THE TEACHING CAPACITY MODEL: A TOOL FOR STRATEGIC PLANNING IN HIGHER EDUCATION

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ABSTRACT

This paper illustrates a practical approach to resource planning in higher education. The Teaching Capacity Model (TCM) applies a well-known economic tool to quantify the relevant opportunity costs facing a research university when it considers strategic policies designed to enhance the undergraduate educational experience. Two possible strategies considered in this paper are (a) increasing the number of full-time tenure-track faculty engaged in undergraduate teaching or (b) reducing the average undergraduate course size. Using hypothetical data for a mid-sized research university, the TCM clearly presents the implications of these strategies in terms of: (a) the reallocation of faculty from graduate programs, (b) the need for increased faculty productivity (teaching loads), and (c) the additional full-time faculty resources required.

INTRODUCTION

Perhaps the most serious contemporary challenge facing higher education in the United States is how to provide adequate institutional support for intellectual inquiry at the graduate and undergraduate levels. Many colleges and universities, both public and private, are now confronted with a two-fold dilemma: declining financial resources combined with escalating costs. When one considers the combined effects of recent upheavals in financial markets, a severe economic recession, stagnant demographic trends in the college-age population, and the reduction in public and private funding for higher education, it is not surprising to find a certain level of pessimism in the professional academic literature. Faced with limited options, institutions typically respond to budgetary pressures with a combination of revenue enhancement policies such as increasing tuition and fees and cost-containment strategies such as increasing class sizes or cutting programs and personnel. The former increases the financial burden for students and families while the latter often erodes the quality of the educational experience.

In addition to the financial difficulties facing American higher education, there is an upsurge in public scrutiny for better accountability in the educational outcomes of colleges and universities. This is especially true for undergraduate education at public universities. For example, a recent comprehensive study by two former college presidents is highly critical of U.S. public educational outcomes, especially as measured by 4-year graduation rates for undergraduate students (Bowen, Chingos, & McPherson, 2009). This study confirms and reinforces what higher education experts have known for at least 20 years: a typical publicly-supported university in the U.S. graduates less than half of its first-year students within 4-years, and barely two-thirds within 6-years. Although graduation rates vary by institutional characteristics, it is not unusual for a public university to graduate less than one-third of its entering class four years later (Planty, et al., 2009). These relatively poor student outcomes at public universities have led some analysts to question the viability of public undergraduate education in general (Bowen, et al., 2009; Sperber, 2000). One possible suggestion to improve graduation rates for public universities is that they become more like their private liberal arts counterparts by offering smaller undergraduate class sizes and increasing the use of full-time, tenure-track faculty in undergraduate and core courses. An interesting example of this strategy is the recent growth of “Honors Colleges” at many large public universities. By their nature, these programs provide an enriched educational experience that emphasizes critical thinking, creativity, and written expression through seminar-type courses taught by seasoned, full-time faculty. Although such strategies are easy to propose, actual implementation is another story.

According to Facione (2009), it is now imperative for the higher education industry to engage in a more serious analysis of the delicate balancing act between academic mission and available resources, especially in this tough economic climate. Many will agree that in order to achieve this balance, it is critical for institutions to protect their main revenue streams, and for most this means the retention of full-time undergraduate students. For research universities with unstable financial health, this focus may come with the difficulty of re-distributing faculty teaching loads. In the last 40 years, higher education went through the deliberate move from an undergraduate to graduate/research model (Sperber, 2000). The basis of this shift was to provide graduate students with new and more in-depth knowledge from research-active faculty members. In addition, there is a popular opinion among academics that the graduate-research model greatly facilitates faculty scholarship (Bowen, et al., 2009; Sperber, 2000). As a result, it is not unusual to see full-time, tenure-stream faculty members assigned to only graduate-level courses, consequently pulling them away from teaching at least one undergraduate section. In these tough times, however, it has become evident that many universities are strengthening their emphasis on a stronger undergraduate education by eliminating graduate studies that are not academically strong and re-examining faculty teaching loads. While it is difficult to go through this process, academic administrators may need to consider that faculty scholarship should not be the primary justification in the allocation of full-time faculty members to graduate courses (Facione, 2009).

