

## Cost of Instruction: Research and Praxis

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### *Abstract*

This article provides an overview of cost of instruction methodologies that are relevant to larger discussions about costs, price, and affordability, with a focus on their practical applications. A variety of approaches and policy issues are analyzed, with emphasis on the models of NCHEMS and NACUBO.

### *Introduction*

The topic of cost of instruction is sometimes overlooked in the broader context of discussions about affordability, cost, price, and the economics and finance of higher education. There is, however, a distinct though relatively small knowledge base of literature and research about cost of instruction. This document presents a meta-view of the practical applications, scholars, and audiences for this methodology. Without a full understanding of what is possible with this type of modeling, the understanding of affordability, cost, and price is incomplete.

The language of cost is “used constantly in higher education and has many different meanings. Cost information abounds, yet... it is seldom what it appears to be” (Jenny, 1996, p. xv). Jenny explains that:

*...higher education accounting is not organized to answer questions concerning the full costs of teaching a conventional course, conducting a seminar, admitting a freshman class, or managing the institution’s heating and cooling system... Sometimes the normal accounting system is so far removed from what is needed that elaborate new stand-alone costing models must be constructed (Jenny, 1996, p. 93).*

Ash and Bacsich liken cost modeling to “weighing air,” something which “describes the process of quantifying something that quite definitely exists but is normally invisible and can only be measured by using special tools” (Ash and Bacsich, 1999, p. 2). Without these models and tools, information about costs is hidden in what the National Commission on the Cost of Higher Education (1998) calls “a veil of obscurity.” The recently released, draft report of the Secretary of Education’s Commission on the Future of Higher Education states that:

*College and university finances are complex, and are made more so by accounting habits that confuse costs with revenues and obscure production costs. The lack of transparency in financing is not just a problem of public communication or metrics. It reflects a deeper problem: inadequate attention to cost measurement and cost management within institutions. (Secretary of Education’s Commission, 2006, p. 12).*

Jones (2000) describes how cost data analyses “start with accounting data and rely on adjustments to, and allocations of, these financial data to yield answers. As a consequence, the re-

sults are influenced heavily by the purposes, conventions, and limitations of such data” (p. 80). These data were designed as part of transaction-based systems for financial, human resources, and enrollment management. “These data were not intended to serve the primarily analytic needs of the institution, such as providing a straightforward answer to the cost question” (p. 80).

The New Millennium Project on Higher Education Costs, Pricing, and Productivity states that “costs are complicated and there is an internal incentive structure that leads institutions to avoid being clear about them. There are several subsets to this overarching problem, including issues of measurement, audience, and culture” (IPEP, 2000, p. 7). Recognizing that measuring costs is complex because of the nature of higher education and its multiple revenue streams, “the complexity of the enterprise should not be masked out of concern for simplicity and ease of public communication” (p. 7). At the state level, institutions may be “hesitant to provide detailed cost data for fear of inviting micromanagement by state officials, particularly because of concerns about unfunded research” (p. 8).

In a white paper for the Secretary’s Commission, Dickeson reinforces this point that “the specific cost drivers – the major factors that induce institutions to spend (and charge) more are often neglected. Such factors are usually hidden from public view” (2006a, p. 1). This situation is described in the Commission report:

*Our higher-education financing system is increasingly dysfunctional. State subsidies are declining; tuition is rising; and cost per student is increasing faster than inflation or family income. Affordability is directly affected by a financing system that provides limited incentives for colleges and universities to take aggressive steps to improve institutional efficiency and productivity. Public concern about rising costs may ultimately contribute to the erosion of public confidence in higher education (Secretary of Education’s Commission, 2006, p. 11).*

This erosion is worsened because “Dialogue about the issue has become counterproductive. Harsh proposals and counterproposals and arguments about who’s to blame add to the divisive nature of this topic” (Dickeson, 2004, p. 1). The 1998 National Cost Commission report recommended that institutions address cost issues or face “unilateral solutions that are likely to be heavy-handed and regulative” (Harvey et al., 1998, p. iv). Prefacing a collection of papers responding to the crisis, Dickeson admonishes that “America is wasting human resources because of runaway college costs, and its time to do something about it” (2006b, p. 3).

The reader is referred to the extensive literature on cost, price, and affordability in the bibliography to understand this dialogue. For example, see Adams et al (1978), Bottomley et al (1972), Bowen and Breneman (1993), Breneman (1994), Clotfelter (1996), Coombs and Hallak (1987), Cunningham et al (2001), Davis (1997), Gonyea (1978), Hansen and Weisbrod (1969), Hart and Teeter (2003), Harvey et al (1998), Heller (1997), Hoenack and Collins (1990), Ikenberry and Hartle (1998), IHEP (1998, 2000a), Johnstone (1991, 1998), Jones (2000), Leslie and Brinkman (1989), Lewis and Dunder (1999), Levin (1983), Levin and McEwan (2001), Mancini and Goeres (1995), Masland (1982), Massy (1981, 1991, 1996, 2003), Maynard (1971), McPherson and Schapiro (1991), Olson (1997), O’Neil (1971), Reindl (2002), Rothschild and White (1995), Schulz (1960, 1968), Sheehan and Gulko (1976), Stedman (2003), Stringer and Cun-

ningham (1999), To (1987), Vedder (2006), Wellman (2006), Winston (1992, 1993, 1998, 1999, 2000, 2001), Winston and Lewis (1996), Winston and Yen (1995), and Winston and Zimmerman (2000).

The purpose of this synthesis is not to replicate this previous work, but to contribute to this dialogue by disseminating methodologies for calculating better cost of instruction data.

### *The developing knowledge base*

The development of the knowledge base on cost of instruction follows the same timeline as the professionalization of higher education administration as a field of study, as well as the emergence of technology and specific policy interests. Beginning in the 1970s and early 1980s, there was growing excitement about management decision-making at the institution and state level (Halstead, 1974; Hollander, 1991; Mingle, (19??); Moak, 2000).

