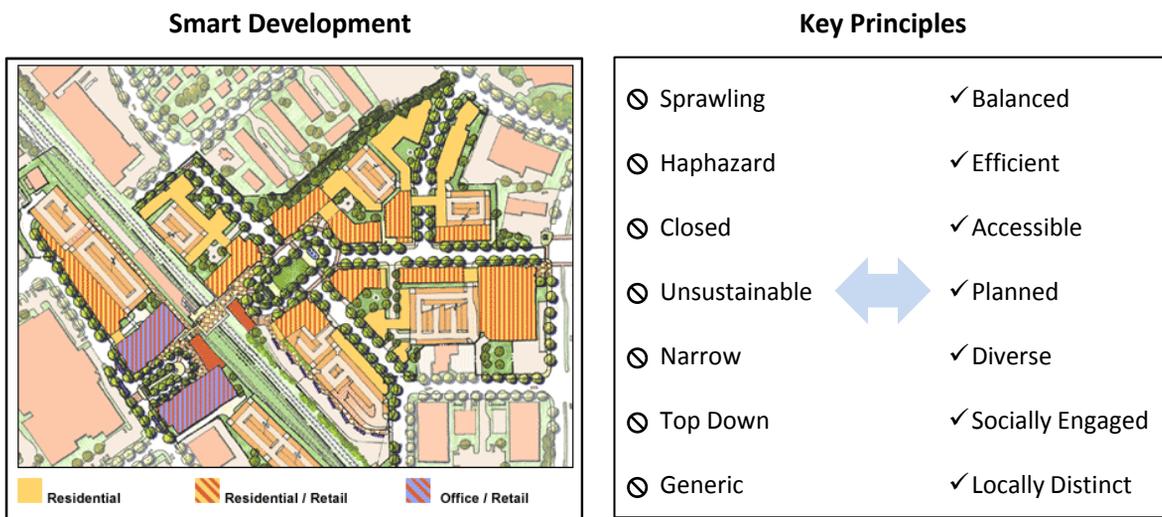
Source: http://www.co.suffolk.ny.us/stormwater/SmartGrowth.html;
http://www.smartgrowth.org/; Education Advisory Board interviews and analysis.

One way to think about growth within a college or university is in analogy to urban development. Urban planners seek a balanced growth that acknowledges the diversity of the community. Haphazard growth leads to urban sprawl, which negatively impacts the entire town. A smart growth strategy carefully balances the needs of different constituencies for the good of the community.

Like a town, a university includes many subpopulations, each with different interests and needs. Some institutions, like some towns, do not want to grow larger, but that does not mean that they should stop developing. Even with stable enrollment, academic programs will wax and wane with changing student and social demands. Managing that evolution requires many of the same tools as pursuing a strategy to increase overall enrollment.

Many believe that the smart growth ideal is impossible to achieve—that an institution can never truly balance competing goals. This view is often summarized by the so-called "iron triangle", a zero-sum game in which one must always sacrifice something of value—access, cost, or quality.

The Iron Triangle
Seeing Higher Education Management as a Zero-Sum Game

Cost

Access ←→ Quality

Access	*vs.*	*Financial Reality*		*Quality*	*vs.*	*Financial Reality*
Add Students	⊘	Cap Enrollment		Provide Merit Aid	⊘	Reduce Discounting
Add Sections	⊘	Reduce Adjuncts		Reduce Teaching Loads	⊘	Grow Enrollment
Add Classrooms	⊘	Stop Building		Launch New Programs	⊘	Freeze New Hiring
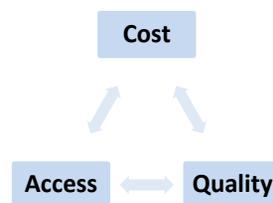
Source: Education Advisory Board interviews and analysis.

Higher education administrators often feel stuck between mutually exclusive (but equally desirable) options. Try to increase access by broadening admissions criteria, offering increased financial aid, and expanding enrollment and, many would argue, you will necessarily lower the quality of incoming students, increase student faculty ratios, and dramatically increase your costs. Focus on improving quality by tightening admissions standards, increasing merit aid, and launching new programs, and costs will rise while access declines.

In the current financial environment with increasing pressure from the federal and state governments to increase productivity and reduce costs, administrators are struggling to break free of the iron triangle of cost, access, and quality to find decision-making tools that enable more subtle ways to manage the tensions between these three factors.

Education Advisory Board research has identified a set of analytical approaches used by the most sophisticated colleges and universities that have enabled them to make significant gains in efficiency without sacrificing academic quality or access.

Understanding the Resource Implications of Academic Decisions

Three Lessons from Education Advisory Board Research

1	**2**	**3**
Metrics Are Meant to Inform Academic Decisions, Not Dictate Them	Controversy About Quality Indicators Are No Excuse for Ignoring Resource Metrics	Significant Gains Are Possible Without Sacrificing Quality (However You Define It)

Source: Education Advisory Board interviews and analysis.

Faculty often fear that quantitative analysis necessarily reduces academic decisions to a rote calculation based on one-dimensional metrics, devaluing academic judgment and threatening shared governance. The most effective institutions understand that metrics are meant to inform academic decisions, not dictate them. At mission-driven institutions (particularly institutions with multiple missions), no equation can determine the right path forward. However, data on costs, capacity, and demand can help identify the range of options and clarify the trade-offs presented by different alternatives.

The challenge (many would say the impossibility) of identifying a measure of academic quality valid across disciplines does not mean that quality cannot be integrated into discussions of costs and efficiency. A number of institutions have found that they can make significant gains in efficiency without sacrificing quality. The key is to leverage faculty-generated, discipline-specific guidelines around maximum section sizes and appropriate course loads, and then provide data to help faculty, chairs, and deans better manage to those targets.

A smart growth strategy depends on understanding the resource implications of different academic policies. It avoids multiple rounds of cuts and unchecked growth while identifying the optimal trade-offs—for example, between the financial benefits of larger classes versus the pedagogical downside.

The Economics of Class Size
Easy to Understand, Under Faculty Control, Significant Financial Impact

**Average Net Financial Contribution for a Class at Capital University
By Number of Students Enrolled**

Capital University

Relationship to revenue is non-linear, e.g., going from 12 students to 20 students (a 67% increase in enrollment) increases revenue by a factor of four

At fewer than 10 students, a class loses money

$58,225

$39,217

$20,209

$8,804

$5,003

$1,201

4   6   8   10   12   14   20   30   40

-$2,600

-$6,402

-$10,204

Class Size
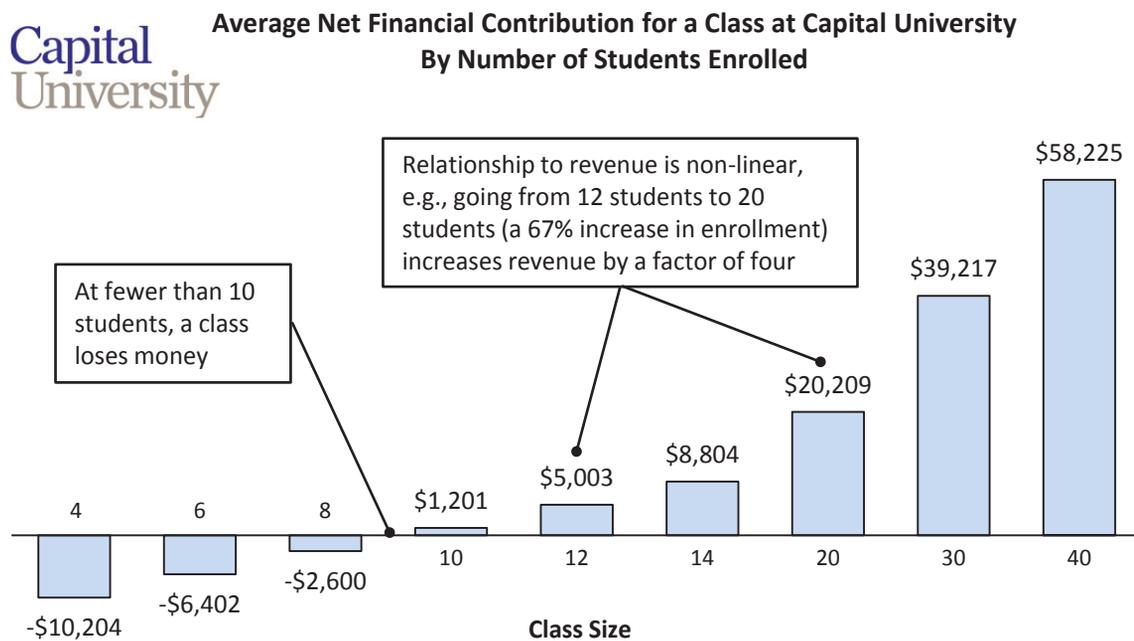
Facing large budget deficits in the mid-2000s, Capital University, a comprehensive, independent university in Columbus, Ohio, with approximately 3,600 students, undertook an analysis of the net financial contribution of a class based on the number of students. Looking across all disciplines, they found that on average a class with fewer than 10 students costs more to run than it generates in tuition revenue. Not surprisingly, the more students in the class, the more marginal revenue it generates. In fact, the amount of revenue increases significantly faster than the number of students. A 67 percent increase in class size (from 12 to 20), for example, generates a fourfold increase in revenue (from $5,000 to $20,000).

Not only did this analysis support high level administrative decisions at Capital, but perhaps even more importantly, it communicated to deans, chairs, and faculty the resource implications of offering very small classes. Decisions to offer or cancel a small class were typically made within departments. Chairs and faculty could now see how their decisions could contribute to the institution's broader need to reduce its deficit.