This paper develops a basic model to illustrates the trade-offs, or opportunity costs, for an institution that attempts to reallocate faculty resources to enhance the educational experience of its undergraduates. The basic premise is that the university is considering a change in strategic direction; one that places a greater emphasis on providing a strong undergraduate curriculum. In the model presented below, the opportunity cost of devoting more attention to undergraduate programs will be measured by the sacrifices (reductions) in graduate programs that must occur, if the university's overall instructional resources are held constant. The model's results are illustrated using a practical example with hypothetical data for a medium-sized research university. We assume that our hypothetical university is fully engaged in providing graduate-level education, along with extensive undergraduate programs. As an example, assume a university classified as "RU/H"-- Research Universities (high research activity) by the Carnegie Foundation.

Basic Teaching Capacity Model (TCM)

A modern research university is a complex institution that must somehow reach a balance between a myriad of competing missions (e.g., basic and applied research, graduate and undergraduate instruction, service to the community) with a wide, albeit finite, array of human and physical resources. For the purposes of this paper, we will narrow our focus to a single, yet important, mission: full-time student instruction. Similarly, we consider the allocation decisions for a single instructional resource: full-time, tenure-track faculty (FT-TT), that is, faculty who are either tenured or tenure-eligible. Thus, for simplicity, we are not directly including other faculty categories (e.g., full-time, non-tenure track -- also referred to as "contract" faculty; part-time (adjunct) faculty and graduate teaching instructors). Also for simplicity, we ignore specific divisions within a university (colleges and departments), and assume that all students attend full time.

A university must offer an adequate number of courses to meet the academic needs of its students. This number is based on many factors such as enrollment levels, student course loads, class sizes, and curricular needs. For simplicity, we will ignore curricular issues and other factors, and combine all courses into one aggregate measure: the overall number of classes needed per year (#CLASSES NEEDED). It is possible to express the fundamental instructional allocation problem for a university, in terms of annual number of classes, as the following equation:

$$\#\,CLASSES\ \ NEEDED = \frac{\left(\#\,STUDENTS \times AVE.\,COURSES\ PER\ STUDENT\right)}{AVE.\,CLASS\ \ SIZE}$$

(1)

Expression (1) shows explicitly the well-known outcome that class offerings are directly related to enrollment and average student course load, and indirectly related to the average enrollment per course (Massy and Zemsky, 1997).

The university's ability to meet the demand for courses specified in (1) is primarily determined by its endowment of instructional human resources, i.e., full- and part-time faculty.

Given that we assume one type of faculty resource (FT-TT faculty), the teaching capacity can be depicted as:

$$\overline{TC} = N \times \overline{CPF} \qquad \textbf{(2)}$$

where $\overline{TC}$ = annual teaching capacity (number of courses)

N = number of FT-TT faculty

$\overline{CPF}$ = average number of courses taught per faculty (i.e., annual teaching load)

Given $\overline{TC}$ from expression (2), the university must allocate its annual teaching capacity among graduate (G) and undergraduate (UG) courses as follows:

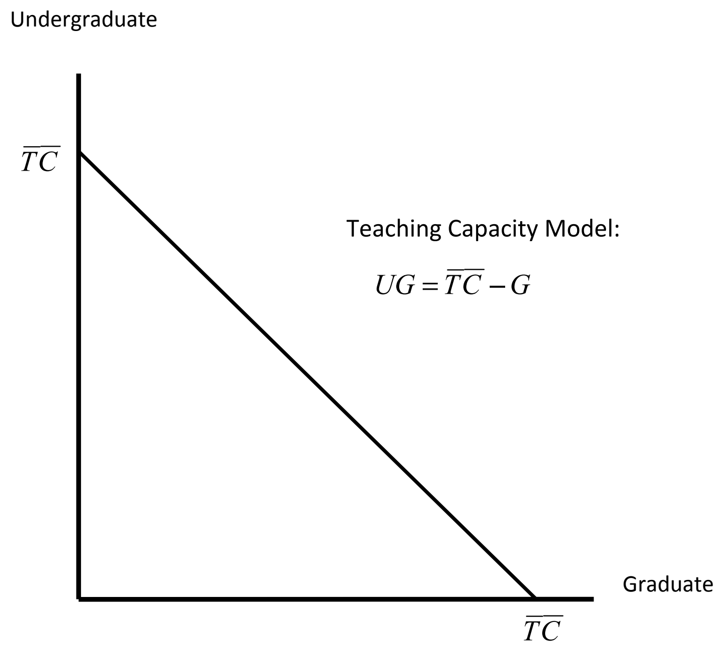
$$TC = G + UG \qquad \textbf{(3)}$$

Or, equivalently,

$$UG = \overline{TC} - G \qquad \textbf{(4)}$$

Expression (4) forms the basis of our Teaching Capacity Model (TCM), and shows the competing relationship between graduate and undergraduate course offerings with a given (fixed) level of faculty: e.g., more graduate classes taught (G) mean fewer undergraduate courses covered by the full-time faculty**.** The allocation problem facing the university, as given by the TCM, can also be illustrated with a diagram. Figure 1 illustrates teaching capacity as distributed among graduate and undergraduate classes. Each point along the TCM shows a possible mix of graduate and undergraduate classes that can be accommodated with the current faculty size and average teaching load. This graph applies the well-known Production Possibilities Frontier from economics to illustrate class allocation choices for the university (Mankiw, 2008).

Figure 1: The Basic Teaching Capacity Model



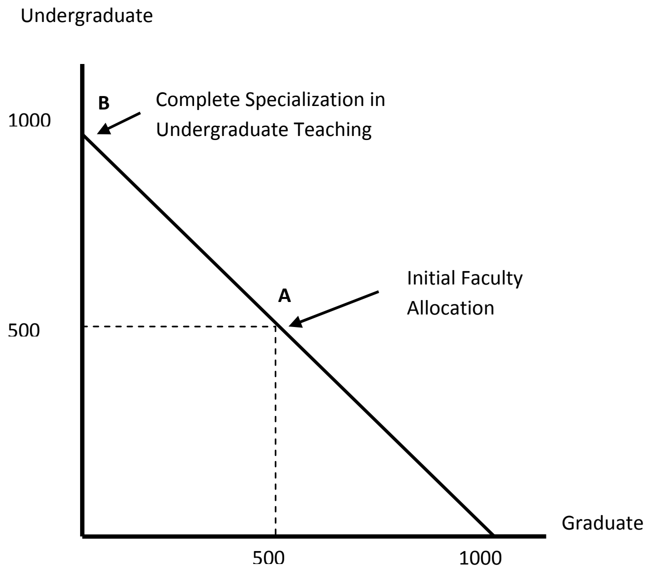
TCM with Hypothetical University Data

Borrowing terminology from Bowen, et al., (2009), suppose we are considering a medium-sized, research university with mid-level selectivity, or, in the words of Sperber (2000), a "Big-time U." The university has the following basic characteristics:

- 9000 full-time undergraduate students (0 part-time)
  The average student takes 10 "lecture" classes per year
  The average class size = 50 students
- 1000 full-time graduate students (includes doctoral and masters)
  The average student takes 5 "lecture/seminar" classes per year
  The average class size = 10 students
- 250 FT-TT faculty
  The average faculty member teaches 4 courses per year

