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The Approaching Crisis in Computing Education: Enrollment, Technology, Curricula, Standards and Their Impact on Educational Institutions

Mark Hensel
Information Systems & Management Sciences College of Business Administration
University of Texas at Arlington, Box 19437 Arlington, TX 76019

AUTHOR'S COMMENTS

The 1991 *article by Cale, Mawhinney and Callaghan about the implications of declining enrollment in undergraduate degree programs caught my attention because* The *University of Texas at Arlington (UTA) was experiencing declining enrollment and shrinking budgets. I wrote this paper for the ISECON* '94 *convention and added material about the experiences at UTA, which had become so turbulent that the business dean was fired and* two *other deans resigned.* As *always, when trying to predict the future, nobody can contradict your forecasts because they have not yet occurred.*

The *test of time* is *the acid test of a paper such as this, and it has stood the test very well. Although the so-called "echo boom" of increased births from* 1977 *to* 1987 *has caused there to be more 18-year-olds entering colleges and universities enrollments are still declining in most institutions. That* is *because there are many, many more institutions of higher education competingfor the 8-year-olds, and because the Echo Boom* is *not as large as the Baby Boom of the 19605 and 705.* As *a result, budgets continue to decline and* it is *difficult to teach the students of today with the most recent of the rapidly changing IT tools. ..and we are in a constant technology chase to update our IT facilities. America5 mathematics and science scores continue to be poor when compared to other nations. At the same time, the demand for IT professionals* is *greater than evel; so those trends continue, as well. In short, I stand by my conclusions of* 1994.

The greatest change for me has been a personal change related to this and other papers about upgrading the computing technology in order to teach with the latest hardware and software. My dean finally told me to shut about upgrading the technology and appointed me to do it, or to practice what I preached in the NEW *TECHNOLOGY section of the papel: I have been doing just that for the last two years, so watch what you say. ..You just might have to show that you can* do *what you talk about. Mark (Buzz) Hensel July* 31, 1998

ABSTRACT ***The academic computingfteld*** **is** ***changing rapidly.*** **This** ***paper focuses*** **upon** ***the problems and challenges facing a university computer infonnation systems department in the face of declining enrollments while trying to raise its admission standards and simultaneously implementing*** **new** ***technological packages.***

INTRODUCTION The post-World War II eras of the 19505, 605 and 705 were marked by three trends that had an immense impact on American life.

The first trend was an increase of people caused by the so- called Baby Boom of the post-war era. This caused a population groWth that had never before been seen in America. The resulting larger population caused an increased demand for government services and suppon. The United States' population increased by 41% between 1960 and 1992, for example; and total social spending by the gov- ernment increased almost fivefold during the same period [3].

The second trend, which was caused by the first, was an increased demand for higher education opportunities. When the Baby Boomers became eligible to enter formal education progratnS in the 19605 and 705 their numbers caused an increased demand for educational institutions at all levels. They also created a special demand for a college level edu- cation as a way to secure a good job and to achieve fInancial security.

The third trend was a shift from an industrialized society to a

white collar, information society. America changed forever in 1956 when more than 50 percent of its non-farm labor force ceased to be classified as blue collar factory or manual labor work- ers and became white collar workers [26].

America's education and government institutions answered these demands in a variety of ways. The demands for more institutions of education at all levels resulted in the construction of more public and private schools. The demands for higher education opponunities resulted in the creation of government, private, and industry grant and loan programs to finance higher education and to encourage more people to seek a higher education as a way to get a better job.

DECLINING ENROLLMENT

The heady growth periods of the 605, 705 and 805 that led to expansion in American higher education are ending and some new trends are emerging. .These new trends are forcing us to reevaluate many of the plans and

programs of the past. Even the most elite schools such as Yale, Columbia and Stanford find themselves in a fmancial crunch, which tnay force them to reshape their plans and programs just to stay open. A reduced number of 18-year-<>lds entering colleges is causing schools to compete for a Stnaller entering student population [18, 21]. A shon period of increases is approaching but it will not be as dratnatic as the earlier Baby Boom and will offer only temporary relief [Putka 1995 and 21].

There is an even greater problem in the fields of science and technology including the field of computer information sys- tems/management information systems (CIS/MIS).

A series of studies by UClA has shown that there was a huge growth in the numbers of entering freshman college students who were interested in computing occupations from 2.8% of entering freshmen in 1977 to a high of 8.8% in 1982. That dramatic increase was followed by a precipitous decline to a low of2.7% in 1986 [18]. The decline has continued, and is expected to continue after a brief increase between 1995 and 2010 [3, Putka 1995 and 21].

