USING RETURN ON INVESTMENT MODELS OF PROGRAMS AND FACULTY FOR STRATEGIC PLANNING©

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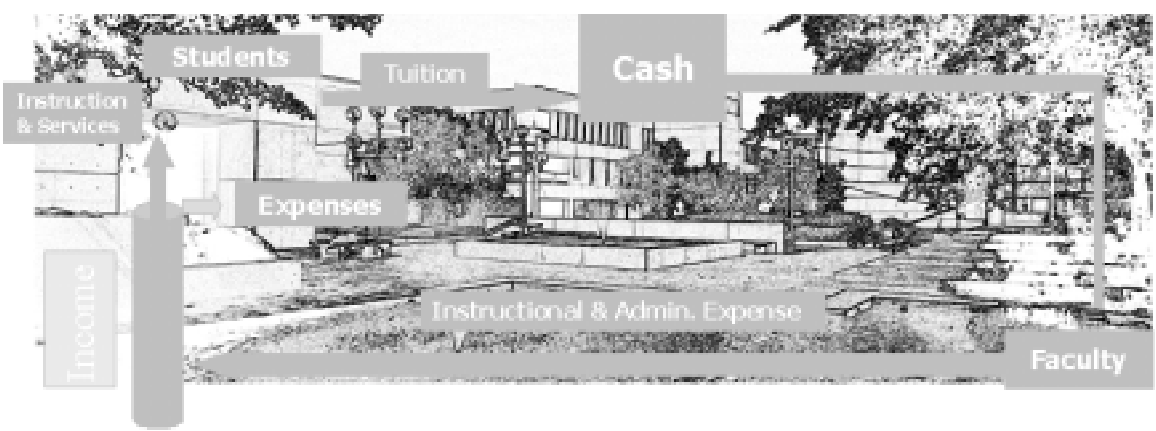

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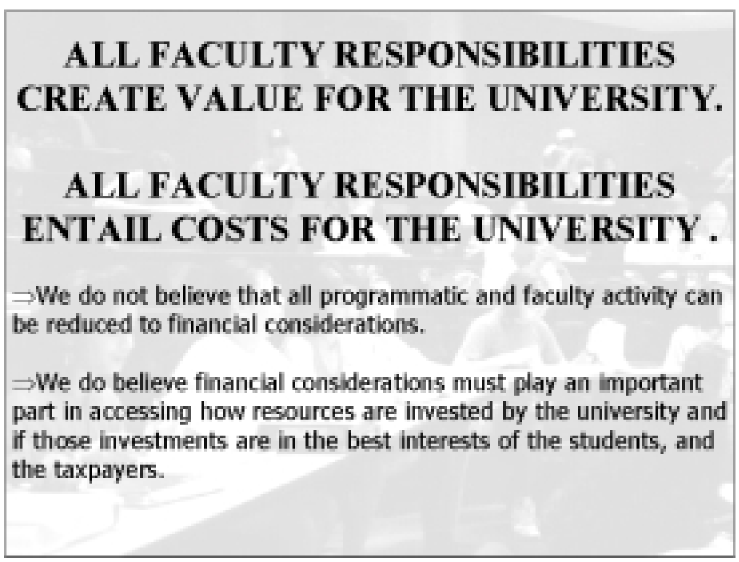
Introduction

Traditional conceptions of faculty and program productivity typically emphasize in varying degrees research, publication, creative work, teaching, service to the university and service to the community. Evaluation of these areas and the relative weights assigned to them varies greatly from unit to unit within a university and even more so among universities. Thus, it is no surprise that decisions about “teaching load,” class size, curriculum, programs and faculty appear to be driven more by polemics than by analysis. Moreover, without measurable weights assigned to each activity, it becomes more difficult to make planning decisions ranging from funding new positions to post-tenure review. In truth all faculty activities both create value and entail costs for universities. While we do not believe that all programmatic and faculty activity can be reduced to financial considerations, financial considerations must play an important part in accessing how resources are invested by the university and if those investments are in the best interests of the students, and the taxpayers.