Given the data above, the university needs to provide instruction for 10,000 students with 250 FT-TT faculty (along with other instructional staff). From Expression (1), we see that our university requires 1800 undergraduate lecture courses ((9000 x 10) ⁄ 50) and 500 graduate lecture/seminar courses ((1000 x 5) ⁄ 10) to be offered each year, or a total of 2300 classes. Given a FT-TT faculty of 250, with 4 classes taught per faculty member per year, the FT-TT teaching capacity is 1000 courses, according to expression (2). If 100% of graduate courses are taught by FT-TT faculty, 500 undergraduate lecture courses (28% of 1800) can also be covered by FT-TT faculty, with the remaining 72% (1300 classes) taught by adjuncts, contract faculty, and graduate students. These percentages are consistent with results reported elsewhere for public universities (Schibik & Harrington, 2004; Sperber, 2000).

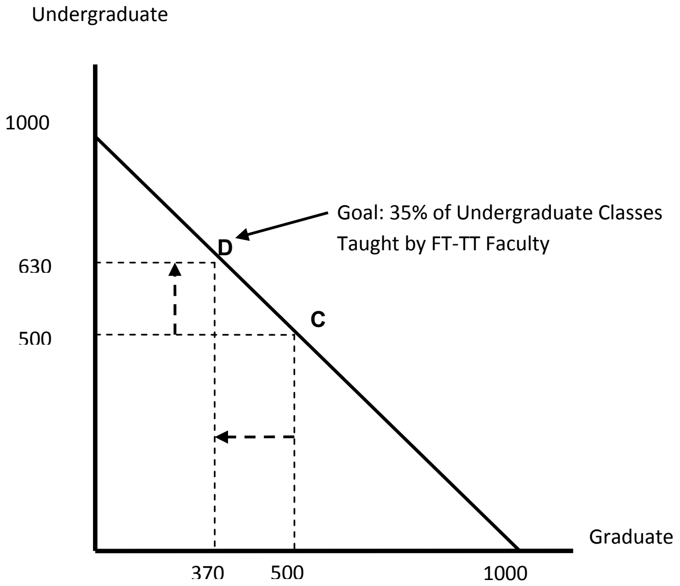
Point A in Figure 2 illustrates the initial teaching allocation for our hypothetical university: 500 undergraduate classes and 500 graduate classes taught by FT-TT faculty. At first glance, the implicit trade-off between undergraduate and graduate classes appears to be one-to-one – i.e., if one faculty member is removed from an undergraduate class, he/she is available to teach one more graduate seminar. Yet, from a productivity standpoint (e.g., student credit-hours), the opportunity cost of a graduate class is five-times more than an undergraduate class. That is, student credit hours for 50 undergraduate students must be "sacrificed" to teach 10 additional graduate students. In financial terms, graduate classes are even more expensive relative to undergraduate courses because of graduate stipends and tuition benefits. Figure 2 also indicates that if every FT-TT faculty member was engaged in undergraduate teaching (point B), to the exclusion of all graduate classes, there are 800 undergraduate classes (44%) that still need to be covered by part-time and/or contract faculty. Figure 2: TCM for Hypothetcal University



The TCM model can also be used to illustrate the implications of a strategic change of direction for the university. For instance, suppose the university's goal is to improve the overall undergraduate experience by reducing student attrition and increasing the 4-year graduation rate. In addition, assume that a consensus has been reached that this goal might be accomplished by having a greater percentage of undergraduates taught by full-time, tenure-track faculty, especially in lower-division core academic courses. If no additional resources are available (i.e., new faculty lines), achieving this goal has obvious consequences: either diverting faculty resources from graduate education, or somehow increasing faculty productivity. These outcomes can be presented easily with the TCM using the hypothetical university data.