This paralleled the developing influence of national associations such as the Association for Institutional Research (AIR), the Society for College and University Planning (SCUP), the State Higher Education Executive Officers (SHEEO), and the National Association for College and University Business Officers (NACUBO), as well as their sector and regional counterparts such as the National Association for State University and Land Grant Colleges (NASULGC), the Western Interstate Cooperative for Higher Education (WICHE), and the Western Cooperative for Educational Telecommunications (WCET). The bibliography documents the prolific contributions of these and other groups. For example, see the *AIR Professional File* contributions on cost-related topics by Brinkman and Allen (1986), Cox et al (2000), Hample (1980), May and Kallio (1983), and Taylor (1982, 1984, 1986).

From these role, sector, and regional affiliations, a range of initiatives and publications have addressed numerous evolving finance issues. These helped to develop standards, best practices, and expectations about budgeting, cost accounting, and indirect cost analysis for institutions, systems, sectors, and states. At the same time, with the creation of administrative information systems and the introduction of the mainframe, mini, and personal computer, practitioners and consultants tapped into the potential for supporting better decision-making through computer simulation models. The dramatic increase in capability and availability of computing at a fraction of its cost in the 1970s runs parallel to the development over the same time period of statewide unit record data collections (Ewell et al, 2003; Moak, 2000).

Following this, since the mid-1990s, the perceived panacea of technology and the Internet have helped shape myriad attempts at potential cost savings, from the use of instructional computing technologies (ICTs) to online learning. The Carnegie, Pew Charitable Trust, Andrew W. Mellon, Ford, Annenberg/CPB, Alfred P. Sloan, and Lumina foundations have all focused at some point in their respective research agendas on costs, often with a focus on technology, helping to fuel this momentum (Carnegie Commission on Higher Education, 1972, 1973; Lumina Foundation for Education, 2004, 2006). The topic of technology has drawn its own share of the cost methodology literature, described by (Bacsich et al, 1999, p. 75) as “confinable, with a slow rate of accretion.” This may be categorized geographically, U.S. versus international, and by

application, distance education as a whole versus the incorporation of specific tools or technologies in teaching and learning. A separate literature about information technology (IT) funding in higher education is also relevant but not addressed here.

There have been several rounds of national drivers as well that have contributed to the debate on costs, including the National Commission on the Financing of Postsecondary Education (1973), the National Commission on Responsibilities for Financing Postsecondary Education (Greer, 1993), and the National Commission on the Cost of Higher Education (1998). With the last, Congress mandated a three-year Study of College Costs and Prices by the National Center for Education Statistics (NCES, 2001). Other efforts around the turn of the century include the New Millennium Project on Higher Education Costs, Pricing, and Productivity (IHEP, 2000); the Congressional Research Service's College Costs and Prices by Skinner (2003); Boehner and McKeon's (2003) Congressional critique The College Cost Crisis; and NACUBO's (2002) Explaining College Costs: NACUBO's Methodology for Identifying the Costs of Delivering Undergraduate Education.

There are multiple dimensions to these discussions. These include: (1) a public, political issue concerned with perceptions of price and focused by federal, state, and media attention to increasing tuition and fees and the impact of financial aid; (2) a policy issue focused on public subsidies and funding priorities; and (3) an institutional-level issue in which administrators and trustees have admitted that their cost structures are not well understood (IHEP, 2000a).

Given this background, there are two general approaches to understanding the relevant literature on cost of instruction. These include: (1) specific policy topics such as cost, price, affordability, state funding, financial aid, technology, and nontraditional students; and (2) methodologies such as net price, performance measures and ratios, cost accounting, macro- and micro-costing, activity-based costing (ABC), benchmarking, peer comparisons, responsibility-centered management (RCM), and indirect cost recovery. Each policy topic and each methodology has its own proponents. This confluence of multiple, competing themes, interests, and models confounds and overshadows the discussion of cost of instruction per se.

While individual scholars have contributed to the literature on cost of instruction and the related methodologies of cost accounting and resource allocation, two organizations have been the primary drivers for more than thirty years behind the research and practice – the National Center for Higher Education Management Systems (NCHEMS) and NACUBO, with NCHEMS at the center of the theoretical vision for leveraging existing data and NACUBO supporting methodologies for cost of instruction within the larger context of cost accounting, resource allocation, and budgeting (Hyatt, 1983). Evidence of this is seen in the three editions of the NACUBO administrative handbook for budgeting (Meisinger and Dubeck, 1984; Meisinger, 1994; and Goldstein, 2005). The Instructional Workload Matrix of the consumption and contribution of credit hours has its own chapter in the second edition. A chapter is likewise devoted to costing academic programs and disciplines using the NACUBO Cost Accounting Handbook model of Hyatt (1983).

## *Basic methodologies*

A variety of relatively simple methods may be used to calculate “the cost of instruction.” This terminology is used loosely, however, and does not necessarily imply the level of complexity that may be involved. There are many approaches to calculating how much it costs to provide instruction, including performance measures and ratios, depending upon institution, state, or national focus (Brown and Wolf, 1993; Carpenter-Hubin and Hornsby, 2005; Jones, 2000; Moak, 2000).

*Does cost mean what a student spends to get an education? Does it mean expenditures per student where “expenditures” is defined as the total spent by all higher education in a state or as the total spent at one institution? Does it mean total state appropriations? Does it mean state appropriations per student at a single institution? Does it mean expenditures per credit hour? Does it mean expenditures per credit hour in each discipline? Which of these questions or any others state officials ask depends upon what public policy issue they are trying to address. In each case, however, state officials would seek data that have common definitions, are used in a common context, and can be verified as valid and reliable (Moak, 2000, pp. 10-11).*

The results of these macro-level, institutional calculations may be used for benchmarking and peer comparisons (Coopers and Lybrand and Barbara S. Shafer Associations, 1995; Midgough, 1994, 2000a, 2000b). NACUBO has spearheaded the use of financial indicators and the reader is referred to the association’s many publications and its website for guidance in their application (Goldstein, 2005; NACUBO, 2005; Townsley, 2004).