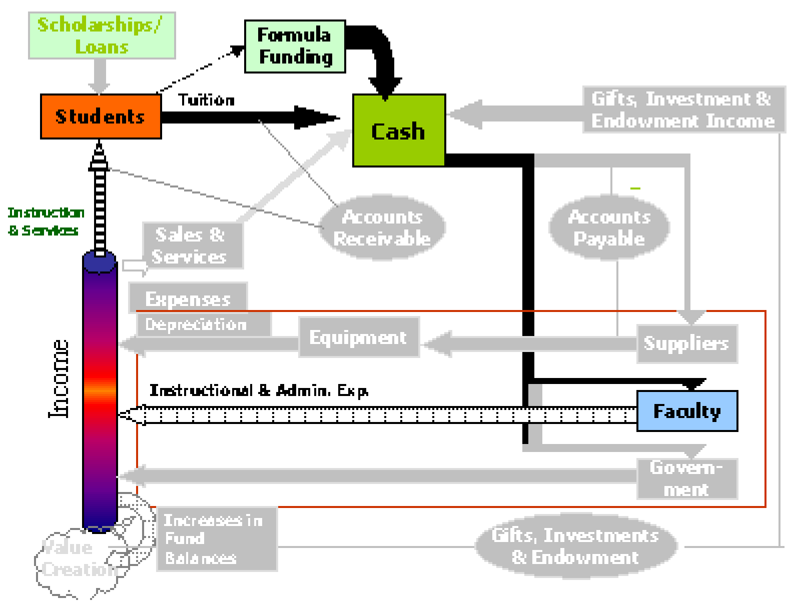
The modeling we report here is part of a larger proprietary system for assessment of faculty and unit productivity. The model focuses on revenue streams versus cost expenditures for different areas of the University and makes use of data routinely available in a university’s databases and takes account of the percentage of time a faculty member is assigned to or engages in varied activities. The approach allows unit heads to have a comparative manner in which to track relative performance over time and use these data to make performance decisions. Coupled with other measures (e.g., teaching evaluations, class dropout rates, and measures of student learning), our Return On Investment (ROI) model creates a robust means for continued and future allocation of campus resources. The output from the model also establishes the basis for performance evaluation available to all those concerned.

Criticism of this approach arises when faculty and others argue that universities are not businesses that bodies of knowledge are not product lines, and that intellectual workers cannot be evaluated in terms of cost/revenue streams. These are valid concerns lest universities discontinue the teaching bodies of knowledge because they are temporarily unpopular or, however necessary, appear to a given set of students too difficult or no longer germane. On the other hand, modern colleges and universities that ignore revenues relative to costs do so at their own peril. The rise of for-profit universities is based precisely on the efficient delivery of bodies of knowledge that have been sanctioned by accrediting agencies or are tested by certification exams. Unlike colleges and universities that promise a status education, which is intended to solidify a student's social class status or provides a particular social or religious environment, these for-profit institutions are promising measurable results, and they hold their faculty accountable for enabling students to succeed. It may be that niche schools like the well-endowed Ivies can well afford inefficiencies (even though there is a strong relationship between student subsidies and SAT scores), but in the rich cornucopia that is American higher education there are many more state and small schools whose continued survival depends upon efficient monetary management.[1] As one moves down the endowment list from the top 100 institutions endowments drop off rather precariously. Many schools do not have the abundance of resources to retain faculty who cannot deliver instruction in a cost effective, efficient and learning effective manner.

While we offer no panacea in our approach, we do provide schools with a tool for assessing their strategy in utilizing resources toward the best interests of the students and the effectiveness of organizational stewardship with which they have been entrusted. The results of the modeling provide a common basis for policy discussions of issues that have long remained obscured in academe. For example, what is the appropriate compensation for a departmental chair position? What is an appropriate teaching load and what rewards should be available on a merit basis for those who teach many students and teach them well? Why do some programs of similar size and needs cost more than others? The comparative data generated by the ROI model allows for clarity in these types of policy debates.

The overall model views students as cash generators for the university. Scholarships, loans, and other forms of subsidy flow through students, who then apply the funds toward tuition to the university and, in our case, generate formula funding. A large portion of the cash generated by students is allocated to faculty to teach the students. A smaller portion is budgeted for administrative and other instructional costs.

RETINA focuses on cash flow from student to instructor and the resultant stream of costs; it also focuses on the resulting revenue stream (Income) that results with the delivery of instructional services. The relationship comprises a significant portion of the larger cash flow model illustrated below[2].



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[1] See for example, Gordon C. Winston, "Why Can't a College Be More Like a Firm?" Change, vol. 29, no. 5, Sept/Oct. 1997: 33-38. See also with regard to graduate students, The Chronicle of Higher Education, Vol. XLVIII, no. 5, A24.

[2] Adapted from W. R. Purcell, Jr., Understanding a Company's Finances. New York: Barnes and Noble, 1983.

As with any project, design is crucial to obtaining accurate results. In Texas, state colleges and universities operate in a formula-funding environment. In this environment, public funds are allocated based upon a formula that utilizes a student's class level and the course level of the course in which the student is enrolled. Depending upon the student's class level and the level of the course the student a dollar amount of formula funding per semester credit hour is allocated. Currently, the state formula uses four divisions for stratifying course levels: lower division (freshmen and sophomore); upper division (junior and senior); masters and doctoral. The base credit hour rate is for a lower division (freshmen/sophomore) student taking a liberal arts course. Liberal arts courses are defined by their CIP designations and include Mathematics. There are twenty categories of courses ranging across the lower division to doctoral levels. Weights are applied to the base credit hour in the formula depending upon various designations of coursework (science) and conceptions of the actual costs of instruction in an area. For example, the weight for fine arts masters level (6.51) is approximately the same as the weight for master's level instruction in agriculture (6.64) because of the presumed parity in the costs of instruction, overhead, and support.