While the analysis clearly showed significant financial benefits to larger classes, administrators and faculty at Capital University were able to look beyond the results to a more subtle point. Rather than cancelling all classes with fewer than 10 students and pushing all other classes to the maximum size, they identified a "sweet spot"—classes of between 12 and 20—that allowed them to maximize the economics without sacrificing quality.

Finding the Sweet Spot
Engaging Faculty to Improve Performance

**Percentage of Classes with
Fewer Than 12 Students**
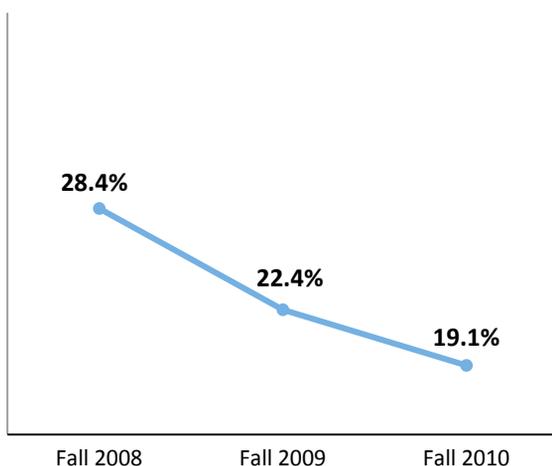
In Response to the New Metric

- Faculty are much more conscious about splitting sections or generating new sections

- Faculty can still make pedagogical arguments for smaller classes, but now they need to justify class size decisions

- Target is an institutional average, not a target for every class or every program

- Target of minimum 12 students not achievable in some programs (e.g., nursing)

- Also track percentage of classes with fewer than 20 students, widely seen as measure of quality

28.4% — Fall 2008
22.4% — Fall 2009
19.1% — Fall 2010

Source: Education Advisory Board interviews and analysis.

Based on the data showing that classes with fewer than 10 students generated a deficit, Capital University began tracking the percentage of classes with fewer than 12 students. Their goal was not to eliminate any class smaller than 12 but rather to gradually reduce the percentage. The number fell from over 28 percent when they first started tracking it in 2008 to below 20 percent just two years later. The change generated significant financial gains while still allowing faculty the flexibility to offer a significant number of small courses (with appropriate justification). They also recognized that some programs were required by their accreditors to maintain a certain maximum class size.

Neither did the analysis push them to offer significant numbers of classes with 40 or more students. In fact, Capital also tracked, and tried to increase, the percentage of classes with fewer than 20 students (interpreted as a measure of pedagogical quality as well as an important metric for the *U.S. News* ranking).

Brandeis University faced a similar financial challenge when the recession caused a significant decline in the endowment and annual giving. The board of trustees asked the administration to undertake academic restructuring to avoid years of projected budget deficits.

Adjusting to a New Financial Reality
Explicit Growth and Faculty Reduction Goals Focus Magnitude, Timing of Change

Curriculum and Academic Restructuring Task Force 2009-2010

Brandeis University

Permanently Rebalance Core Costs and Revenues

12%

Arts & Sciences Faculty

Undergraduate Enrollment

(10%)

Restructure Curriculum
- Decrease the number of required courses for majors
- Expand number of cross-listed courses
- Reduce course duplication and redundancy
- Standardize faculty workload

Consolidate Small Programs
- Cut seven programs, majors, and minors
- Merge six departments into Division of Science
- Reorganize American Studies as an interdepartmental program
- Restructure languages to facilitate resource sharing

Reduce Number of Small Classes
- Cancel courses with fewer than 8 students enrolled
- Restrict binding caps on class size
- Limit small-enrollment courses to 2- or 3-year cycle

Source: Education Advisory Board interviews and analysis.

Recognizing that the ratio of students to faculty was the core driver behind financial stability, Brandeis decided to reduce the number of faculty by 10 percent (35 FTEs) while increasing enrollment by 12 percent (400 students). Starting from this target, a series of committees were tasked with identifying policies and structures that would enable this smaller group of faculty to effectively serve a larger group of students.

Over the course of 16 months, committees at Brandeis examined classroom scheduling, the undergraduate curriculum, distance education, faculty workload, class size, administrative cuts, and new revenue-generating ideas. Ultimately they found that reducing the number of small classes, standardizing (but not increasing) faculty workloads, limiting credit creep, and consolidating a number of smaller programs would allow the university to operate within their financial constraints while minimizing the impact on students.

The current economic recession has created a great deal of frustration on many campuses. Administrators have imposed a range of cost-cutting measures that many faculty believe have unfairly burdened them while reducing educational quality. Our research has identified a number of approaches that have enabled institutions to achieve significant budget, access, and student success gains without negatively affecting academic quality.

A Better Approach to Increasing Instructional Capacity

Touching Third Rails	*A More Promising Approach*
Fighting Faculty and Student Preferences	**Matching Supply to Demand within Existing Quality Standards**
Teach Sections in Off-Peak Hours	Match Courses to Right Classrooms during Prime-Time Hours
Increase Teaching Loads	Increase Section Fill Rates within Enrollment Caps
Cut Low Enrollment Programs	Reduce Unnecessary Sections

Welcome Findings

Institutions can achieve significant budget, access, and student success gains without changing academic quality policies

Source: Education Advisory Board interviews and analysis.

Almost every college and university is currently struggling to support more students with fewer resources. This is creating tremendous tensions on campus as faculty fear that quality is being sacrificed in the name of productivity. Many universities have taken drastic steps—increasing teaching loads, terminating low-enrollment programs, and even coercing faculty into teaching at times that neither they nor their students want.

The examples in this report show that better results can be achieved without taking these difficult steps. By better matching the supply of classrooms and faculty time with student needs, it is possible to find efficiencies and cost savings without increasing faculty course loads or cancelling small programs. Ultimately the key is identifying—and removing—inefficiencies in order preserve those factors that are essential to providing a quality education.

II. Classrooms: Removing Scheduling Bottlenecks

The most common measure of classroom utilization—the percentage of time that classrooms are in use—fails to identify the real space challenges on most campuses. By averaging over all classrooms, it obscures the bottleneck rooms that limit capacity and instead misdirects attention to driving increased activity to low-demand rooms.

Removing Scheduling Bottlenecks

Traditional Reporting

Status Quo Metric:
Average Classroom Utilization

Target: 60%-70% (50-hour week)

What It Misses

⊘ Average fails to identify the highest demand spaces that limit capacity

⊘ Measures use of room but not student credit hours produced

⊘ Includes specialized, low-demand spaces unlikely to support growth

What the Best Are Measuring

Prime Time Utilization by Room Type   *Seat Utilization*   *Share of General Classrooms Centrally Controlled*

Key Decisions Informed

✓ How many additional students could we accommodate in our existing facilities?

✓ Which room types or class times should scheduling policies focus on?

✓ What kinds of space do we need more of (or less of)?

Source: Education Advisory Board interviews and analysis.

Average classroom utilization, or the percentage of time that classrooms are in use, is the most common metric for the productivity of classroom space. In fact, most state systems require that all public universities report this metric, and often facilities funding depends on hitting a certain threshold utilization. A typical target for a large public university might be 60 to 70 percent (based on a standard 50-hour week).

There are a few problems with this metric, however. First, it averages over all classrooms at the university, so it says nothing about which rooms are in high demand and which are in low demand. Second, it measures whether the room is in use, but not how full it is, so it provides no data on how many student credit hours are being produced in the room. Finally, the calculation includes all classrooms on campus, even those that are so specialized (or in such poor repair) that they are essentially unusable most of the time.

There are three alternative measures that solve many of these problems. First, prime time utilization by room type measures which types of rooms are used the most during the busiest times of the week. Second, seat utilization captures the percentage of seats that are full when classes are being taught. And finally, the share of general classrooms that are centrally controlled indicates the opportunity for balancing demand across the entire campus.

Many campuses believe that they are out of space, and they can point to evidence in many areas that student and faculty needs are not being met by the current facilities.

The Perception: "We're Full"