The problem with these basic indicators of the cost of instruction is that the data behind them can be misleading and oversimplified. For example, one indicator of cost of instruction is calculated by NCES using IPEDS data and labeled “instructional expenditures per student FTE.” Analyzing comments from the postsecondary community as part of its review process, NCES found that “There is a lack of consistency in the reporting models (accounting standards) used by different types of institutions that would make it difficult for a parent or prospective student to make a meaningful comparison between institutions” NCES (2004, n.p.). Part of the problem is that the calculation of student FTE does not include noncredit courses and other instructional productivity measures that do not equate to student credit hours. Fringe benefits are not always included in instructional expenses because they are paid at the state not the institution level. Definitions of credit hour vary widely and cannot consistently be used to calculate FTE. Also, there is inconsistency in reporting due to recent changes in the use of required accounting standards.

There are, however, “variables that explain institutional costs,” argues Jones (2000, p. 82), especially with data on “human assets – the number of employees of various kinds, compensation levels, and their utilization.” Since “relatively few of the data necessary to address cost issues in the way being proposed come from accounting records,” other key variables are presented that are “most useful in explaining institutional costs.”

Key performance measures that can be related to costs include number of employees, including ratios of FTE students to FTE total employees, FTE faculty, FTE administrators, FTE technical staff, and FTE clerical staff. Patterns of employment are also useful, including levels of technical support being provided, with ratios to technical FTE; size of administration; the “top heaviness” of the administrative structure; and the reliance on part-time faculty as seen through SCH from part-time faculty, the ratio of full to part-time faculty, and FTE part-time/FTE full-time. Compensation levels may be analyzed in terms of average salaries by rank, executive competition, trends relative to the Consumer Price Index, and in benefits trends and as a proportion of total compensation (Jones, 2000).

Like Middaugh and others, Jones (2000) argues for the importance of faculty workload data, including “the allocation of time to functions and activities.”

*Data in this form are seldom readily available in institutions. The interesting phenomenon is that data on individual faculty members are commonly collected and maintained in their personnel folders. However, the data rarely are compiled to provide management information about the (probably changing) patterns of utilization of higher education institutions’ most important asset (Jones, 2000, p. 85).*

There are some important implications of workload data for policymakers interested in cost that are presented by Jones (2000). These include conclusions that there is: (1) “Much greater variation in teaching loads across institutions with different missions”; (2) “An increasing amount of unfunded research”; (3) “A changing mix of faculty and staff”; (4) “A significantly more internally focused notion of public service”; (5) “Increases in faculty and staff salaries (asset prices) that exceed the CPI in most years”; and (6) “increases in costs of technology” (p. 88).

One of the aims of the NACUBO Cost of College Project is to present “the vision of a simple methodology to explain college costs” (NACUBO, 2002, p. 16). The principles of the methodology use “basic averaging techniques,” focus on undergraduate costs, use accepted allocation methods, and attempt simplicity. Various data issues are addressed, including the definition of price, calculations of student FTE, weighting of graduate education, departmental research, institutional and community costs, financial aid, and facilities and capital costs. Further complexities are identified as a result of accounting practices and governance structures. Three pilot tests and a field test with 150 institutions were conducted.

The one-page template for data collection “identifies three categories of expenditures: instruction and student services, institutional and community costs, and undergraduate financial aid costs. Under each category, the cost per undergraduate is recorded for the various expense items and then subtotaled... An optional section on facilities capital costs appears at the bottom of the template” (NACUBO, 2002, p. 25). The results of the study, while they cannot be used meaningfully to compare institutions, suggest that cost exceeds price, that the highest costs are for instruction and student services, and that there is a great diversity in costs across higher education institutions in America.

The third volume of the Congressionally-mandated study of higher education costs reports on the Delaware Study of Instructional Costs and Productivity by Middaugh et al, 2003.

The report analyzes three cycles of Delaware Study data collection to “identify those factors that are associated with the variation in direct instructional costs between and across academic disciplines, and to identify those cost factors that are tied to the magnitude of instructional expenditures in a given discipline” (p. 7). Teaching load and financial data are collected at the disciplinary level, including direct expenditures for instruction and separately budgeted research and public service, using NACUBO definitions and accounting conventions.

The first volume of the NCES (2001) Study of College Costs and Prices suggests that price is “largely associated with factors external to the institution.” The third volume for the Delaware Study suggests that direct costs are linked with internal, institutional decisions and priorities.

*The mix of disciplines that compose an institution’s overall curriculum is associated with direct instructional expense at that institution and, to a smaller extent, its designation as a research, doctoral, comprehensive, or baccalaureate institution. Costs vary more substantially across disciplines within a given institution than they do across institutions within a given discipline. Within the individual disciplines at an institution, economies of scale have the greatest impact on instructional costs... And to a lesser extent, introducing or increasing the level of graduate instruction raises instructional costs (Middaugh et al, 2003, p. xii).*

The conclusions of this study report are that tuition rates are tied to the marketplace and state subsidies, while expenditures for instruction are tied to fixed costs such as disciplinary mix, credit hour productivity, department size, and faculty tenure ratio. There are multiple sources of revenue to cover instructional costs and tuition is only one of these. The “factors that are associated with instructional costs are very different from the factors that are associated with tuition prices” (Middaugh et al, 2003, p. xii).

### *Net price*

Winston commented in his white paper for the Congressionally-mandated cost study by NCES that “Colleges are part charity and part commerce – churches and car dealers” with the result that “prices never cover costs so every consumer is subsidized” (2001, pp. 117-118).

Describing the difference between price and cost, Trout explains that price represents tuition and fees charges, cost is what colleges and universities spend for instruction, and subsidy is “the difference between the cost to the institution and the tuition and fees charged to the students” (2004, p. 7) .