At the same time the industry's demand for CIS/MIS profes- sionals has grown steadily and the number of CIS/MIS graduates has declined just as steadily [12, 23, and 27].

This discrepancy between the growing demand and the falling grad- uation mtes can lead to an ironic problem in the next few years. Industry will face a shonage of college-educated CIS/MIS graduates and academia will face a simultaneous lack of demand for their ability to educate CIS/MIS professionals. The decline in student interest is quick- ly approaching the point at which many institutions tnay be forced to reduce their course offerings in CIS/MIS and many institutions may not be able to suppon CIS/MIS as a separate ma.ior program [8].

Some members of industry have a different perspective about the problem of declining enrollments in the CIS/MIS field. Nick Simmons, executive director of MIS at Chrysler Corporation, agreed that the declining binh rate is reducing the numbers entering the field. As a result, he said, IS directors expect to hire fewer and fewer entry-level applicants with technical degrees in the field. Chester Delaney; vice president and manager of systems human resources at Chase Manhattan Bank, said that the drop in enrollments has been caused because the CIS/MIS curriculum has not been very suppon- ive. Delaney said that schools are teaching students about computer architectures and compiler design when they need to learn skills and tools such as COBOL. Delaney also said the problem is compound- ed because CIS/MIS students are considered to be elite, and many are hired by vendor firms because they expect to do more than maintain someone else's work in an IS depanment's entry-level positions [11].

Another problem is that some students are avoiding the tougher science and technology fields and majoring in easier fields to build a better resume. A 1991 study of the humanities fields at seven universities found that the generally lower grades award- ed in science and technology were discouraging enrollment in those disciplines. Higher grades in the humanities were attracting students to those disciplines in order to build a better looking transcript so they could get into a better graduate school [1, 16].

This problem is compounded by a general decline in the educa- tion levels of Americans as compared to students in other countries. There was a drop of almost 80 points in the SAT (Scholastic Aptitude Test) scores between 1960 and 1992 although spending for education increased almost 225% during the same period [3]. A 1992 interna-

tional test of 175,000 students in 20 countries by the Educational Testing Service showed that, in spite of spending more on education than almost any other tested country (7.5% of GNP), American stu- dents ranked close to the bottom in mathematics and science [15].

Another cause of declining enrollments may be increased com- petition. More colleges and universities were built in response to the increased demands of the past, so more institutions are com- peting for the decreasing numbers of students. UT Arlington faces a very competitive situation in an area served by ten colleges or universities and eighteen community colleges with more campus- es planned or being built.

Tarrant County Junior College (TCJC), for example, is build- ing a fourth campus in Arlington, Texas; and there are some con- cerns that this will drain more students away from UT Arlington [9] .The president of UT Arlington believes that active recruiting will add up to 10,000 new students at UT Arlington in the next 10 years. Some of the faculty believe that may not be possible due to the intense competition for students in the north Texas area [4] .

Texas community colleges have had an annual groWth of 5% for the last five years and private schools have had some groWth, but public colleges and universities have had smaller and smaller enrollments [25]. UT Arlington's fall 1994 semester figures show a further decrease in enrollment to 23,982 students, a decrease of 500 students from the fall 1993 semester [13], which continued a downward trend in enrollment [6].

ADMISSION STANDARDS It was Boom Time for the CIS/MIS field in the 19605, 705 and 805 with more and more people seeking entry into the field. Demand for a technical education was so high at one time in the early 19805 that some schools eliminated students in special "weeding out" classes at the freshman and sophomore levels [8].

The University of Kansas even imposed strict enrollment lim- its in the computer science field in 1980. The faculty felt that the university's computing facilities were too crowded to support any more students, so they limited enrollment as a way to conserve their computing facilities.

The University of Texas at Arlington (UTA) College of Business Administration (CoBA) started losing faculty in the 19805 because it was not getting enough money to be competitive for faculty pay and some were moving to other institutions. The college decided to hire more non-tenured faculty to cut expenses and to use the savings gen- erated in that manner to grant pay raises to tenured facult~ They also decided to reduce undergraduate enrollment in the college of business by raising the CoBA admission requirement from a 2.0 GPA to a 2.25 GPA; and to increase the better-paying graduate enrollment [7].