Many Believe Their Institutions Are Operating at Capacity

Residence halls at capacity

Students can't get into courses they need to graduate

Classes are overcrowded

Most popular majors have to turn students away

No available space to launch new programs

Hard to find classrooms when faculty need them

Faculty teaching maximum course load
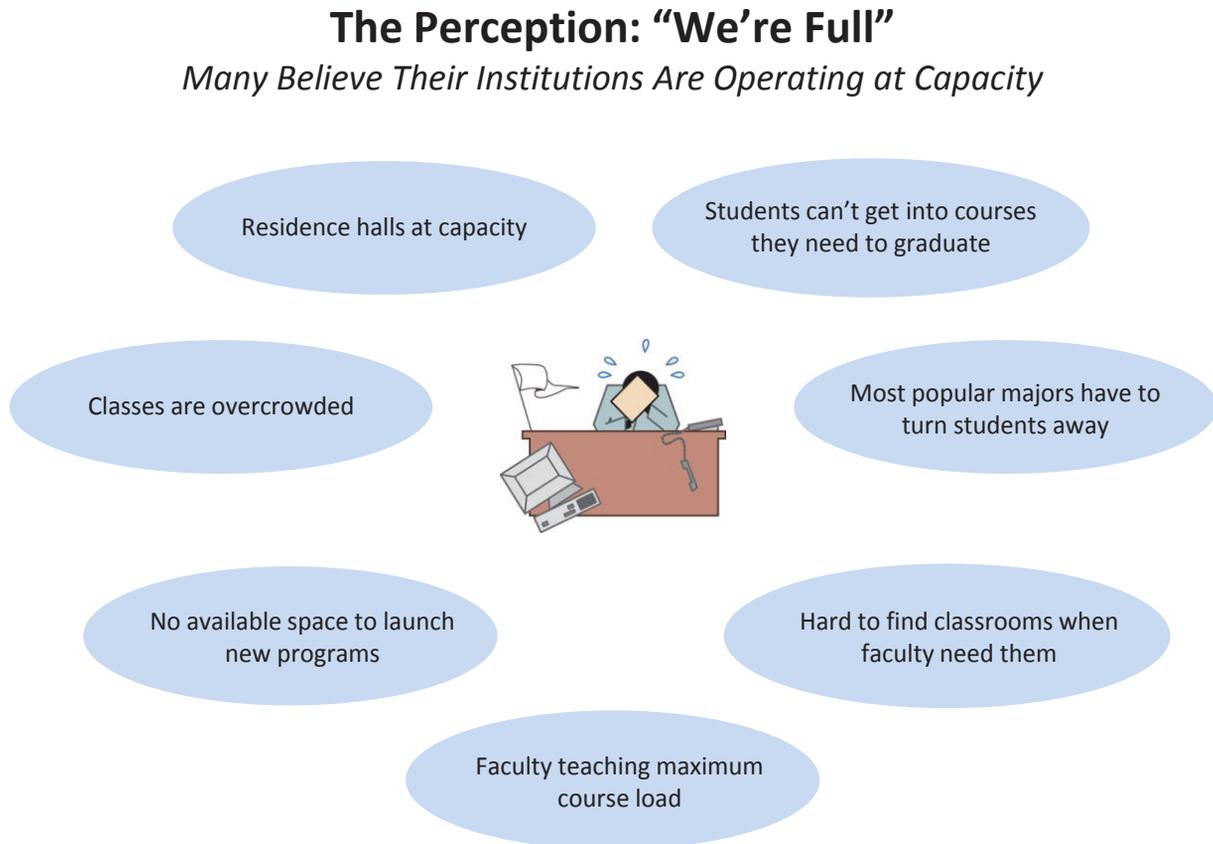
Source: Education Advisory Board interviews and analysis.

Given the significant enrollment growth over the past decade, particularly at access-focused public universities, faculty and administrators at most campuses can point to evidence all over campus that they do not have the capacity to take in any more students—classes are overcrowded, faculty struggle to find a classroom when they need one, and students cannot get in to the courses they need to graduate. As a result, most believe that the only solution is to build more classrooms and to add more faculty. Yet state budget cuts have made that increasingly difficult.

While there are clear signs of overcrowding on many campuses, the data actually show significant underutilized capacity. On average, classrooms are in use less than half of the time, and when they are used, they are only 60 percent full. Independently of room size, only about a quarter of sections are at least 80 percent of their maximum size.

The Reality at Most Institutions: Underutilized Capacity
National Data Shows Significant Excess Capacity

Underutilized Rooms

60%

Average seat fill rate

Underutilized Faculty

26%

Sections that are at least 80 percent full
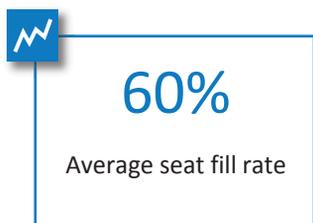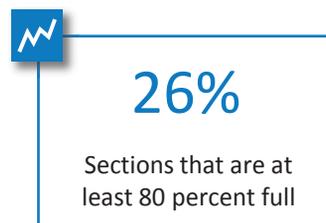
Average Classroom Utilization
Based on a 50- to 60-hour Standard Week

4-Year Publics	4-Year Privates	2-Year Institutions
44%	42%	41%
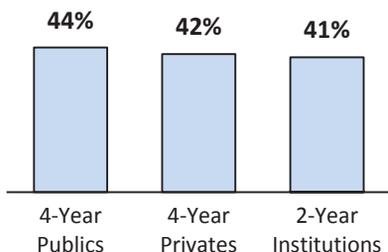
Average Section Enrollment Ratio

4-Year Publics	4-Year Privates	2-Year Institutions
72%	70%	73%
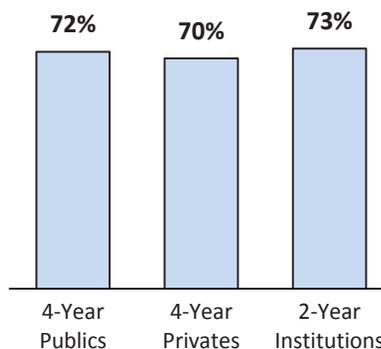
Source: Ad Astra Information Systems; Education Advisory Board interviews and analysis.

National classroom scheduling data from Ad Astra Information Systems shows that classroom utilization rates typically average just over 40 percent (or 24 hours of use in a 60-hour standard week). Actual unused capacity is even higher given that on average 40 percent of the seats are empty even when the room is being used. Faculty are underutilized as well. On average they teach 76 percent of the "standard" workload, and when they are teaching, their sections are only about 70 to 73 percent of the maximum size.

Of course, no one would expect utilization to ever approach 100 percent. The specialized nature of both faculty and facilities severely limits the ability to reallocate resources from low-demand to high-demand areas. Nevertheless, the data indicate that the underlying issue is not primarily an actual lack of physical or instructional capacity. Nearly every institution could fit more students into existing classrooms and existing sections.

A range of factors prevent classroom utilization and seat fill rates from reaching 100 percent. Mismatches between section sizes and room sizes and student drop-off throughout the term leave utilization well below its theoretical maximum.

Peeling Back the Onion
Compounding Factors Drive Low Seat Fill Ratios

Typical Utilization Rates for Scheduled Classrooms
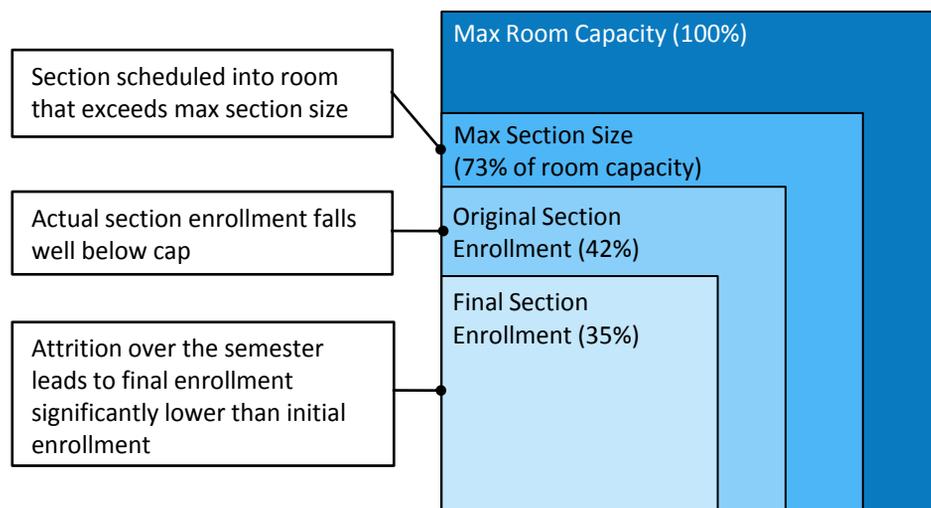
Section scheduled into room that exceeds max section size	
Actual section enrollment falls well below cap	
Attrition over the semester leads to final enrollment significantly lower than initial enrollment	

Max Room Capacity (100%)

Max Section Size (73% of room capacity)

Original Section Enrollment (42%)

Final Section Enrollment (35%)

There probably never was a time when the size of classrooms perfectly matched the size of the classes scheduled into them, but at many institutions average class sizes have changed over time while classrooms remain relatively fixed. On some campuses there is a shortage of smaller rooms, while on others, the large classrooms are the problem.

Classes are typically scheduled into a room based on the maximum possible size of the section. That compounds the mismatch because few sections are actually full. And finally, some percentage of students who attend on the first day of class will end up dropping the course, leaving a seat fill rate that might ultimately be only a third of the room's capacity.

While the limitations of existing space and fragmented student demand prevent classroom utilization rates from approaching 100 percent, typical scheduling practices further exacerbate the problem. Despite a perceived scarcity of space on campus, most institutions set schedules and assign rooms with little attention to changing patterns of demand.

The Root Cause: Supply and Demand Mismatch
Space and Schedule Assigned by Tradition, Faculty Preference

Status Quo Approaches to Section and Room Assignment

Enrollment Caps

Section caps based on faculty preferences rather than historic demand patterns

Class Schedules

Class schedules typically rolled over from year to year and rarely realigned with changing faculty resources or student demand

Room Assignment

Faculty request rooms for location or technology rather than matching room size to section size

Registration

Students register for more credits than they need and then drop classes, leaving under-enrolled sections

Source: Education Advisory Board interviews and analysis.

Few institutions are sophisticated in assigning space precisely where and when it is needed. Sections and classrooms are often assigned based on tradition and faculty preference rather than the optimal arrangement to accommodate student demand. For example, a faculty member might set a section size for the coming term at 30 because it has always been set at that size, despite the fact that no more than 15 students have ever registered for the course in a term. The registrar will then schedule that class into a room that fits at least 30 students, leaving 50 percent or more of the seats empty.

Classrooms are often assigned because faculty prefer to teach close to their offices or in high tech rooms (even if they do not plan to use most of the technology), and for simplicity in planning, class schedules are often rolled over from year to year with minimal changes. Finally, because students typically register for more credits than they plan to take classes end up under-enrolled after they drop. The paradoxical result is that seats go empty much of the time, yet faculty and students are still frustrated because they cannot get the courses they want in the rooms they want.