The formula uses the lowest common denominator between the student's status and the course level. For example, a freshman taking a senior level course receives freshmen funding, and a senior taking a freshmen course receives freshmen funding (see below).

2000-01 FUNDING FORMULA COEFFICIENTS

- The gross base value for a formula unit of one student semester credit hour is $54.44. The net-to-unit value is $46.01 or 84.6%. For some Biennia, the Legislature did not fund the formula at 100%.
- The funding formula provides support for faculty salaries, departmental operating expenses, instructional administration, library, research enhancement, student services, and institutional support.

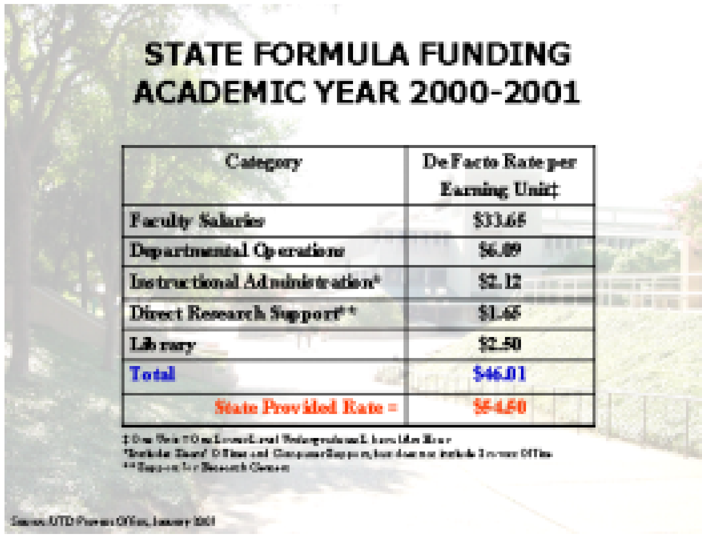
Type	Lower Division	Upper Division	Masters	Doctoral
Liberal Arts	1	1.96	3.94	12.04
Science	1.53	3	7.17	19.29
Fine Arts	1.85	3.11	6.51	17.47
Teacher Education	1.28	1.36	3.23	9.95
Engineering	3.01	3.46	8.2	21.4
Health Services	2.87	3.46	6.47	15.98
Business Administration	1.41	1.59	4.59	13.91

Source: UTD Office of Strategic Planning and Analysis

The rationales for the weights appear to be as historical as they are empirical; it is not clear how the weighted values of instruction in a particular discipline actually represents the true cost of instruction for that discipline. This is particularly the case where changes in the knowledge base of the discipline have shifted from more of a "liberal arts" base toward a "science" base or at least an information or technology intensive base. Furthermore, it is not clear that providing instruction at one school as opposed to another actually costs the same. Indeed there is evidence that it does not. A more accurate assessment of the landscape is that there are universities of unequal size, in different locales with different missions that serve highly diverse student populations with widely divergent instructional needs.[3] Even so, the formula is designed to remove some of the politics from higher education funding. While there have been many criticisms of the formula funding system in Texas, it is, in fact, the major method by which the state allocates general appropriations to its public institutions. Obviously in a private school or university not funded by these means, these considerations do not matter. In our case, however, establishing the true reimbursement rate is the first step in creating the measurement of the state revenue stream. In a larger sense, any institution that wishes to accurately track it revenue flow and return on investment can utilize the concepts and practices presented here.

The exhibit below provides a breakdown of how the current formula funds various aspects of the E&G budget. The base we are using is $46.01 and $33.65 (73.1%) contributes directly to faculty salaries. The remainder contributes to Library, Departmental Operations, Instructional Administration and Research Support. So each semester credit hour makes a contribution to all of these areas.

[3]Formula funding in Texas has a rich and elaborate history. It was originally designed to rationalize funding and reduce the politics of higher education. At various time prestigious commissions have tried to reform the formulas and/or reduce them in a single formula. As far as we know, no recent empirical work has been published that demonstrates how the various weights actually relate to the real costs of instruction. But it is not that simple because historically, the legislature has not funded the formula at 100% but at some percentage less than 100 percent. So for example, the base credit hour may be worth $56 dollars on paper but in fact, real appropriations indicates it is actually $50. At the present time (October 2001) new formula committees have been appointed to again review and propose modifications to the formulae.