*All college students, whether they attend a public or private institution, receive this subsidy and pay a price that is often significantly less than cost. This general subsidy does not include the additional subsidy many students receive through scholarships and other forms of financial aid. For most American families, the most meaningful distinction is not cost vs. price but net price – what students pay after financial aid is subtracted from*

*the total price of attendance.. getting a clear picture about net price and net price increases is the crux of determining college affordability (Trout, 2004, p. 7).*

Berkner and Wei (2006) document in their recent NCES study the “Student Financing of Undergraduate Education: in 2003–04, With a Special Analysis of the Net Price of Attendance and Federal Education Tax Benefits.” Net prices are defined as “the price of attendance minus all or some of the types of financial aid received by the student, and represent different ways of calculating and interpreting postsecondary price reductions to students” (p. iii). The results of net price calculations were for the first time based on an estimate for tax benefits. These show that “about three fourths of all full-time undergraduates are estimated to have received federal grants, veterans benefits or tax benefits, and about 9 out of 10 fulltime undergraduates (87 percent) are estimated to have received some type of grant aid (from all sources), veterans benefits, or federal tax benefits” (p. xiii).

In comparing cost methodologies and how these address different policy topics, the research suggests that it is only through individually-identifiable, unit record data collections that net price can be calculated accurately to determine the actual effect of tuition discounting, financial aid, and variations in student charges. In contrast to basic methodologies discussed above, the complex cost of instruction models that have evolved from NCHEMS and NACUBO require individually identifiable, unit record data.

This methodology is discussed in the IPEDS Student Unit Record Feasibility Study by NCES, which analyzed the utility of a new, proposed national student database for postsecondary education (Cunningham and Milam, 2005). The Berkner and Wei (2006) study by NCES was based on sample student survey data from the 2003–04 National Postsecondary Student Aid Study (NPSAS:04). While the sample data allow for comparisons by institutional type, attendance status, income level, and other variables, they do not provide institution-specific estimates of net price. The concept of net price cannot be understood fully unless there is an effort to “collect student–level information on prices and financial aid, in order to calculate net prices that take into account the individual circumstances of each student” for each institution (Cunningham and Milam, 2005, p. iv).

### *Cost accounting*

Meisinger (1994), Hyatt (1983), and others detail the NACUBO approach to cost accounting with a focus on costing academic programs and disciplines, including the use of allocation schemes to proportion costs to objectives such as instruction. This generally incorporates a three-tier accounting approach to “collect and analyze instructional costs by groupings and levels of cost.” Tier one includes all direct costs for a specific cost center or cost objective of interest. The second tier adds indirect costs that can be attributed to the same cost center or objective, related to support services and other forms of overhead such as administration. The third tier builds in assignable depreciation or use charges for facilities and capital equipment. A fourth tier, revenues, is discussed by Jenny (1996).

In building a cost model, five basic steps are taken: (1) specify the objective or cost center; (2) determine the categories of cost information; (3) assign tier one costs; (4) assign tier two and three costs; and (5) calculate the output measure or unit cost (Meisinger, 1993).

Hyatt (1983) illustrates the same steps, but breaks out step four (assign tier two and three costs) into: (a) allocate annual use charge on all buildings, land improvements, and capital equipment; (b) allocate all plant operation and maintenance costs; (c) allocate all institutional support costs; (d) allocate all academic support costs; (e) allocate all student service costs; and (f) calculate tier three costs for all final cost objectives.

Asking how costs should be measured, Brinkman and Allen (1986) rely on the work of Fisher (1971), who documents the following steps: (1) estimate the resources required; (2) identify alternative uses of the resources; (3) estimate the value of the alternative use of resources; and (4) estimate the expenditures involved. This is essentially what Winston (2000) does with opportunity costs that measure potential rental income that could have been garnered through the alternative use of campus space.

Ehrmann and Milam (1999, 2003) describe this process in another way, as “building an economic model” that includes seven steps: (1) identify the resource concerns and questions; (2) identify the outputs; (3) identify activities required to produce outputs; (4) identify academic and support units involved in the activities; (5) identify the resources used by the units in the activities; (6) calculate costs for the activities; and (7) total costs of all activities to determine output costs. Earlier descriptions of this economic model are presented by Ehrmann, Lovrinic, and Banta (1999), Ehrmann and Zuniga (1998), and Thomas and Lovrinic (1994).

Case studies of instructional costing at Farleigh Dickenson University and Ohio Wesleyan University are given as examples by Hyatt (1983). Gaffney (1988) provides a case study for Boson College, rejecting the full costing approach of NACUBO because it “tends to camouflage the real differences in the cost structures of university departments and hinders the development of unit cost statistics, which could serve over time as benchmarks and control indicators” (p. 38).

Much of the difficulty in building these models is in developing the allocation schemes and in finding and preparing the data required to implement them. Gaffney’s (1988) collection phase gathered data from the registrar’s office for faculty workload, from the academic services office for faculty salaries and stipends, from the budget office for direct expenses by department, and from the space management, budget office, buildings and grounds office, graduate arts and sciences dean’s office, computer center, controller’s office, and other offices for data about square footage, space-related costs, fringe benefit rates, tuition remission, computer usage, library acquisitions, and equipment depreciation.

A more conceptual understanding of costs is provided by Brinkman and Allen (1986), who catalog five types of studies based on the work of Carlson (1976). Most cost studies simply provide cost calculations, using some form of statistics, but with “no attempt to relate variables statistically.” An example would be cost per credit hour across departments. A second set of cost studies “statistically estimate average behavior between two or more cost-related variables”

using some type of regression. These studies try to understand “how average or marginal costs behave in response to changes in enrollment or credit-hour production” (p. 2). More “rare” is a third type of study which focuses on efficient behavior. While the first three take an accounting or statistical approach to cost estimating, the use of engineering methodology is a fourth type. This “consists of modeling a production process by decomposing the process to a very basic level and then studying alternative ways of putting the pieces back together to achieve alternative ends” (p. 3). The study of liberal arts education by Bowen and Douglass (1971) is cited as an example of this approach, examining how production relationships in class size, mode of instruction, and other factors impact costs.

A fifth type of cost study is cost-behavior analysis, which projects cost behavior for planning with three factors: (1) the volume of activity; (2) the environment for the activity; and (3) decisions affecting the resulting cost. The NCHEMS-NACUBO (1980) model is an example of this final methodology (Brinkman and Allen, 1986).