The problem with classrooms is not an absolute lack of capacity, but rather specific spaces that are bottlenecks. Demand is uneven, leaving some rooms with very low utilization and others with very high utilization.

Choke Points Limit Full Utilization
The Problem Is Not Lack of Capacity but Specific Bottlenecks

Typical Bottlenecks
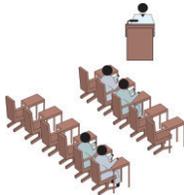
Specifically Sized Classrooms	Tech-Enabled Classrooms	Prime Time Classrooms	Centrally Located Classrooms

A bottleneck is defined as any room or time period at greater than 80 percent utilization

According to experts, utilization over 80 percent constitutes a bottleneck or choke point. At that level of usage it becomes too difficult to manage maintenance, adjust schedules, or respond to other needs. Typical bottlenecks are specifically sized classrooms (the problematic size varies by campus), classrooms with the most advanced technology, and nearly all classrooms during prime time (typically 10 am to 2 pm, Monday through Thursday, though this varies from campus to campus). For those with sprawling campuses, centrally located classrooms could be bottlenecks as well.

Data from Baylor University illustrates the issues that are hidden by the typical focus on average classroom utilization rates. Baylor's overall classroom utilization is quite low (34 percent), and yet certain size rooms (as well as high tech rooms) have very high utilization rates; some are clearly bottlenecks.

Uncovering Capacity Constraints in Prime Time
Baylor's Analysis by Room Size and Technology Type Reveals Constraints

Certain Room Sizes Are More Constrained	Variable Technology Levels Contribute to the Problem
Prime-Time Utilization by Room Size	*Prime-Time Utilization by Room Technology*
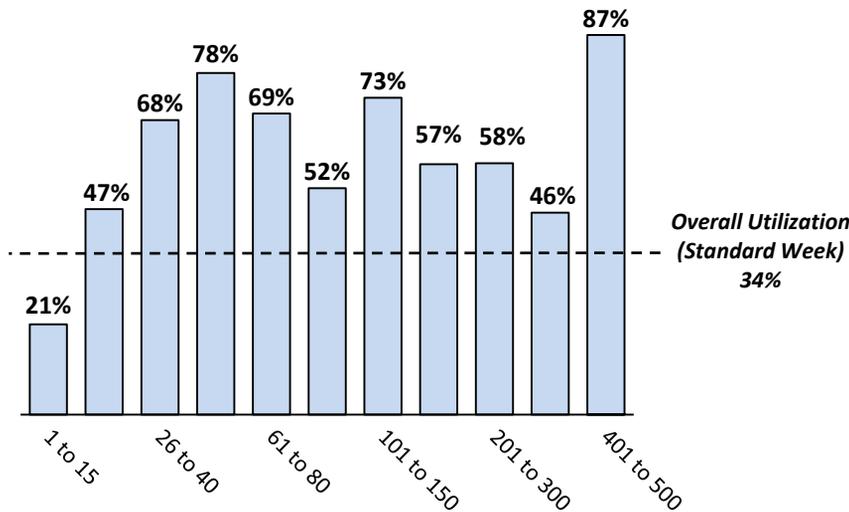
Prime-Time Utilization by Room Size (bars): 21%, 47%, 68%, 78%, 69%, 52%, 73%, 57%, 58%, 46%, 87%

Room size categories: 1 to 15, 26 to 40, 61 to 80, 101 to 150, 201 to 300, 401 to 500

Overall Utilization (Standard Week) 34%

Prime-Time Utilization by Room Technology: Below Threshold Technology 51%, Above Threshold Technology 69%
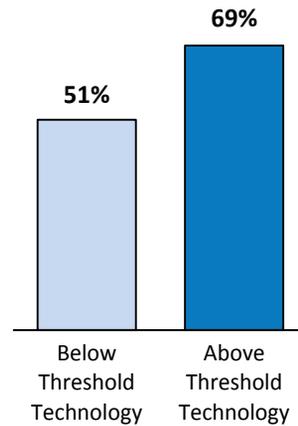
Source: Baylor University; Education Advisory Board interviews and analysis.

Like many private research universities, Baylor University has an average classroom utilization rate well below 50 percent. A high-level analysis might indicate that Baylor should have no problems with classroom capacity, and yet an analysis of utilization by room size shows significant variation. Similarly, those rooms with more sophisticated technology have much higher utilization rates than the standard room.

A common mistake is to focus policies that incentivize faculty and students to make more use of underutilized rooms and times of the week. There are reasons (often good ones) why students and faculty avoid certain rooms and times. A more effective approach is to focus efforts on relieving congestion in the bottlenecks, helping students and faculty to get access to the rooms and times they do want.

The Key: Optimizing Peak-Time Demand

Distribution of Classrooms by Utilization

Low
Utilization

High
Utilization

Typical Approach:
Channel Activity to Underutilized Spaces
What activity can we put in this room?

- Force departments to schedule courses off-peak
- Schedule lectures into specialized rooms

Drawback: Utilization is typically low because demand is low, and increasing demand is hard

More Effective Approach:
Find Capacity to Alleviate Choke Points
Where can we put this activity?

- Reduce unnecessary sections during peak times
- Add sections to courses that are overenrolled

Benefit: Addresses high demand activities that need more capacity (and ignores everything else)

Source: Education Advisory Board interviews and analysis.

Because most institutions are trying to maximize their average classroom utilization, they tend to focus on the rooms and times that are not being used and encourage people to make more use of them. A common question from administrators is, "How can I get my faculty to teach on Fridays? Or before 10 am?" While some schools have successfully convinced faculty to teach at unpopular times or locations, at many institutions the political struggle is simply too difficult.

A more effective approach is to focus on the bottlenecks or choke points rather than the low utilization rooms or times. Focus limited analytical resources on identifying activities in bottleneck spaces or times that do not need to be in such a high-demand spaces or times. Typically, the analysis will identify faculty using the most sought-after rooms even when their classes are half full or when they are not using the technology. Policies can then help ration high-demand space rather than fight the uphill battle to get faculty to use low-demand space.

The table below summarizes the most promising practices for removing scheduling bottlenecks. For each practice it evaluates the expected level of faculty resistance, impact, and the cost or effort to implement. The practice with the largest ratio of impact to effort is removing unnecessary sections from bottleneck spaces, freeing up high demand rooms for more critical activities.

Removing Scheduling Bottlenecks

◯ Low
⬤ High

Strategy	Faculty Resistance	Impact	Cost/Effort
Bring All Rooms Up to Minimum Technology Standard	◯	◔	⬤
Enforce Standard Meeting Patterns (Block Scheduling)	◔	◑	◕
Remove Unnecessary Sections from Prime Time/Bottleneck Rooms	◑	⬤	◕
Fix Room Codes to Maximize Schedulable Rooms	◑	◑	◯
Set Limits on Prime Time Scheduling by Department	◕	◑	◕
Centralize Scheduling for All Classrooms	⬤	◕	◔

If You Do Only One Thing

Remove Unnecessary Sections from Prime Time/Bottleneck Rooms

Source: Education Advisory Board interviews and analysis.

III. Instructors: Consolidating Unnecessary Sections

The focal point for both classroom allocation decisions and faculty workload calculations is the maximum section size. Caps are set by departments to ensure that sections do not exceed a pedagogically appropriate size, and yet the vast majority of sections never come close to reaching this maximum. Better matching sections to actual student demand can free up significant classroom and faculty capacity without violating quality standards.

Matching Sections to Student Demand

Traditional Reporting

Status Quo Metric:
Maximum Class Size
Student-Teacher Ratio

Target: Varies by Discipline

What It Misses

🚫 Actual class enrollment often significantly below maximum

🚫 Full load in small courses means too few student contact hours

What The Best Are Measuring
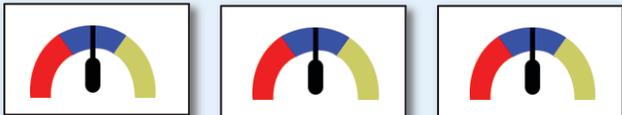
Number of Section Reduction Candidates   *Number of Section Elimination Candidates*   *Student Credit Hours per Full-Time Faculty Member*

Key Decisions Informed

✓ Are there unnecessary sections that we can consolidate?

✓ Are there low enrollment courses that can be cancelled with minimal impact on students?

✓ Can we reduce adjunct use without increasing existing full-time faculty course loads?

Source: Education Advisory Board interviews and analysis.

Typically, each institution and each discipline has certain standards for how large a class can be without impacting quality. Administrators often ask for benchmarks on "appropriate" class sizes, but on this issue there is ultimately no authority greater than the judgment of your own faculty on what is pedagogically appropriate for their discipline. The pedagogical and economic importance of section caps often leads to conflict on campuses, and yet in practice few sections ever get close to that maximum size. As a result, institutions regularly offer significantly more sections than they need to accommodate student demand.

Reducing the number of unnecessary sections offered not only frees up classroom space, it also frees up faculty time. At institutions with significant adjunct populations, that might lead to short-term cost savings as fewer adjuncts need to be hired.

A simple calculation can identify sections that could potentially be consolidated, freeing up both classroom space and faculty teaching capacity. Most institutions will find that a significant number of their sections can be combined without locking students out of courses or going over the faculty-determined section cap.