STATE FORMULA FUNDING
ACADEMIC YEAR 2000-2001

Category	De Facto Rate per Earning Unit‡
Faculty Salaries	$33.65
Departmental Operations	$6.09
Instructional Administration*	$2.12
Direct Research Support**	$1.65
Library	$2.50
Total	$46.01
State Provided Rate =	$54.60

Source: UTD Provost Office, January 2001

In order to obtain a complete picture of revenue flows additional factors need to be considered for faculty engaged in activities other than teaching. First, there are faculty working on research projects. This activity, in so far as it is externally funded, is a value added activity for the university. Moreover, when externally funded, the proportion of the faculty member’s salary funded by formula is reduced by the amount compensated by the contract or grant. In most cases for federal grants and contracts, the portion of faculty salary paid by the grant or contract reduces the amount of time the faculty member works on state funds. This is not true, for example, for certain types of training grants where the faculty member may administer the grant but the main beneficiaries are graduate students. It is also not true for faculty engaged in research, who receive reduced teaching loads but whose activity is paid for out of state funds. A Dean may grant a faculty member reduced course loads to write a grant proposal, finish a book, etc., but pay for that reduced load out of state funds. In our model this subsidy shows up as a deficit since state funds are supporting the activity.

Secondly, there are faculty who are either granted or given special assignments. Special assignments are more difficult to assess because they intrude into the system from multiple points. A common calculus in universities is the reduction of teaching load as barter for undertaking a special assignment (e.g., departmental chair). Alternatively, faculty may be given summer support in which case their teaching load remains the same during the academic year. In instances where administrative or special assignments are funded out of faculty salary accounts, those faculty often show up as deficits on a basic ROI analysis of revenue generated from teaching activities. There are generally cost assignment questions related to these types of assignments. For example, departmental chair activities and associated costs are borne, generally, by the department as a whole as would other departmental operations and support. On the other hand, costs for special assignments that affect the university as a whole, such as reaccredidation efforts, are distributed more widely. Our approach to these assignments is to embed the costs in university-wide administrative overhead. However, the actual calculi for these types of costs vary from university to university and in some cases are not considered at all.

The next step is to compile a program to report state funded salaries versus state revenue (as measured by formula funding) generated and to group the individuals by school, program or department and faculty status (e.g. Tenured Professor, Tenure-Track Professor, Lecturer and Teaching Assistant). This data also allows for the grouping of costs/revenues by subject matter, course level, time of offering, and other measures. The resulting data can be analyzed using descriptive statistics and/or inferential techniques. For example, for any given grouping we can compute a mean, confidence interval and standard deviation. Over a given time period, such as six semesters or three academic years, trends in performance can be revealed and faculty, courses, and other units of analysis that are outliers from the mean can be identified.

Return on Investment Analysis (RETINA): The Program

RETINA is an assessment computer program that is designed to perform several different missions. It is part of a larger proprietary database management system with regard to faculty and the flow of instructional resources.[4] The primary objective of RETINA is to estimate revenue generated by semester and for an academic year. In this respect RETINA calculates revenue generated per class according to state formula funding guidelines. Tuition is also calculated since in Texas, it transitions to Austin and then is recycled into an Education and General account to be used locally. The second objective of RETINA is to determine the cost to the university of various forms of work endeavors as measured by salaries paid to faculty members out of state accounts.

[4] There is a collateral management system for the physical plant and inventory.

RETINA can then be used for a Return on Investment (ROI) calculation to determine efficiencies in the faculty, programs of instruction, departments or schools. RETINA has been used to determine revenue and expenditures on specific areas of concern (e.g., Teaching Assistant and Research Assistant's salaries). RETINA also calculates the relative monetary contributions of revenue from classes to other areas such as departmental overhead, staff salaries, and designated fees. However, our purpose in this paper is to focus on the relationship between instructional costs as measured by state funded faculty salaries and formula funding and tuition and measures of income.