To illustrate, suppose the university's new target for the percentage of undergraduate courses covered by FT-TT faculty is 35%, with no change in the average undergraduate class size or number of faculty. At first glance, this appears a modest goal, especially by private college standards. However, many public research universities would be hard pressed to meet this number (see Sperber 2000, pp. 78-80). This goal requires that 630 classes (35% of 1800) be taught by FT-TT faculty, an increase of 130 classes, and is shown in Figure 3 as the movement from point C to D along the TCM. If graduate instruction is restricted to FT-TT faculty, eliminating 130 courses from graduate programs requires that the number of graduate students (in terms of student capacity) be reduced by 260, a decrease of 26%, assuming stagnant resources.[1]

Figure 3: Shifting Faculty Resources to Undergraduate Classes



If it is not politically possible to cut graduate programs at the university, then achieving the 35% undergraduate coverage rate can be accomplished by two alternatives: (a) additional FT-TT lines, or (b) increasing the average teaching load per faculty member (or some blend of the two). Figure 4 depicts, that an additional 130 undergraduate classes can be covered without sacrificing graduate programs, if the TCM shifts to the right (from TCM_1 to TCM_2). This rightward shift is possible if one of the following occur: an increase in FT-TT lines by 33 (to 283) or the average faculty teaching load increases from 4 to 4.5 classes, that is, approximately half of the faculty must teach one additional course per year.[2] In economic terms, the goal is reached if faculty resources are added, or existing resources become more productiveFigure 4: An Increase in Faculty Resources or Productivity

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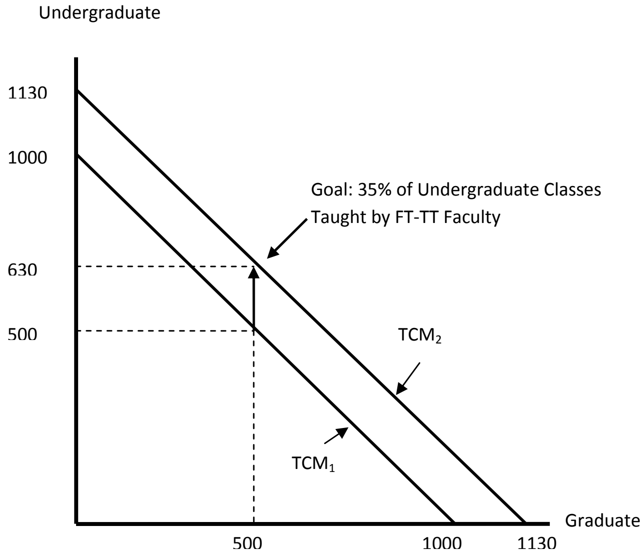
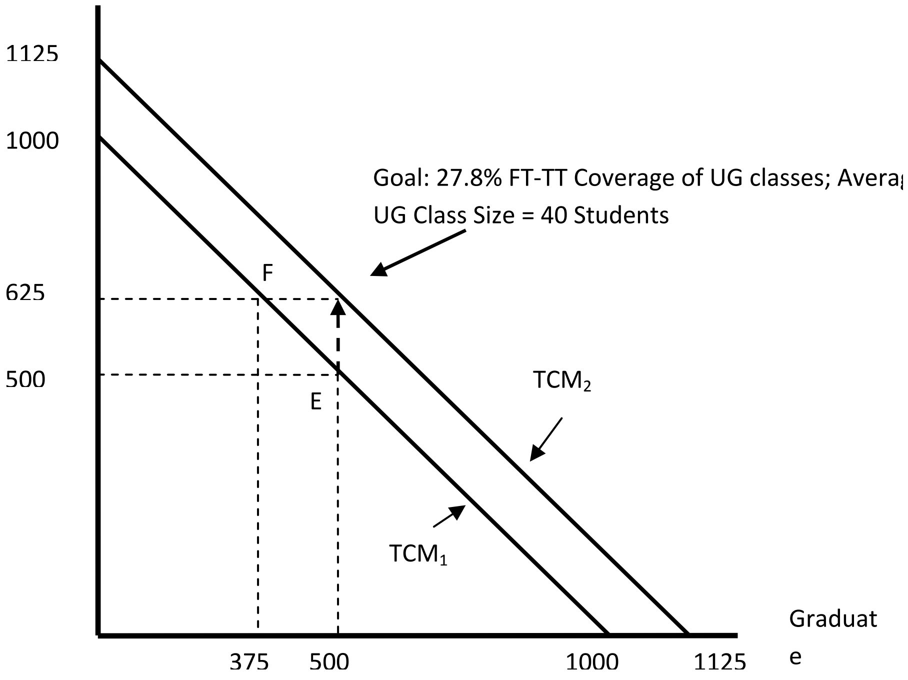