Optimizing Section Offerings
Identifying Sections That Could Be Consolidated or Eliminated

Reduction Candidate

Elimination Candidate

Demand can be accommodated with fewer sections

Demand is so low that course could be eliminated

30	30	30
20	20	20

20
10

30	30
30	30

Section eliminated
- Fill Ratio ≤50%
- Enrollment ≤10

Key	Max Enrollment	20
	Actual Enrollment	10
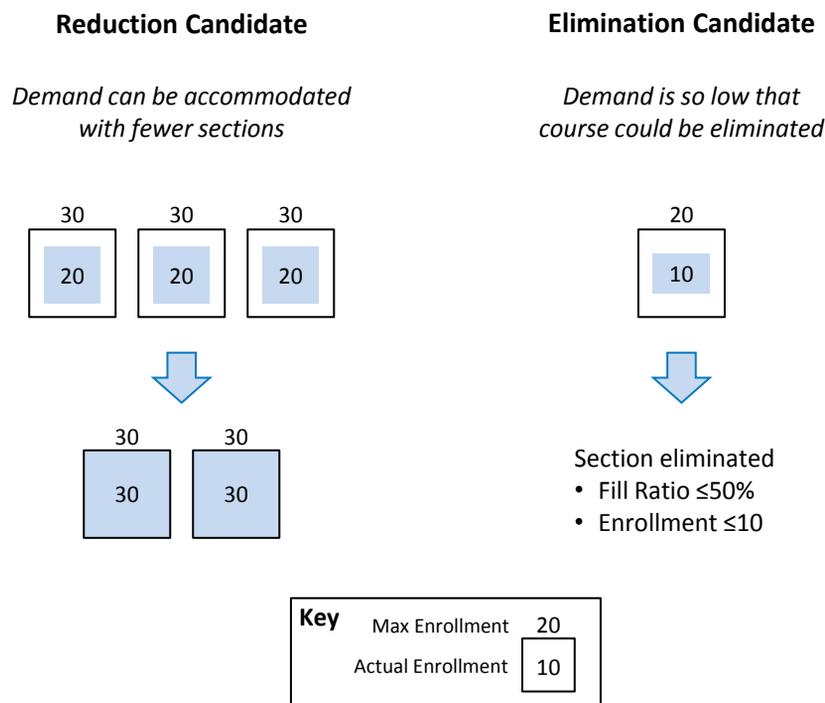
Source: Ad Astra Information Systems; Education Advisory Board interviews and analysis.

In the example on the left, there are three sections, each with a maximum of 30 students. However, there are only 20 students registered in each section. Clearly, all 60 students could be accommodated in just two sections. Note that in the new scenario, every student registered for the course still has a seat and none of the sections exceed the maximum size set by the faculty, yet the number of sections offered has been reduced by one-third.

For a course with a single section (the example on the right), an institution might decide that at a certain level of demand they will not offer the course in a given term. In this example, the institution decided that if the course is less than 50 percent full (in this case, an enrollment of 10 or fewer) they will cancel the course. Different institutions might use different criteria for such a decision.

This calculation should not be taken to imply that all unnecessary sections or underenrolled sections will or should be cancelled. These sections are referred to as "candidates" for reduction or elimination and are described as "statistically unnecessary." Cancelling too many sections might unduly limit schedule flexibility. How far an institution should go in reducing these sections depends on the pressure it is under to increase capacity or reduce costs.

While the basic calculation for eliminating or consolidating sections is quite simple, adding up statistically unnecessary sections over an entire department can produce surprising results. In the example below from a public research university, the English department found that 27 percent of all of the sections it offered were statistically unnecessary. The department could meet all student demand in every course, without increasing maximum section size, and still cancel 17 sections.

Identifying Unnecessary Sections
Department-Level Section Demand Analysis

Course	Historical Demand	Section Capacity	Sections Needed	Planned Sections	Reduction Candidates	Elimination Candidates
ENGL 105	1,000	30	33.33	38	4	—
ENGL 333	5	10	0.50	2	1	1
ENGL 698	10	20	0.50	1	—	1
TOTAL			45.00	64	17	2

All students can fit with 4 fewer sections

Since this section is only 50% full and has 10 or fewer students, consider elimination

Section capacity determined by each department

27% of all planned sections are unnecessary

Sections Needed = Demand / Capacity

Reduction Candidates = Planned Sections - Sections Needed

Source: Ad Astra Information Systems; Education Advisory Board interviews and analysis.

The table above shows part of the section demand analysis for an English department at a large public research university. For each course, it shows historical demand (the number of students who typically register for the course), the section capacity (the maximum size for a single section as determined by the faculty), and then through simple division it calculates the number of sections required. English 105, for example, typically has 1,000 registered students. Each section can hold 30 students, so therefore 34 sections are necessary to meet all expected student demand. The department, however, planned to offer 38 sections (probably based on the previous year's schedule). In theory they could cancel 4 sections of English 105 and still meet all student demand.
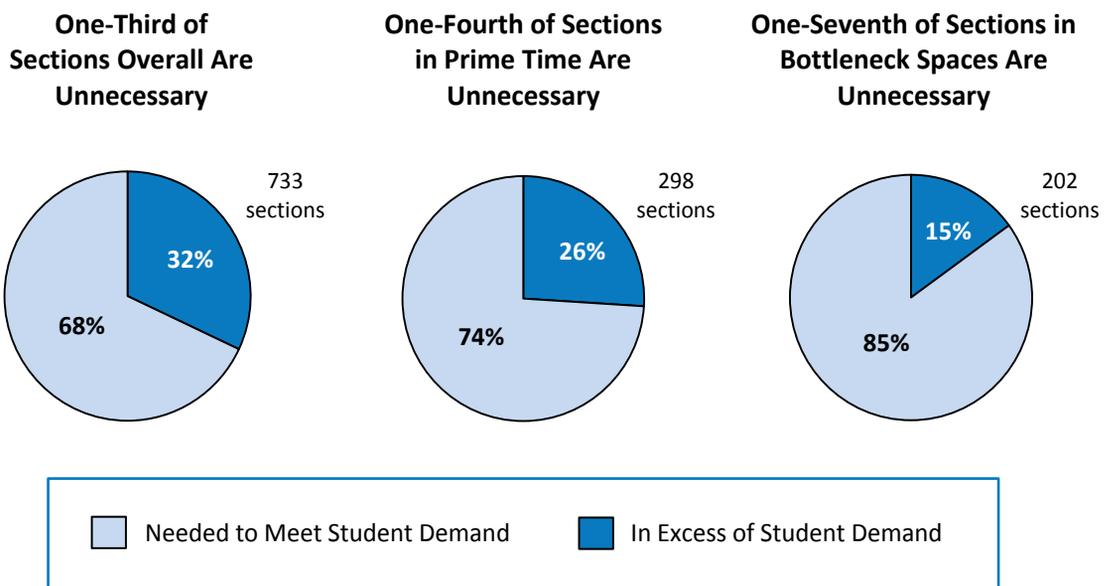
Summed over the entire department, they found that in theory 17 sections, or 27 percent of all of the sections planned for English, could be eliminated.

Cancelling all of the statistically unnecessary sections is neither practical nor advisable. But focusing on unnecessary sections scheduled for bottleneck times or spaces is an easy way to free up capacity in high-demand rooms.

Not Ready for Prime Time
Unnecessary Sections Occupy Highest-Demand Schedule Slots

Sample Data from a Public Research University

One-Third of Sections Overall Are Unnecessary

733 sections

32%

68%

One-Fourth of Sections in Prime Time Are Unnecessary

298 sections

26%

74%

One-Seventh of Sections in Bottleneck Spaces Are Unnecessary

202 sections

15%

85%

Needed to Meet Student Demand   In Excess of Student Demand

Source: Ad Astra Information Systems; Education Advisory Board interviews and analysis.

Extending the section demand analysis to the entire university produces some stunning results. In this case, the institution found that almost one-third of all the sections they offered (733 sections in all) were statistically unnecessary. That does not mean that they canceled one-third of all of their sections (ultimately they cancelled fewer than 100); it simply represents the theoretical maximum. The analysis in the middle chart provides some better direction, showing that 26 percent of sections offered during prime time are unnecessary. In other words, more than a quarter of all of the classes taught at the busiest time of day could be canceled without negatively impacting student access to courses. And the analysis on the right shows that 15 percent of sections offered in bottleneck spaces are unnecessary.

There are two common objections to this approach. First, cancelling all of the unnecessary sections will leave students with fewer schedule options and more conflicts. Secondly, while cancelling excess sections might free up faculty time, it is not always (or often) possible to reassign those faculty to teach other subjects (particularly in smaller departments). The goal should not be to get as close to a perfect schedule as possible, but rather to selectively reduce congestion and free up faculty when they can be used for other purposes. And for those institutions with a significant number of sections taught by adjuncts paid on a course-by-course basis, cancelling adjunct sections can lead to immediate cost savings.

Kent State University undertook an analysis of section fill rates, examining every section at less than 75 percent capacity to determine if cancelling the section could reduce costs without impacting student access to required courses. The business school ultimately cancelled less than a third of all of the sections with a fill rate of less than 75 percent, but it still achieved significant cost savings.

Helping Deans Spot Elimination Candidates
Kent State College of Business Administration Section Offering Analysis
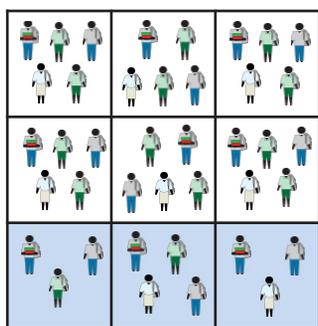
Source: Education Advisory Board interviews and analysis.