Brinkman and Allen note that “Costing looks easier than it is, and it is often done poorly” (p. 3). This occurs because of asking the wrong questions, uncertainty, ignorance, oversight, optimism, prevarication, and lack of standardized terminology. Based on the work of Adams et al (1978), the authors discuss seven ways to define costs: (1) cost objectives (input, output, activity, organizational unit); (2) cost basis (historical, projected, standard, imputed, replacement); (3) cost assignability (direct, indirect, full); (4) cost variability (fixed, variable, semivariable); (5) cost-activity relationship (total, average, marginal); (6) cost-determination method (specific service, continuous service); and (7) cost-time relationship (time period, accrual or cash, deflated) (Brinkman and Allen, 1986, p. 3).

Micro-costing is an alternative approach to costing that is driven from the lowest possible level of data collection. This typically involves the assignment of four tiers of costs. Jenny (1996, p. 92) explains that “it is more practical to look at costing from the ground up by focusing on all the cost elements that must be assembled at the grassroots level if one is to end up with full-cost information for a particular cost center.” The term micro-costing “refers to the determination of the full costs of the many discrete academic and administrative activities and processes that epitomize the institution’s daily work” (p. 92).

There are three types of micro-costing situations: (1) academic activities such as instruction, individual research projects, and degrees/certificates; (2) administrative activities such as departmental operations and repetitive processes; and (3) unit full costs with a focus on average and marginal costs of administrative services. Jenny provides examples of course cost information at a liberal arts college and describes the full costs of an Economics 101 course.

In the calculation of these activity costs, Jenny discusses process costs, with examples using process flow charts from admissions and enrollment management. He describes the NACUBO Benchmarking project and its attempt to document the costs of various processes on campus in order to benchmark the results with insights for reengineering and quality control. The focus is on processes or activities which cross account structures and therefore require new ways of thinking about expenditures.

Activity-based costing (ABC) in higher education involves identifying activities and costs, then reengineering processes and concepts for more efficient planning and management of funds. ABC “analyzes costs at an activity level rather than at a unit level” (Cox et al, 2000, p. 1). “Very few publications have been written on ABC related to the public sector, especially higher education” (p. 2). The reader is referred to Jenny (1996), Cox et al (2000), DeHayes and Lovrinic (1994), NACUBO (2004), and Turk (1992) for discussion of ABC in the context of higher education and to Brimson (1991), Forrest (1996), Lewis (1995), and others for a more general description. The process and ABC approaches to costing are based on the realization that traditional accounting structures are inadequate for calculating what it truly costs to conduct an activity.

Responsibility-centered management (RCM) is another process-oriented approach in which the traditional responsibility for budgeting and monitoring expenditures is purposefully shifted away from hierarchical reporting and given to those more in day-to-day control of the expenses that impact specific outcome measures. Therefore, departments and units are tasked with managing their full costs, not just those that fall under their account structures (Whalen, 1991).

RCM may be seen in application at Indiana University and the University of New Hampshire systems, among others. A NACUBO monograph about RCM by Curry and Strauss (2002) asks "How is responsibility center management working? Is it the work of deities or the work of the devil?" RCM reduces the layers of institutional involvement and holds units responsible for full costs, regardless of their reporting relationship in the accounting system. In this way, costs are better understood and there is greater potential for efficiency.

Essentially, the RCM approach gives administrators responsibility for costs that may appear on the surface to be out of their control, but by using a process or ABC approach are understood to be affected by their decisions. In response to effectively managing process and activity costs, units are given more direct control of resources with a reward system based on increased productivity and efficiency (University of New Hampshire, 2006).

One often overlooked source of cost data is the indirect cost analyses which are conducted as a requirement of sponsored programs research. The negotiation of an indirect cost rate, including overhead costs and those for general and administrative functions, is a critical step for grants and contracts with federal agencies. Institutions that have negotiated indirect cost rate agreements will have a ready supply of data to support the negotiated rate, including standards for fringe benefit calculations, space utilization, and equipment use. These cost analyses include very sophisticated allocation schemes to proportion expenditures for functions such as library services to departments/units.

The U.S. Office of Management and Budget (OMB) Circular A-21 provides guidance about the indirect cost recovery methodology. In negotiating grants and contracts with other non-federal entities, many foundations have much lower rates that must be used as a condition of accepting an award. Cost accounting, ABC, RCM, and indirect cost analyses all have the same basis and function. Yet because different offices are involved in the calculations and reporting is done for very different purposes, the results produced can be different. The reader is cautioned to

understand any indirect cost analyses which are conducted at an institution and to review their use of data sources and allocation schemes as potential sources for cost of instruction data. For complex research universities with separate local, shadow, and/or administrative information systems for sponsored research, research equipment, research space utilization, and research personnel, these data structures must be understood through organizational mappings and cross-walks to other systems before cost studies may be accurately conducted. The work of NACUBO is central to understanding best practices and effective reporting for indirect costs as these relate to cost of instruction studies (Jenny, 1996).

### *Cost simulation models*

As President of NCHEMS, Jones (2002) provides insight into the role of the organization in developing cost data.

*In its earliest days, NCHEMS focused on the basic building blocks of data item definition and categorization... It is likely that few of the current cadre of institutional researchers and higher education data analysts recognize the seminal work done by NCHEMS in devising the data conventions that form the basis of data collection, reporting, and analysis throughout American higher education. While these conventions have been modified somewhat over the course of the last 30 years, the original NCHEMS work is still very much in evidence in today's higher education data "language." The second stage was the conversion of this data into information through use of models—e.g., the Resource Requirements Prediction Model (RRPM), the Student Flow Model—and analytic conventions that were designed to help decisionmakers deal with the key issues of the day. The issues have changed, as has the technology that allows us to manipulate data and convert it into information. However, NCHEMS has continued to develop "good practices" with regard to use of information in support of strategic decisionmaking (Jones, 2002, p. 1).*

The NCHEMS and NACUBO model is discussed by Brinkman (1989), Gaffney (1988), Hample (1980), Hyatt (1983), Meisinger (1994), and others. It was recognized early on that the NCHEMS procedures for cost of instruction data "have received substantial publicity, evaluation, and, in many states, acceptance as the costing system that most effectively minimizes methodological differences" (California Postsecondary Education Commission, 1980, p. 5).