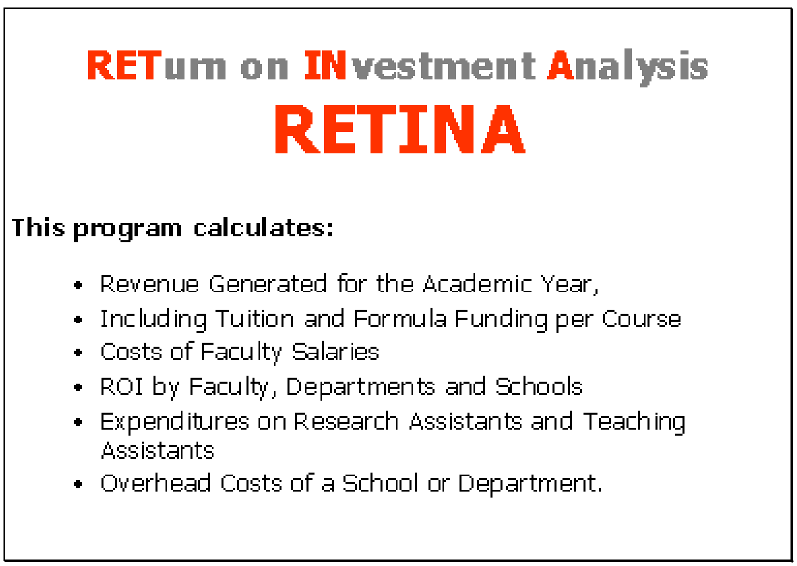
Methodology

There are several restrictions that must be noted. First RETINA does not take into account administrative duties performed by faculty members that are funded using state funds in the instructional budget. For example, if the Chair of a Department is given a course reduction or summer support by the Dean as "payment" for administrative duties, RETINA will not capture this nuance. Instead RETINA output will show the Chair as a deficit to be explained by the Dean to the Provost. Still this output provides a Dean or Provost with valuable insight into the relative cost of administration per department. If there are two departments of the same size and complexity, and two administrative supplements (course reductions) of disproportionate amounts ($15,000 versus $8,000) a question arises as to the efficacy of the reward system. In this sense RETINA provides an alternative basis for examining policy and practice.

Secondly, RETINA does not exclude students whose status is such that their semester credit hours do not generate state formula funding. Examples for Texas are undergraduates who have accrued more than 170 semester credit hours and doctoral students whose doctoral credit hours surpass 100 hours.[5] These students are small in number at our university and they continue to pay tuition; pragmatically, too, there is not a simple way to differentiate these students in the student system. Furthermore, every legislative session considers or passes modifications to the laws that create these special classes of students. A small population group at the mercy of these legislative winds can safely be excluded in most ROI modeling without adversely data accuracy and the general policy making of the university. However, changes in residency requirements, for example, must be taken into account as one would any change that changed the funding or tuition status of large bodies of students.

Third, RETINA excludes non-funded classes. Classes in this category include all executive education courses in which the students pay a fee that covers, in theory, the full cost of instruction. Faculty teaching these courses, in virtually all circumstances, are not supported by state funds but derive their salary from the executive education programs.

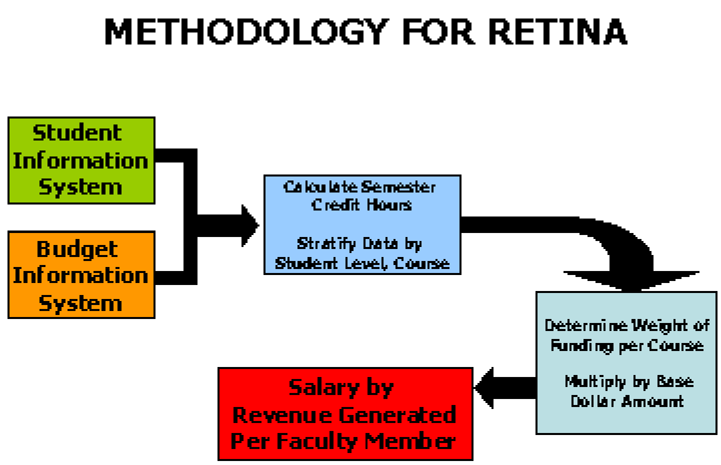
Fourth, RETINA does not account for tuition exemptions and waivers. While these amounts are not trivial for our university, they are also not a direct result of the faculty, program or school effort. Also, exemptions and waivers are determined by student status (scholarship, TA, or special out-of-state). We assume these are distributed across the total credit hour production in a proportional manner.



Information is taken from Strategic Planning and Analysis files, Budget files and the Student Information System (SIS+) and merged to obtain results. The first step is to calculate semester credit hours and the value of those hours for each class taught, which in some systems is a much more simple task than in Texas. Semester credit hour revenue values are based on a lowest common denominator formula (using the lowest value of

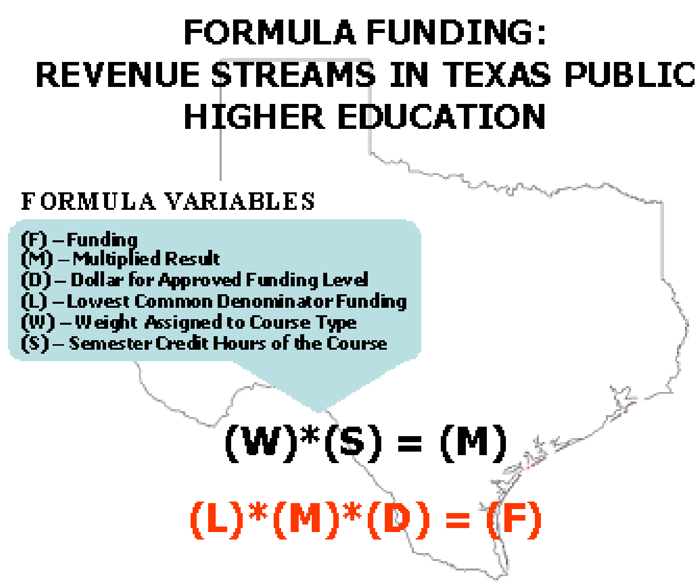
[5] For better or worse these semester credit hour requirements were set into law by the legislature. We have discussed elsewhere the effects of these requirements in terms of their differential effects on universities, community college transfers and minority students.