Kent State's provost sat down with each dean to review all sections that were less than 75 percent full to determine whether some could be consolidated or cancelled. In the case of the College of Business Administration, the data showed that one-third of all sections, or 160 sections, were below this threshold. The dean reviewed each of these reduction candidates to determine which ones could actually generate cost savings. Initially, they decided to keep half of the sections because they served required courses or they did not cost much to offer. Of the remaining half, they ended up eliminating 50, which allowed them to substantially reduce their adjunct budget and reduce costs at a time when state support was declining.

Critical to the success of the approach at Kent State is that the decision on the proper maximum size for a given section is still set by the faculty. Rather than fight about the right maximum size, the faculty determine section caps and the provost's office just tracks how well departments are doing at filling up sections to that maximum. The extra capacity identified also enabled Kent State to grow enrollment without increasing faculty workloads.

Cost and Capacity Improved, Quality and Teaching Load Untouched

Academics Set the Terms

"The great part of this approach is that deans set the terms. All we ask them is what they consider to be the right section size for a given course; that initial decision is all about quality and pedagogy. All we do then is track how we're doing against our own standard, and there are a lot of efficiencies to be gained."

Bob Frank, Provost
Kent State University

Honoring Workload Policies

"This analysis found we can accommodate enrollment growth entirely within our existing faculty workload policies. We are going to get where we want without even touching that third-rail issue."

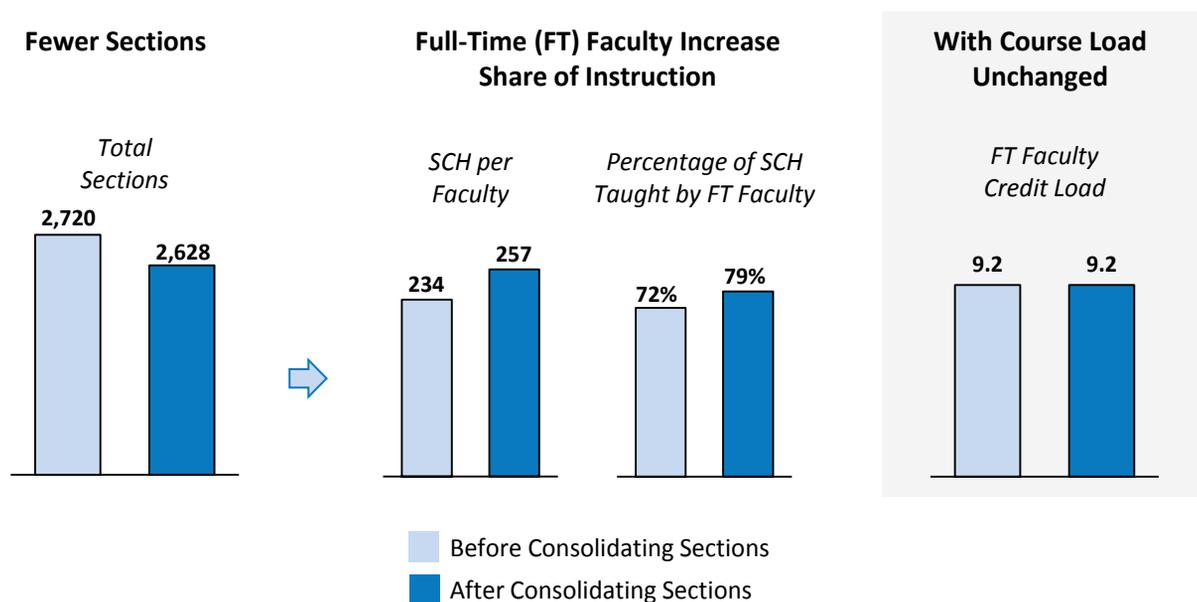*Greg Hackett*
Kent State University

Source: Education Advisory Board interviews and analysis.

The charts below demonstrate the impact of section reduction on faculty workload. This public research university ultimately reduced the number of sections by just under 100 and used the opportunity to reduce its reliance on adjuncts. As a result, the full-time faculty teach the same number of courses, but since those courses are closer to their maximum size, the number of credit hours taught by full-time faculty has increased.

Increasing Instructional Productivity Within the Social Contract
Teaching More Students, Not More Courses[1]

Fewer Sections

Total Sections

2,720   2,628

Full-Time (FT) Faculty Increase Share of Instruction

SCH per Faculty

234   257

Percentage of SCH Taught by FT Faculty

72%   79%

With Course Load Unchanged

FT Faculty Credit Load

9.2   9.2

☐ Before Consolidating Sections
■ After Consolidating Sections

1 Data from public research university.

Source: Ad Astra Information Systems; Education Advisory Board interviews and analysis.

We return here to the previous example of the public university that found that one-third of its sections were statistically unnecessary. This institution ended up making a relatively small reduction in the number of sections offered—dropping just under 100 sections. This enabled them to reduce the number of adjuncts by 10 FTEs, increasing the number of student credit hours per full-time faculty member and raising the percentage of student credit hours taught by full-time faculty. But the course load for the full-time faculty members remains the same. They are teaching more students (but not more than the maximum they set for section sizes), but the same number of courses.

Another way to put this is that most colleges and universities are so inefficient now—so far from the maximum enrollment possible with the existing faculty and facilities—that significant gains can be made without increasing maximum class sizes or faculty course loads.

The previous calculations of section reduction candidates depend critically on estimates of student demand for each course. Currently most institutions simply roll over section caps from term to term with little attempt to estimate the number of students who will actually enroll. A handful of institutions have begun to develop more sophisticated approaches to predicting course-level demand.

How Many Students Will Take This Course?
Perfecting Demand Projections
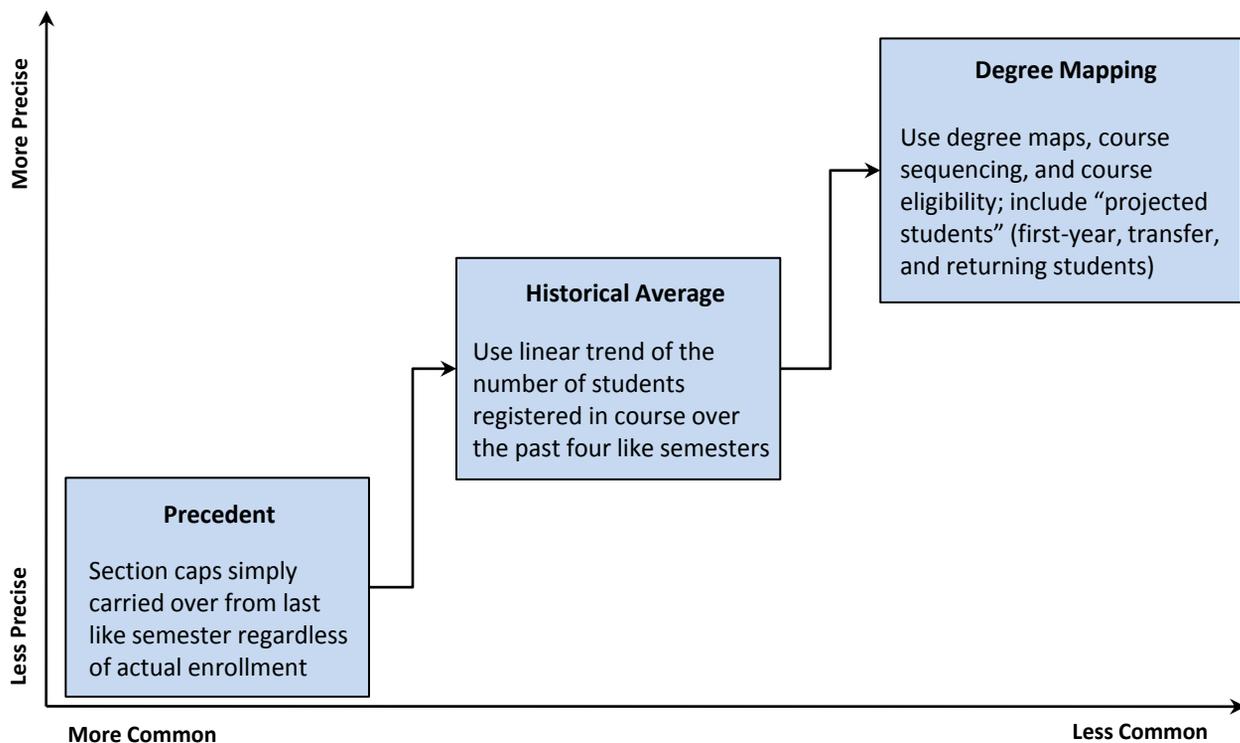
Source: Ad Astra Information Systems; Education Advisory Board interviews and analysis.

Many institutions use section caps to assign classes to rooms, assuming that actual enrollment will be close to the cap. In some cases institutions might schedule a class for a room that fits 30 students even though enrollment in that course has not exceeded 15 each year for the past three years. To create more accurate estimates of course-by-course enrollments some institutions now track the linear trend of registrations in each course over the past four like semesters.

The most sophisticated institutions are beginning to leverage detailed degree maps for each major to predict how many students will enroll in each course based what those students need to take in the next term to make progress toward their degree. These models can even include "projected students," using historical data to forecast what new first-year, transfer, and returning students will take.

More precise estimates of expected enrollment allow for a better match between actual student demand, the number of sections offered, and the right size classrooms, greatly reducing the number of empty seats.

Better forecasts of course demand not only surface lack of demand for some sections but can also indicate which sections are likely to be oversubscribed. These "addition candidates" would require additional sections to meet student demand, forcing administrators to make decisions about when to add capacity and when to turn students away from a popular course.