The NCHEMS cost of instruction model is made possible because all administrative information systems are essentially built upon the same structures of data. Typically, cost of instruction models incorporate data on student enrollment, courses, faculty, space utilization/room inventory, financial aid, and finances. These and other data structures are documented in the 1971 Data Element Dictionary and 1996 and 2004 editions of the CHES Data Definitions for Colleges and Universities published by NCHEMS (Thomas, 2004).

Built at a time when the mainframe computer first made possible the complex simulation of resources, Suslow's Resource Requirements Prediction Model (RRPM) was designed to help planners estimate budgets based on enrollment and to model the impact of institutional policies (Gamso, 1977). Comparable simulation software for this era of educational planning includes

CAMPUS (Comprehensive Analytical Methods for Planning in University Systems); CAATS (Computerized Analysis Adapting the Techniques of Simulation to Colleges of Applied Arts and Technology); HELP/PLANTRAN (Higher Education Long-Range Planning System and PLANning TRANslator); SEARCH; TRADES; EFPM (Educom Financial Planning Model); and HIS (Hochschule Information System). See Bleau (1981), Hopkins and Massy (1981), Hussein (1976), Masland (1982), Sampson (n.d), and Wyatt et al (1979) for a discussion of these models and their use.

Updegrave (2004) describes the evolution of EFPM, funded by the Lilly Foundation, and his work as Director of Model Planning for the first interactive software of Educom, predecessor to EDUCAUSE. “Although the software was ultimately superseded by personal computer-based spreadsheets, such as ‘VisiCalc,’ ‘SuperCalc,’ ‘Lotus 1-2-3,’ and ‘Excel,’ the EFPM project is generally credited with introducing computer-based modeling throughout higher education” (Updegrave, 2004, n.p.). The software was “modified to support ratio analysis and inter-university data comparison, at the suggestion of Nathan Dickmeyer,” leading eventually to the Higher Education Data Sharing (HEDS) consortium activities for private institutions through Educom, Tufts, and Franklin and Marshall College and, for several years in the early 1990s, the Public University Information Exchange (PUIE) through George Mason University.

The problem with modeling, according to Mayo and Kallio (1983) is that “The model does not enter a setting as a welcome and sought-after tool; it enters as a competitor to traditional thought structures which rely on existing information and routines for using it” (p. 2). Models may be used to address a specific problem or “in an environment with many problems and decisions, all of which affect each other” such as higher education (p. 4).

The data required for sophisticated cost of instruction modeling is quite complex. Brinkman comments that “such data are not routinely gathered by all, or even most, institutions. Thus, while such data are important, they are not gathered as they ought to be” (1989, p. 35). Milam (2003) explains that:

*Among the most important contributions of the cost literature are the concepts of: (1) enrollment data and departmental consumption/contribution; (2) space utilization and allocation costs; (3) revenue stream based on tuition and fees minus waivers and tuition discounting; (4) faculty workload; and (5) administrative overhead at the department, college/school, and institution-wide levels. This does not mean that only complex models should be built. But any model development ought to be done with a clear set of assumptions. If assumptions about revenue, for example, are to be ignored (perhaps because student tuition estimates and financial aid data are not available or are too complex to be analyzed within the timeframe and staffing level), this should be stated as a limitation of the model (Milam, 2003, p. 1).*

Suslow’s (1976) conceptualization of the induced course load matrix (ICLM) is central to these resource allocation and planning simulations. The ICLM is a two-dimensional array of student majors against departments. It allows administrators to understand two critical types of enrollment behavior: (1) consumption, the amount and type of student credit hours that different majors take; and (2) contribution, the types of students and majors that are served by departments

(Meisinger, 1994). By modeling different scenarios in consumption and contribution, managers may predict the impact of increasing enrollment in a major, including what courses will be needed to serve these new majors and therefore what amount of faculty resources will be needed to offer courses. While this may seem simple on the surface, the multiple combinations of departments, majors, student levels, and course offerings create potentially hundreds of thousands of cells of data. The ICLM is critical to analyzing the effect of enrollment behavior on resource allocation, whether the resource being allocated is money, space, faculty positions, or administrative infrastructure.

Many statewide resource allocation models have incorporated the ICLM to determine the number and discipline of faculty needed to sustain projected enrollments. The results are tied to state appropriations and to negotiated faculty salary levels. These models require guidelines, however, on the ratio of faculty to student credit hours and these data were expected to vary by discipline and level of instruction, as well as the perceived mission and quality of each institution. Graduate enrollments are sometimes weighted differently than undergraduate in order to predict the need for faculty (Brinkman, 1989; NACUBO, 2002; Washington Higher Education Coordinating Board, 2004, 2005). However, over time there have been few studies that document disciplinary indices and these types of resource allocation models have been replaced with a contextual series of performance measures (Brinkman, 1989; Dickeson, 1999; Jones, 2000; McLaughlin et al, 1983). The Delaware Study analysis for the NCES College Cost Study (Middaugh et al, 2003) is a recent source for these indices.

Direct expenditures relative to instruction make up the second type of data for cost of instruction models. These are rarely so straight forward, though, because they involve faculty workload data, which are sometimes missing and are often suspect (Cox et al, 2000; Jones, 2000; Middaugh and Isaacs, 2003; Middaugh et al, 2003; Schwartz, 2005). Most resources in cost models are fixed, "but faculty and staff time is the only variable resource" (Cox et al, 2000, p. 2). There is a significant amount of research on faculty workload, with surveys such as the NCES National Study of Postsecondary Faculty (NSOPF), which provide national benchmarks on faculty activity (Abraham et al, 2002; Berger et al, 2001; Jones, 2000; Middaugh et al, 2003). Workload is central to models for activity-based costing, which rely on time tracking to document the true expenditures of human resources. The collection of data on full- and part-time, full-time equivalent faculty is linked to their instructional productivity (Kirschstein et al, 1997; McPherson et al, 1993; Middaugh, 1994, 2000a, 2000b).