either course level or student level). Each set of course hours must be weighted appropriately. Information on the faculty member teaching the class, including salary, was then added to the file in order to charge back the hours to the correct program, department or school. This is necessary since some professors teach courses in more than one program and at more than one level. For example, in any given semester a professor may be teaching at both the graduate and undergraduate level; if we wish to determine the cost effectiveness of these programs separately, we need to separate costs by level of instruction. An issue arises with how much salary should be assigned to particular courses when courses are the unit of analysis. This is important when comparing, for example, a graduate and undergraduate program. On one hand, there is an argument (often built into workload formulae) that graduate teaching is "more work" than undergraduate and therefore should be assigned a disproportionate amount of resources. On the other hand, there is an argument for equity; in essence the salary a faculty member earns from teaching for one term should be divided equally among the courses that person teaches for that term. We have programmed RETINA using the latter argument.



Another issue at our university is the relationship between the source of funding for the course and the home department of the instructor. While this is not a problem for many institutions, our university has a long history of interdisciplinarity and of several professors[6] who teach across departments and schools. For these faculty the funding derived from the formula and tuition flows to the academic unit paying the faculty to teach. So, for example, if Professor Alpha holds tenure in the Department of Mathematics but teaches a course funded by Engineering, the Department of Engineering receives the benefits of formula and tuition generation. In short the department that incurs the costs also enjoys the revenue.

The following are variables taken into account when generating income from a class: level of the course (Freshmen to doctoral), type of course (liberal arts, engineering, science etc.), level of student (e.g., freshman, sophomore), and number of semester credit hours per course. Once these variables have been ascertained they are processed through the formula funding weights to determine the value of the class and then multiplied by a set dollar amount by the state. Tuition is determined based on residency. The result is the revenue generated per course (see below).



Deans and Program Heads are tenured and therefore are included into the calculation. As noted above, faculty members who hold a position in a school but are not being paid by their school to teach were removed from that school's calculation. Both state salary funds and all salary funds were calculated for Return on Investment calculations. Because this analysis focuses on teaching revenue and state funds, Contracts and Grants information is not included.

[6] Including one of the authors.

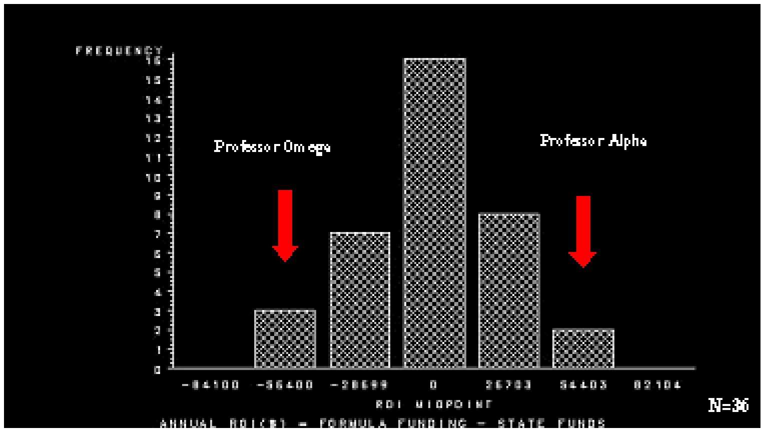
Results

Schools and departments obviously have faculty and staff who generate other funds in addition to state appropriation funds, but this report is designed to guide administrators in their examination of funding source in relation to the activities that generate those funds. How do we subsidize programs that are necessary but are not generating as much state funds due to the classification of their programs by the state formula funding system? Are certain programs classified correctly? What type of personnel is needed to maximize ROI in different areas? To begin the search for answers, we must look at the university in the schools and departments. An example of one type of RETINA output is provided in the slides below. In the first slide, we have a hypothetical output for teaching faculty (including Teaching Assistants with course responsibility). As one can see, there is a great deal of variability and there may (or may not) be sound administrative and policy reasons for this variability. The data frame the policy questions for the administrators (and for faculty).