Adding Capacity to High Demand Courses
Identifying Addition Candidates

**Additional Sections Needed
to Meet Demand**

30	30	30
41	41	42

30	30	30	30
31	31	31	31

Key		
Max Enrollment	30	
Actual Enrollment		41
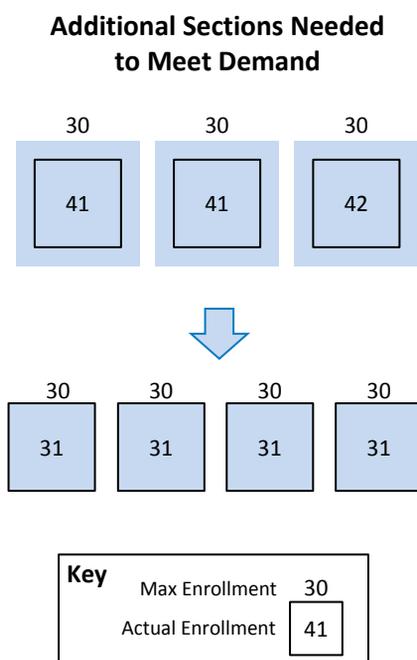
Should We Add More Sections to This Course?

- Is it on the critical path to a degree?
- Is it an enrollment capacity barrier?

Three Potential Responses

- Add a new section during the regular term
- Add an online section
- Add it to summer session

A Philosophical Question

Should we make seats available for all students who want to take the course?

Source: Ad Astra Information Systems; Education Advisory Board interviews and analysis.

When projected demand for a course exceeds the scheduled capacity, administrators have a choice. In the example above, three sections with a maximum capacity of 30 students each are planned for a course, but the expected demand is 124. One option would be to turn away 34 students, leaving the 90 who can be accommodated within the planned sections. Another option would be to add one more section of 30, either locking out the four students who exceed capacity or allowing each section to go over the enrollment cap by a single student.

Key considerations include whether the course is on the critical path to a degree and whether capacity in this course limits the capacity of the entire program. In other words, if other required courses in the program have smaller capacity, this course might not be a bottleneck for the major. If capacity in this particular course is essential for students to make progress toward a degree, other options include offering it during a summer session or adding an online section.

Offering multiple sections in a single course when each has excess capacity is waste of both classroom space and faculty capacity. While 100 percent section fill rates are not consistently attainable, a series of simple approaches can greatly increase efficiency at most institutions. Perhaps the simplest, and one of the most effective, is to use historical data on course enrollments to predict demand for each course offered in the coming semester.

Matching Sections to Student Demand

Low
High

Strategy	Faculty Resistance	Impact	Cost/Effort
Predict Demand Based on Program Requirements	◔	●	●
Consolidate Excess Sections	◐	●	◐
Predict Demand Based on Historical Trend	◐	◔	◔
Reduce Exceptions to Section Enrollment Caps	◔	◐	◐
Redesign Courses to Be Effective with Larger Sections	◐	◔	◐
Add Over-Capacity Sections	◔	●	◐
Eliminate Courses with Low Demand	●	◔	◔

If You Do Only One Thing

Predict Demand Based on Historical Trend

Source: Education Advisory Board interviews and analysis.

IV. Curriculum: Reducing Nonessential Credits

Minimizing the number of unused seats in classrooms and sections can significantly increase capacity. This assumes, however, that most students follow an efficient path to their degree. At many institutions, however, students take an excessive number of credits, they repeat courses multiple times, and they take more credits than are required for a degree—essentially taking up capacity in courses that could be used by other students.
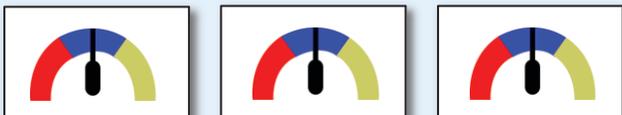
Reducing Nonessential Credits

Traditional Reporting

Status Quo Metric:
Retention Rate
Six-Year Graduation Rate

Target: Varies by institution type

What It Misses

🚫 Fails to identify required courses with insufficient capacity

🚫 Misses students who take excess credits without making progress toward graduation

What the Best Are Measuring

Course Requirement Ratio   *Choke Point Courses*   *Number of "Super Seniors"*

Key Decisions Informed

✓ Are oversubscribed required courses preventing timely graduation?

✓ Are upper-division students with more credits than needed to graduate "blocking" lower-division students?
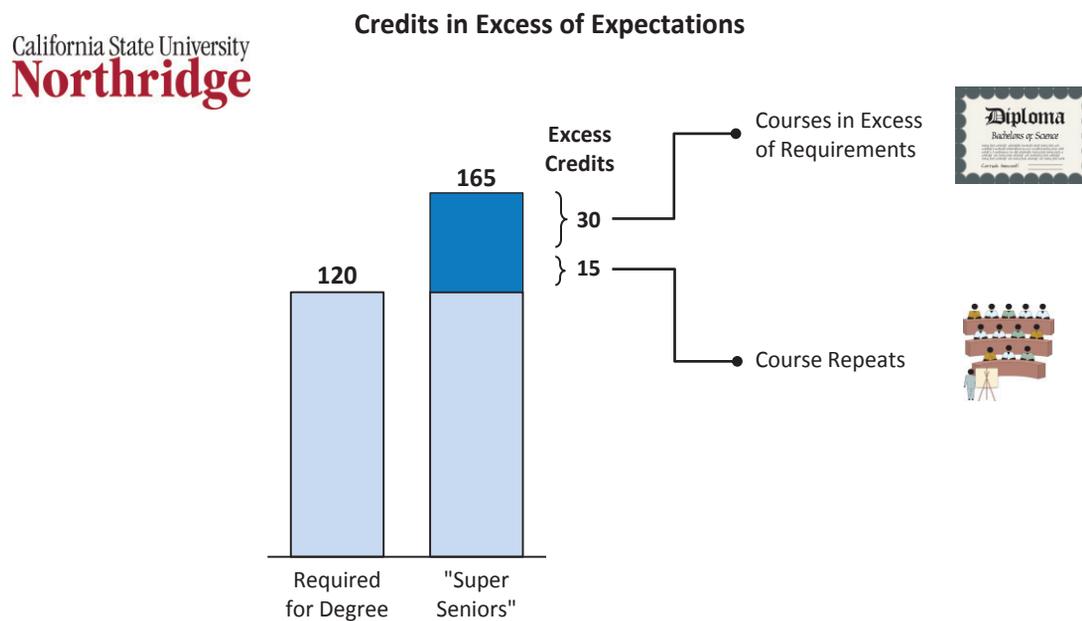
Source: Education Advisory Board interviews and analysis.

Retention is an issue much broader than the challenge of managing instructional capacity, but they intersect in the way that students who take excess credits both slow their own path to graduation and, at the same time, reduce the capacity available to serve other students. The overall retention rate and the six–year graduation rate, two of the typical metrics that institutions track, fail to identify the impact of poor scheduling (such as required courses with insufficient capacity) and of students who take too many credits off the path to a degree. In other words, lack of capacity in bottleneck courses can prevent students from graduating on time, and students who take longer to graduate can themselves create bottlenecks, taking up seats in courses that could have been offered to other students.

Students who take significantly more credits than are required to graduate (sometimes known as "super seniors") are a problem because they use up more resources than students who take a more direct path to their degree. Even allowing for a certain amount of exploration and changes in degree plans, having a significant number of students who complete 20 to 50 percent more credits than required increases costs and reduces capacity.

Extra Credit Isn't Always a Good Thing
Public Institutions Seeing Upper-Division Students "Crowding Out" Freshmen

Credits in Excess of Expectations

California State University
Northridge

120 — Required for Degree

165 — "Super Seniors"

Excess Credits

30 — Courses in Excess of Requirements

15 — Course Repeats

Source: Education Advisory Board interviews and analysis.

The challenge of students who take 120 to 150 percent of the credits required to graduate is most common at public universities. (Students at private colleges and universities are generally motivated to complete more quickly because of the significantly higher tuition.) The data above comes from California State University—Northridge. Like many other public universities, they had a large number of so-called "super seniors," students with more than 120 percent of the credits required to graduate. These students had repeated courses multiple times or simply taken courses in excess of those required for a degree. (Many also transferred in with significant credits.) But many were still short of the specific courses they needed to graduate. Some linger for years, continuing to take up slots in popular courses but failing to make progress toward graduation.

One approach to solving the super senior problem is an advising system that restricts students' ability to repeat courses multiple times, change or add multiple majors late in their career, and register for non-required courses. Many state institutions also begin charging out-of-state tuition once a student passes a certain threshold (typically 120 percent of required credits).