In addition to faculty salaries prorated by workload, various types of direct instructional expenses at the course, program, and department level may be allocated to instruction. General departmental expenditures may be allocated based on different criteria, depending upon how different types of resources are used. A clerical position may be involved in keeping class rolls. The cost of this position may be allocated by student headcount. A departmental advisor may be allocated by student credit hour, since the work will vary with the volume of educational activity in which each student is engaged. There are standards presented by Hyatt (1983), Jenny (1996), and others for these allocation schemes.

Room utilization may also be included in complex modeling, tying total plant and maintenance costs to allocation by square footage based upon how much space the department uses

for instruction-related activities. An alternative proposed by Winston (2000) involves the calculation of opportunity cost – how much revenue is foregone from not renting the same amount of space commercially. A dollar amount per square foot may be used as a multiplier that includes various proxies for capital outlay and maintenance.

Administrative overhead charges will vary by department and school within an institution and these may be used for cost of instruction models if the data are available. Some departments with high numbers of courses, especially large undergraduate sections, will appear very productive with low administrative costs per SCH (Middaugh et al, 2003). With fewer course offerings, overhead may be much higher. These data provide insight into the differential cost of instruction across a campus. Equipment costs and other special rooms, such as labs or seminar/conference rooms, need to be included in these calculations.

Another piece of finance data that needs to be included is revenues generated from students, after taking into account financial aid, tuition discounting, assistantships/fellowships, and student waivers. With access to individually-identifiable, unit record data on student charges, waivers, and financial aid, it is possible to calculate revenues per student and aggregate these to different levels for cost of instruction.

### *Technology cost models*

The National Cost Commission's 1998 report, prior to the College Cost study, states that "increasing costs for technology almost certainly translate into higher prices charged to students." Furthermore, "Although technology holds promise for making educational operations more efficient and less costly, there is no evidence to date to indicate that the use of technology in higher education has resulted in widespread cost savings to colleges and universities" (Harvey et al., 1998, p. 16). A similar conclusion was made at the time by The College Board, finding that "Most educational technology introduced over the past 50 years has supplemented and often enhanced – but not supplanted – traditional classroom instruction, thus adding to its cost, not reducing it" (Gladieux and Swail, 1999, p. 15).

There are interesting variations in the methodologies used for the study of technology costs and potential cost savings through the use of technology. These include costing research funded by Annenberg/CPB to develop the Flashlight Toolkit and Flashlight Program, with technology surveys of students and faculty, technology roundtables for institutional change, and the "Flashlight Cost Analysis Handbook"; the Andrew W. Mellon Foundation project to develop "Cost Effective Uses of Technology in Teaching"; the Pew Charitable Trusts for work by the Center for Academic Transformation for "Course Redesign"; WCET and NCHEMS for the "Technology Costing Methodology" (TCM) project, funded by FIPSE; and the Bridge Model by Jewett developed for the California State University system.

Key scholars contributing to the literature on technology costs from an international perspective include Ash (2000), Ash and Bacsich (1999), Bacsich (1999a, 1999b), Bacsich and Ash (1999), Bakia (2000), Bates (1995), Mace (1978), Moonen (1997), Rumble (1986, 1992, 1997, 2001, 2002), and Ruth and Shi (2001). General discussion of technology costing is found in

Ehrmann and Milam (1999), Graves (2004), Green (1999, 2001, 2002), Hahn and Jackson (1995), Jewett (2002), Jones (2001), Leach and Smallen (1998), Lovrinic (1994, 1996), Massy and Wilger (1998), Massy and Zemsky (1995), NASULGC (1999), NPEC (1998), Opper and Mathews (2002), Twigg (1996, 2002), and others.

Bacsich and others studied the “Costs of Networked Learning” and concluded that:

*the problem can be analyzed not by educators inventing a new vocabulary for finance and planning (as some have effectively tried to do over the years), not by their denying the need for such tools (as others have often tried), but by using the tools that are (slowly) being used in universities to solve more general and management problems (Bacsich et al, 1999, p. iii).*

Similarly, in his article “Analyzing Costs/Benefits for Distance Learning Programs,” Rumble explains that “each technology used also has a different cost structure” (2002, p. 62).

Online education is analyzed in studies funded by the Alfred P. Sloan Foundation. Institutions received grants as part of the Asynchronous Learning Network to develop online programs. Case studies were developed for each institution and they vary in terms of how costs and expenses are accounted for. Among the questions addressed in the multiple volumes of Online Learning that were published as a result is: “How can schools drive down costs and prices to achieve capacity enrollment while maintaining and improving the quality their distinctive missions have established?” Overall highlights from Sloan’s studies of the cost effectiveness of online education are presented by Bishop (2006), focusing on specific types of indicators, measures of effectiveness, indices of progress, and links to institutional web sites for case studies and projects.

The Joint Funding Councils of Great Britain and KPMG (1997) present a model that is very similar to that of the Flashlight Cost Analysis Handbook (Ehrmann and Milam, 1999). It includes data about staff costs, depreciation, other operating expenses, and overhead.

The Andrew W. Mellon Foundation funded 25 projects as part of its “Cost-Effective Uses of Technology in Teaching” (CEUTT) program. This program is also responsible in part for the development of the “Costs Project,” the WICHE/WCET “Technology Costing Methodology” project, and the “Flashlight Cost Analysis Handbook.” There were three components required of each institutional grant: (1) measuring pedagogic effectiveness; (2) measuring teaching costs; and (3) assessment of cost-effectiveness as a balance of teaching effectiveness and costs. Many different approaches to cost models were tried, though there were similarities and best practices shared by all. These different approaches to costing technology include both traditional accounting and specialized cost analysis methods, as well as hybrid models. Over time, with the dissemination of results, the projects built on the success of earlier grants and developed a more narrow and accepted range of costing methods.