The TCM can also illustrate another potential strategy to improve undergraduate education: a decrease in the average class size. Given the basic institutional data above, we can determine the effects of reducing the average undergraduate class size to, say, 40 students (from 50). To implement this strategy, expression (1) indicates that 2250 undergraduate classes are needed per year, an increase of 450. If faculty resources, productivity (teaching loads), and graduate course offerings remain unchanged, the FT-TT coverage of undergraduate classes would consequently decline from 27.8% to 22.2% (i.e., 500/2250). Since the additional classes must be covered, with adjunct and/or contract faculty, the net outcome for undergraduate educational quality is uncertain (Schibik & Harrington, 2004). If the university wishes to maintain FT-TT coverage at 27.8%, then 625 undergraduate classes must be taught by this group (27.8% of the 2250 smaller-sized undergraduate classes). As shown in Figure 5, this objective is met if 125 fewer graduate classes are offered (i.e., moving from point E to point F). On the other hand, if each faculty member taught 4.5 classes per year (an increase of 0.5), the TCM would shift outward (from TCM_1 to TCM_2 in Figure 5), allowing 625 undergraduate classes to be taught without sacrificing graduate courses. Alternatively, moving from TCM_1 to TCM_2 could be accomplished if approximately 31 new FT-TT faculty are added, while maintaining the same number of graduate courses and faculty teaching loads.[3]

The similarity in outcomes for the FT-TT coverage and class size scenarios is not surprising. In the first scenario, the proposed faculty allocation to undergraduate education was increased by approximately 26%; in the second scenario, average undergraduate class sizes were reduced by 25%. Both of these scenarios require one, or a combination of, the following: more faculty resources, higher faculty productivity, or a reallocation of faculty resources from graduate teaching. The TCM clearly quantifies the relevant opportunity costs for university administrators when they attempt to implement a reallocation of instructional resources.

Figure 5: Reducing the Average Class Size for Undergraduates



CONCLUSION

The Teaching Capacity Model (TCM) provides a clear illustration of the opportunity costs a university encounters as it attempts to enhance the undergraduate educational experience. In this paper we evaluated two possible strategies for improving undergraduate education at a mid-sized research university: (a) allocate more full-time, tenure-track faculty to undergraduate courses, or (b) reduce the average undergraduate class size. Implementing either of these strategies requires one, or a combination of, the following: (a) additional faculty lines; (b) higher faculty productivity (teaching loads); or (c) a reduction in instructional resources devoted to graduate education. The TCM presents choices related to the key elements in a straight-forward manner and provides a useful analytical framework for resource allocation discussions or strategic planning exercises.[4]

In an era of severe resource constraints, addressing these opportunity costs is a daunting task for most institutions. In one hypothetical scenario presented above, a modest increase in the percentage of full-time tenure track faculty teaching undergraduate classes would require that half of the faculty teach one more class per year; or, on the other hand, that graduate enrollments be reduced by 26%. Alternatively, assuming no reduction in graduate course offerings, 33 additional full-time tenure-track faculty would be needed. At current salary and benefit levels, this could easily add nearly $3 million to the operating budget of the institution – an unlikely outcome in the current economic climate. These types of issues are facing many institutions today. For example, just a cursory review of recent articles on higher education reveals outcomes that can be illustrated easily with the TCM approach: one university implemented an early retirement program for faculty and is now planning for larger class sizes and fewer offerings since many of the retirees will not be replaced (Mangan, 2011); another university is trimming under-performing graduate programs (and faculty positions) to meet its basic need for undergraduate instruction (June, 2010). Unfortunately, there is no indication that these choices will become easier in the foreseeable future.