School	Dept	Name	% of Time on State Funds	Academic Year State Salary	Tuition & Formula Funds Generated	Annual ROI for Tuition & Formula Funding - State Salary in 2000-01
LSA	FA	Adams, D.	50%	$2,000.00	$14,000.00	$12,000.00
ENG	CSE	Curtis, T.	50%	$4,000.00	$14,000.00	[illegible]10,000.00
TA Subtotals				$6,000.00	$28,000.00	[illegible],000.00
LSA	HIST	Bacon, K.	100%	$2,250.00	[illegible]	[illegible]10,750.00
ENG	CSE	Houk, L.	100%	$3,250.00	[illegible]	$2,750.00
ENG	ME	Larson, G.	100%	$21,250.00	$37,[illegible]	$15,750.00
SCE	BIO	Rembrant, C.	100%	[illegible]	$65,000.00	$50,750.00
Lecturers Subtotal				[illegible]	$111,000.00	$80,000.00
LSA	SOC	Brown, C.	[illegible]0%	[illegible]	$180,000.00	$140,000.00
ENG	CSE	King, S.	[illegible]	[illegible]5,000.00	$71,000.00	($4,000.00)
ENG	SOF	Kirk, J.	[illegible]	$40,000.00	$89,000.00	$49,000.00
SCE	AST	[illegible] L.	[illegible]	$60,000.00	$89,000.00	$29,000.00
Tenure-Track Faculty Subtotal				$215,000.00	$429,000.00	$214,000.00
LSA	[illegible]	[illegible] S.	100%	$65,000.00	$95,000.00	$30,000.00
ENG	[illegible]	[illegible], B.	90%	$120,000.00	$31,000.00	($89,000.00)
ENG	[illegible]	Jobs, S.	88%	$175,000.00	$230,000.00	$55,000.00
SCE	PSY	Hartley, R.	100%	$70,000.00	$114,000.00	$44,000.00
SCE	BIO	Cousteau, J.	90%	$38,000.00	$0.00	($38,000.00)
SCE	BIO	Indi, S.	89%	$76,000.00	$335,000.00	$259,000.00
SCE	BIO	Indi, T.	89%	$76,000.00	$270,000.00	$194,000.00
SCE	PHY	Bond, J.	89%	$80,000.00	$25,000.00	($55,000.00)
Tenured Faculty Subtotal				$690,000.00	$1,090,000.00	$400,000.00
Grand Total for the University				$942,000.00	$1,658,000.00	$716,000.00

The following slide provides a histogram demonstrating the relationship of two Professors in a hypothetical department of 36 faculty. Arrayed in this manner, the data

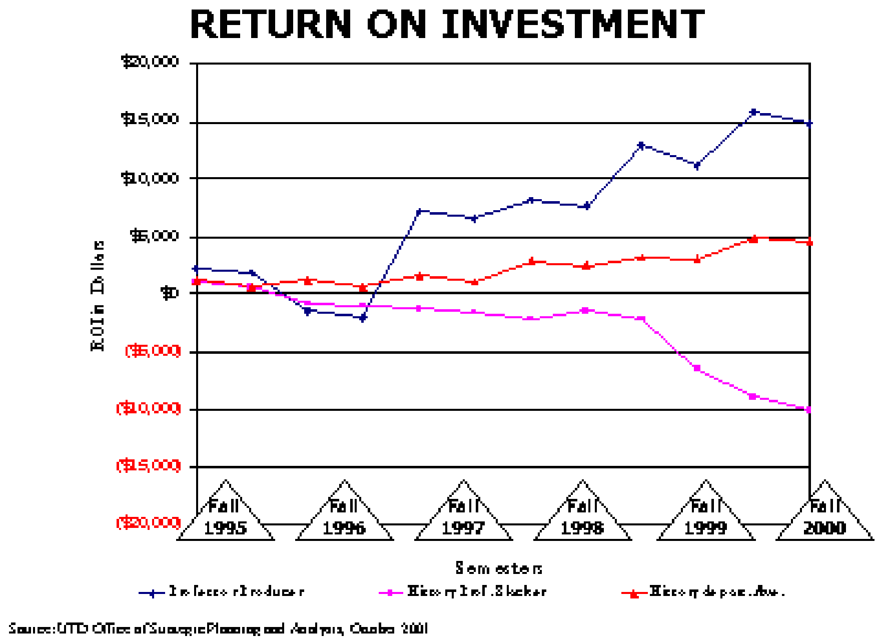
HISTOGRAM OF REVENUE OUTLIERS



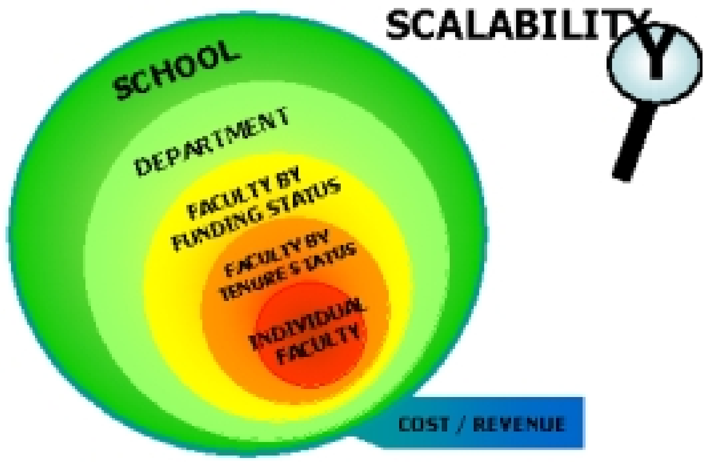
Source: UTD Office of Strategic Planning and Analysis, October 2001