Milam (2000, 2003) prepared a cost methodology and plan for George Mason University as part of the CEUTT project. This plan was built in part upon a previous, university-wide cost of instruction study. The methodology includes: (1) complex micro-costing of four-tier, full

costs for courses, using finance, human resources, student, course, and space data from the data warehouse; (2) faculty workload data to weight personnel costs; (3) activity-based costing using budget data and interviews of course faculty; (4) data on student course-taking behavior using the Induced Course Load Matrix; and (5) revenue stream data that included financial aid estimates by student level, course load, residency, and tuition discount percentages. The results are presented with the outcome measures of cost per student credit hour for the micro-costing model and cost per course in the ABC model. Comparisons are made of the two output measures for courses with and without the use of technology to assess potential cost savings with the use of technology in teaching.

WCET partnered with NCHEMS to develop standards for technology cost measurement (TCM), culminating in the TCM project, which included case studies and spreadsheet software called the a “TCM Tabulator” and a simpler “TCM Tabulator-EZ.” TCM involves a complex methodology based on the NCHEMS “Cost Funding Principles.” The principles were refined through the process of developing the case studies. Seventeen institutions participated in the first pilot testing. A second round of testing with eight more institutions resulted in TCM Version 2.0.

Some of these case studies found that technology-mediated delivery systems cost more than traditional delivery modes. The differences in costs occurred for different reasons, depending on the method of delivery. TCM focuses on direct costs allocated to instruction, with the course is the unit of analysis. Nine steps are documenting for determining the costs of a course, including creating an activity structure, identifying resources, assigning costs to activities, and documenting student headcount and credit hour activity. Costs are calculated per student and per credit hour. Various white papers such as Opper and Mathews (2002) “Funding and Cost Containment of Educational Technology: Shifting Policy and Practices” were produced.

Jewett assisted WCET in developing the TCM, drawing on his previous work on campus level costs. Jewett developed the “Bridge Model” to compare the cost of instruction by mediated versus traditional delivery. When his own Mellon Foundation-funded project was completed, WCET took over and continued the effort. The “full-blown BRIDGE project was beyond the needs of most of the pilot sites, so a new simplified tool, mini-BRIDGE, was created to assist in making the link between the two projects” (Jewett, 2002, p. 5). Jewett used the mini-BRIDGE model at TCM pilot institutions and the results were disseminated as the “TCM/BRIDGE Project” (Jewett, 2002). The TCM/Bridge report compares costs, though it notes that “calculation of costs based upon the TCM Handbook or any other methodology is a very different thing from the comparison of costs” (p. 14).

Another approach to course costs and technology was funded by the Pew Grant Program in Course Redesign and conducted by the Center for Academic Transformation at Rensselaer Polytechnic Institute. The purpose of the Course Redesign program was to “encourage college and universities to redesign their instructional approaches using technology to achieve cost savings as well as quality enhancements.” Institutions use a “Course Planning Tool” or spreadsheet to compare cost results before and after implementing a course redesign. There are many different ways to redesign a large, lecture section of an introductory course, including maintaining steady enrollment but reducing instructional resources, increasing enrollment but not resources, and reducing the number of course repetitions required to pass a class. Instead of using contact

hours, the focus is shifted to asynchronous, self-paced learning. Faculty time is unbundled to focus more on technology (Graves, 2004; Twigg, 1996, 1999, 2002).

### *Conclusions*

The practical application of cost of instructional methodology to a sector, state, system, or institution requires assumptions about what data can reasonably be collected and the utility of specific types of analyses and reports. It is possible to combine include different approaches into one with hybrid models. Whatever methodology is used, there needs to be support for the choice within the literature and it needs to be meaningful within the context of the situation.

Regardless of their availability and whether an activity-based costing approach is supported by the organization, there is no substitute for data on faculty workload. Gross estimates of instructional assignments may be used, if necessary, though these will vary by status, rank, administrative stipends, tenure track status, contract length, and sponsored research funding.

While there are many different ways to look at costs, there is a benefit in shifting away from the discussion of price, costs, and net price to collecting and understanding actual instructional expenditure data at the micro level. Three examples of cost of instruction models stand out from the research: (1) the NACUBO (2002) data collection and methodology Explaining College Costs; (2) the NCES (2003) compilation of three years of Delaware Study results; and (3) the NCHEMS and NACUBO complex cost simulation model. The TCM documentation for modeling the cost of technology in teaching provides a useful restatement of the NCHEMS and NACUBO approach and highlights the benefits of this complex methodology (Jones, 2001, 2004).

Performance measures about human assets that are outlined by Jones (2002) and others serve as a useful proxy for the macro-level discussion of costs. These may be overlaid with the results of the NACUBO and Delaware research, noting that costs vary more across disciplines within an institution than across institutions within a discipline; that costs vary with the mission of the institution; that there is an economy of scale at work that decreases the cost per SCH for large departments; and that faculty workload and compensation are the critical cost drivers that may be linked to changes in institutional policy.

There is a rich literature to inform the further discussion of costs and this article has attempted to provide an overview of this knowledge base. Various methodologies may be applied to different policy concerns, such as the cost-effective use of technology in teaching or course redesign. Yet it must be realized that even the NACUBO and Delaware Study methodologies, if implemented, do not address the full range of enrollment and resource allocation behavior which must be understood.

Suslow's (1976) induced course load matrix is the only way to document the changing relationships in the enrollment behavior of majors and departments through consumption and contribution. For institutions with large offerings of non-credit instruction, this must be modified to include a productivity measures such as seat time or contact hours (Milam, 2005).

The NCHEMS and NACUBO methodology ties ICLM data to direct instructional resources using data on faculty compensation and workload. Whether or not the tier of indirect costs is allocated, there also needs to be some sense of how space utilization affects instructional costs. This is why Winston's concept of opportunity costs is helpful, when the actual data may not be available. The results of these calculations cannot be modeled effectively unless they are somehow tied to revenues and the individual, unit record determination of net price. This methodology is now better understood because of recent NCES studies of net price and unit records.

The technology for conducting these types of cost studies has never been more readily available and the methodology for costing has never been better understood. While there is a time and place for simpler performance measures and ratios, the need for more complex cost of instruction studies has never been greater. The knowledge of NCHEMS and NACUBO should not be lost as the next generation of researchers and policy analysts makes its mark on policy questions about cost. There is much to be learned and much to be done.

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