Giving Registration Priority to Students Who Need It
Selected Elements of the CSU-Northridge Graduation Initiative

Nudging "Super Seniors" to Graduation

Reducing Preventable Repeats and Drops

Advisement Holds

- Requires meeting with advisor; registration limited to required courses

Administrative Graduation

- Students with all requirements met mailed a degree

Financial Aid Limit

- Reduces aid cutoff from 180 credits to 150

Summer Sections for "Bottlenecks"

- Offers and funds additional sections of critical courses in summer term

Major/Minor Restrictions

- Limits students to two majors and two minors

- Requires students to declare major by 60 units; add or change major by 90 units

Registration Triage

- Second attempt gets lowest priority

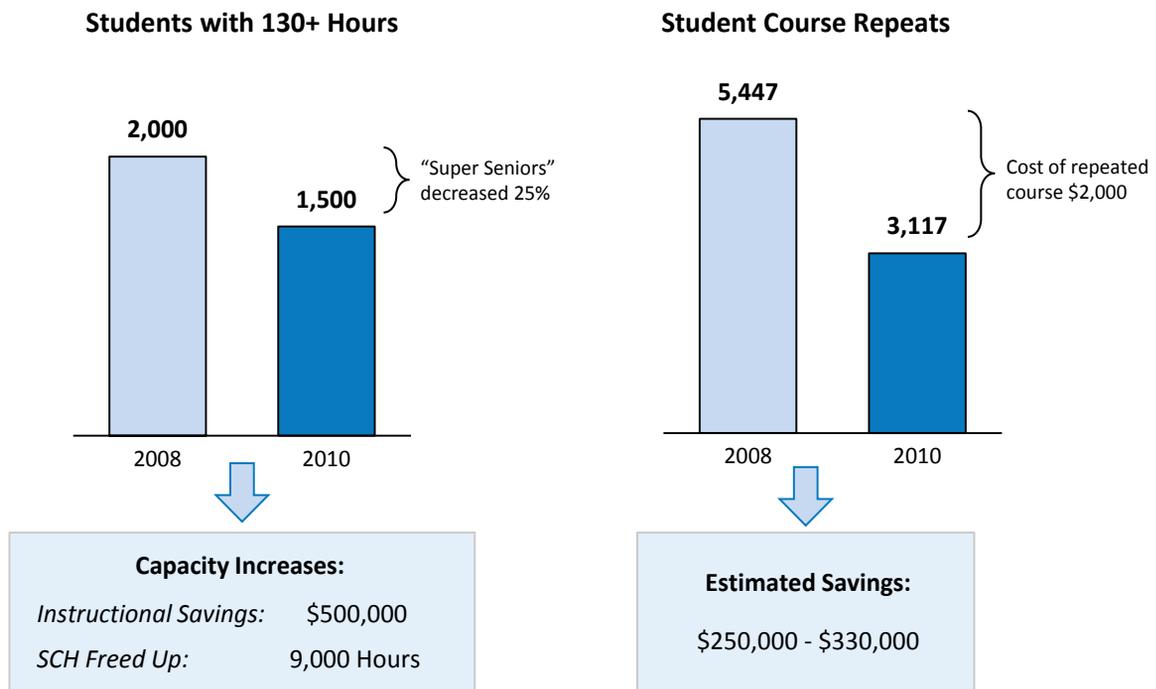- Third attempt requires associate dean approval

Source: Education Advisory Board interviews and analysis.

To address this issue of super seniors, Northridge launched a "Graduation Initiative." They made all super seniors meet with an advisor and limited their registration to required courses. Students who had already completed all of the requirements for a degree but were still taking classes were mailed a diploma. Northridge reduced the cutoff for financial aid from 180 credits down to 150, and they limited majors and minors. Students were allowed no more than two majors and two minors, and they were required to declare a major by 60 units and to add or change major by 90 units.

All of these steps were to help students move through to graduation more quickly. They also changed the policies on registering for repeat courses. Originally, students with more credits had priority in registration, even if they did not need that particular course for graduation. Northridge gave students repeating a course the lowest priority, and students repeating a course a second time required approval from an associate dean.

Over just two years, the Graduation Initiative at Northridge reduced the number of super seniors by 25 percent and the number of repeated courses by almost 43 percent, representing significant avoided costs and increased capacity.

Avoiding Costs by Reducing Excess Credits

Students with 130+ Hours

2,000
1,500

} "Super Seniors" decreased 25%

2008   2010

Capacity Increases:

Instructional Savings: $500,000
SCH Freed Up: 9,000 Hours

Student Course Repeats

5,447
3,117

} Cost of repeated course $2,000

2008   2010

Estimated Savings:

$250,000 - $330,000

Source: Education Advisory Board interviews and analysis.

Cal State Northridge calculates that reducing the number of super seniors saved them $500,000 and freed up 9,000 student credit hours. Each course repeated by a student, they estimate, costs $2,000, yielding savings of well over a quarter of a million dollars for the 2,300 course repeats they avoided. This is not to say that Northridge suddenly found themselves with $750,000 in extra cash. These avoided costs manifested themselves as new capacity—new students could now find seats in those courses once filled with repeaters and super seniors.

More important than any imputed cost savings were two outcomes linked directly to Northridge's mission. Helping super seniors graduate more quickly rapidly boosted their six-year graduation rate, and it also allowed them to admit more new students while holding overall enrollment (and overall costs) constant.

Increase Access Without Increasing Costs
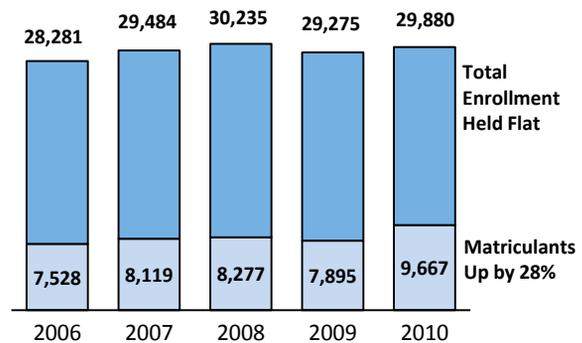## *CSU – Northridge Graduates More Students and Admits More Freshmen*

Rapid Improvement in Graduation Rate
Six Year Graduation Rate
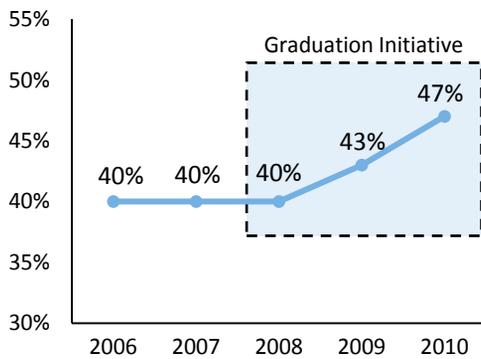
Increasing Access Amidst Budget Pressures
Undergraduate Enrollment

Source: California State University; Education Advisory Board interviews and analysis.

Northridge can calculate how much money it saved by reducing wasted credits and repeated courses, but the real goal was to unlock capacity and serve more students. The Graduation Initiative moved so many super seniors to completion that the six-year graduation rate jumped from 40 percent in 2008 to 47 percent in 2010. Perhaps even more importantly, it enabled Northridge to continue to expand access despite its financial constraints. Like all of the CSU's, Northridge is limited in its ability to grow enrollment to meet expanding demand. In fact, it is operating under a tight cap on overall enrollment. By getting more of the super seniors out, they were able to free up space and actually increase the number of new students admitted. To use a manufacturing analogy, they were able to increase throughput—serving more students with the same facilities and therefore lowering the cost per student.

Guiding students to the right courses and preventing them from taking excessive courses off their degree path can significantly increase capacity at institutions facing tight limits on enrollment. Automatically registering students for required courses is one of the simplest and most effective approaches to ensuring that students get access to the courses that they need, without preventing others from doing the same.

Reducing Nonessential Credits

○ Low
● High

Strategy	Faculty Resistance	Impact	Cost/Effort
Limit Number of Times Students Can Retake a Course	◔	◐	◐
Automatically Register Students for Required Courses	◔	●	◔
Penalize Students for Dropping Courses	◐	◐	◐
Offer Required Courses During Summer Term	◔	◐	◔
Move Required Courses to Online/Hybrid Delivery	◔	◐	◕
Reduce Number of Credits to Degree	●	◔	◔

If You Do Only One Thing

*Automatically Register Students for Required Courses*

Source: Education Advisory Board interviews and analysis.

All of the approaches described in this report are based on the premise that seats in classes are the critical factor limiting instructional capacity. The traditional education model reinforces this belief, measuring student learning in terms of credit hours (essentially, seat hours). Innovative new pedagogical approaches, however, offer the possibility of rethinking instructional models with potentially disruptive impact on capacity limitations.

Flipping the Classroom
Blended Alternatives Replacing Face-to-Face Lecture Model

Traditional Lecture	The "Flipped" Course		
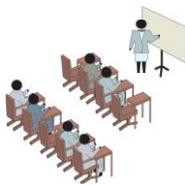
Classroom Lecture	*Recorded Lecture*	*Online Learning Platform*	*Interactive Lab Sessions*
• 1-2 hours of prepared remarks by faculty	• Shorter "mini-lessons" mirror TED Talks/YouTube	• One-stop portal for all course-related materials	• Opportunity for questions, discussion, group work
• Students transcribe presented information	• Students can pause, repeat, and view indefinitely	• Enables online discussion of content	• Break-out sessions broaden participation
• Little time for discussion or engagement	• Aids both preparation for class and review for tests	• Breaks traditional limits of physical classroom	• Multiplies "face time" with faculty and TAs
• Impossible to review or repeat presentation	• Expands faculty reach beyond classroom walls	• Tracks student activity and engagement	• Project-based learning encourages collaboration

Source: Education Advisory Board interviews and analysis.

Despite decades of innovative developments in pedagogy, most classes are still delivered as face-to-face lectures. Not only does this approach generate the broad range of resource challenges described in this report, but educators are increasingly seeing limits to the effectiveness of the traditional lecture. New approaches that leverage lecture capture, learning management systems, and project-based learning are quickly becoming pervasive enough that they are beginning to change the way in which colleges and universities plan for and manage capacity. One contact at a fast growing public research university told us, "I don't believe that we will ever need more classrooms than we have right now." He expected enrollment to continue to grow rapidly, but he also believed that online and hybrid courses would expand capacity (and lower costs) faster than demand.

Given the traditionally slow pace of pedagogical innovation at most colleges and universities, however, it is likely that practices to better manage class schedules and section assignments will be useful tools for improving capacity and reducing costs for many years.