provide a clear policy issue and a point for discussion by the Departmental Chair in performance evaluations. Again there may be good reason for the distribution, but over time, one should expect changes in the ordering of faculty. As demonstrated in the final slide, the accumulation of this data over time can tell a clear story about faculty who produce positive revenue results and those who are not.[7] While we have admittedly taken the two extreme examples, the slide demonstrates the power of RETINA. In this example, both Professors finished books in the fall of 1996 and in fact were given course relief (small class sizes and reduced loads) to finish their scholarly work. But observe what happens after fall semester of 1996. Clearly one Professor is a candidate for counseling while the other has a clear case for positive performance review.

[7] Note we are neither discussing teaching effectiveness nor learning outcomes.



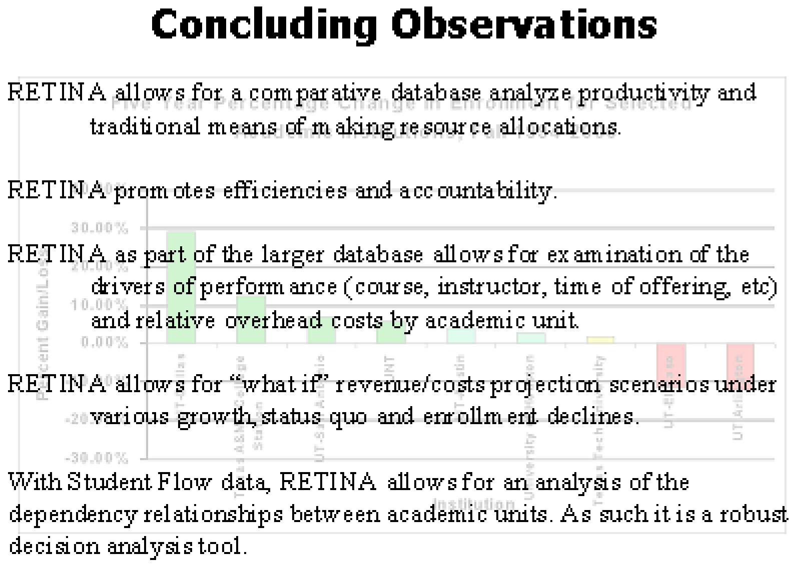
The data in RETINA allows for scalability in analysis. Because it builds the database up from the course level (including individual instruction), the data can be arrayed in a variety of ways. Graduate programs can be compared to undergraduate programs, for example, and with other available data, administrative costs of these programs can be assigned and reviewed. Data can be examined for core versus non-core courses and for so-called "gateway courses" and their subsequent effects on courses that follow. Besides descriptive statistics, the RETINA database allows for inferential work. Variables such as time of day, length of session, instructor evaluations, and drop-rates can be combined in multivariate analyses. Demand elasticities for courses and instructors can be established; this can have an impact on creating more efficient course scheduling.



Concluding Observations

Universities need to realize that resources are not infinite, and controls and accountability need to be put into action. However, this cannot be accomplished if the university cannot identify what areas to control or who needs to be held accountable. In order to do this, the university knowledge management system must be upgraded to gather data in a useful format. If the data is not accessible, then the university will be unable to mount successful action on constraints to resources or hold anyone accountable for spending resources ineffectively. Armed with clear data, universities and colleges can begin to compile schematics of how departments and schools truly operate and compete for resources.

RETINA can help administrators differentiate between departments and schools that subsidizing programs that struggle financially, but are necessary to the overall academic curriculum of the school, and departments that are wasteful, inefficient or support programs that are esoteric and/or not viable. In a wildly fluctuating economy, some programs and departments will be more vulnerable to unemployment, inflation, and recession. The capacity to project enrollments, semester credit hour generations, tuition, and funding from the state may avert or at least mitigate economic hard times for the university and individual departments during economic downturns.



Detailed analyses of overhead costs and revenue generation do have an important place in higher education. Such information guides colleges and universities as they seek to lower costs, streamline operations, and improve the quality and effectiveness of the educational experiences of their students. Resources can be redirected to bolster efficient yet struggling departments, industrious faculty can be identified and rewarded and under performing faculty can be counseled to improve their performance.

While RETINA cannot track faculty with administrative duties or research it can be used in tandem with other measures and data (e.g., contract and grant information, teaching evaluations) to helps yield a clearer picture of the effectiveness of a program or department. RETINA is not a panacea but rather a tool designed to enable colleges and universities to provide the finest educational services possible to their communities while simultaneously utilizing their resources with great economy and wisdom.