Endnotes

1. We obtained the number of displaced graduate students by using a modified version of expression (1) for graduate students: $\Delta C = \Delta S \times \left(\frac{\overline{CPS}}{\overline{CS}}\right)$ where ΔC is change in number of classes can be offered, ΔS is change in number of students, $\overline{CPS}$ is the average number of classes taken per student, and $\overline{CS}$ is average class size. Since ΔC = -130, $\overline{CS}$ = 10 students, CPS = 5 classes per year, $\Delta S = -130 \times \left(\frac{\overline{CS}}{\overline{CPS}}\right) = -260$ students. We assume the displaced graduate students cannot be taught by part-time or contract faculty, or moved into larger classes.

2. Covering 1130 classes, with the average faculty member teaching 4 classes, requires 282.5 faculty; conversely, covering 1130 classes with 250 faculty requires each faculty member teach 4.52 classes per year.

3. If the average undergraduate class size is reduced to 40 students, we see from expression (1) that the number of required undergraduate classes increases to

UG CLASSES NEEDED = $\frac{(9000 \times 10)}{40}$ = 2250. Hence, with 250 faculty teaching 500 undergraduate courses, the coverage rate falls to 22.2%.

4. TCM approach can be easily extended to illustrate other well-known resource allocation problems in higher education, for example, athletics versus academics; upper-division, specialized courses versus lower-division general education (core) courses; “honors” versus “regular” courses, etc.

REFERENCES

Bowen, W. G., Chingos, M. M., & McPherson, M. S. (2009). *Crossing the finish line: Completing college at America’s public universities*. Princeton, New Jersey: Princeton University Press.

Facione, P. A. (2009). Adaptive budgeting: Thirty-four suggestions for raising revenues, cutting costs, retaining students, and saving jobs in hard times. *Liberal Education, 95*(3), 24-31.

June, A. W. (2010, February 17th). U. of Iowa lists 14 graduate programs at risk for cuts or eliminations. *The Chronicle of Higher Education.* Retrieved from http://chronicle.com/article/U-of-Iowa-Lists-14-Graduate/64229/.

Mangan, K. (2011, January 3). At 2 Texas campuses, faculty buyouts create staffing headaches. *The Chronicle of Higher Education*. Retrieved from http://chronicle.com/article/At-2-Texas-Campuses-Faculty/125796/.

Mankiw, N. G. (2008). *Principles of economics*, (5th ed.). Cincinnati, Ohio: Southwestern College Publishing.

Massy, W. F. Zemsky, R. (1997). A utility model for teaching load decisions in academic departments. *Economics of Education Review, 16*(4), 349-65.

Planty, M., Hussar, W., Snyder, T., Kena, G., Kewal Ramani A., Kemp, J., Bianco, K., Dinkes, R. (2009). *The condition of education 2009* (NCES 2009-081). Washington, D.C.: National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education.

Schibik, T., Harrington, C. (Spring, 2004). Caveat emptor: Is there a relationship between part-time faculty utilization and student learning outcomes and retention? *Association for Institutional Research Professional File* , 91

Sperber, M. (2000). *Beer and circus: How big-time college sports is crippling undergraduate education.* New York, NY: Henry Holt.

U.S. Department of Education, National Center for Education Statistics, (2009). 1999-2000 through 2007-08 integrated postsecondary education data system, “salaries, tenure, and fringe benefits of full-time instructional faculty survey” (IPEDS-SA:99), Winter 2001-02 through Winter 2007-08.