The effect was immediate. The college of business had a total decrease in enrollment from ~987 to 1992 of 17%. During the same period it had an increase in graduate enrollment that gener- ated an increase in masters degree student contact hours of 39% and an increase in doctoral student contact

hours of 114%. This represented an overall decrease of 4% in total hours taught, but generated much more income for the college of business because of the higher fees paid by the state for graduate contact hours [7] .

The rest of the UT Arlington faculty proposed raising the admission standards for all parts of the university based upon the

successful program of the college of business. Some feel that rais- ing the standards will also improve the university's image by mak- ing the academic standards more difficult to achieve, and by gen- erating more time to do research due to smaller class sizes [6].

The university president has a different vision of the future and is encouraging the faculty to take another path [6] .The president wants to recruit more students and believes that raising the admission stan- dards will frustrate his plans. Disagreements over the policies and direction of the university became so emotional that the vice presi- dent of student affairs and the dean of liberal arts resigned over this issue. The dean of the college of business was 'fired' by the presi- dent after announcing that he could not work with the president [5] .

Another pan of the controversy is the role the university should play in the community. Some believe that state-supponed schools such as UT Arlington must emphasize teaching over research, and that those located in large Metropolitan areas must provide an edu- cational opponunity to low-income and disadvantaged students. Some believe that it is an obligation of the state and the university to provide at least an opponunity for a college education to every- one. Others believe that many students would do better staning in a community college, and attending a four-year school later [5]. California implemented its famous California Plan in the 19705

and promised that the state's top students could go to top schools, others to lesser schools, and everyone else could go to community colleges. This plan worked in the boom times of the 19705 and 805 but California is facing deeper and deeper cuts in its higher education program and may have to eliminate some schools and some opponu- nities to reduce the costs of their social and academic programs [21] .

Some are predicting smaller schools and a smaller system of higher education by the year 2000. Smaller schools may be appropriate given the over-building that took place for the last 20 years [21]. The UT Arlington faculty plan to reduce enrollment may therefore be appropriate for the times, but the president's goal to raise the university's enrollment may have doomed this plan [6] .

The Depanment of lnfonnation Systems at UTA has experi- enced a different enrollment pattern. Although the CoBA enroll- ment has been declining, the depanment's enrollment has been slowly increasing during the same period.

There are several reasons for this gradual increase, including a major change in the Dallas and Fon Wonh (DFW) economy as it shifts from a defense to a non-defense industry economy; and an otherwise nonnal growth in one of the most viable industries in one of the most viable growth areas of the country [10].

NEW TECHNOLOGY Academia is aware of the problem of technological obsolescence and the pressures it can exen on a depanments curriculum. It is very difficult to stay current with the hardware and the software of comput- ing, given the budgetary constraints on academic resources [14]; but keeping up with new technology is needed for a successful academic program, and necessary to prepare our students for their careers [24].

Although budget constraints play an imponant role, there is another factor that may limit the acquisition of new technologies. There is usually almost no incentive for a tenured faculty member to work very hard to introduce new technology in the classroom. Tenure, promotion, and pay increases at a four year college or uni-

versity is usually based more upon research and writing for publi- cation than upon teaching and classroom performance, so there is little or no reason to seek to implement new technologies into the curriculum unless they can be used for research and publication.

The UTA Department of Information Systems and Management Sciences, for example, places more weighting upon research and scholarly publications than upon both teaching and service [22] .No credit is given for tenure and promotion for introducing new technology into the curriculum.

In spite of budgetary constraints and the lack of incentives for the faculty to seek and acquire new technology, some new tech- nology is acquired through those traditional, budgeted ways. There are other ways to acquire new technolo~

One way is through industry grants and gifts. Industry wants to hire graduates with a technical degree from a curriculum that teaches and emphasizes current practices and methodologies [11] .

Texas Instruments (TI), for example, donated new hardware and their Interactive Engineering Facility (IEF) development tool to UT Arlington. This gift gives TI a place to recruit graduates who are familiar with their CASE product. TI can also name UT Arlington as a place where companies can train their people to use IEF; and where they can recruit graduates familiar with the product.

Business 'partnerships' offer another opportunity. Like many other companies, TI offers a program for colleges and universities to create local area partnerships with businesses to fund acquisi- tion of the IEF development tool at a relatively low price.

Another source of new technology gifts is student professional associations. The UTA student chapter of the DPMA, for example, acquired sold coffee and doughnuts to buy a client- server devel- opment package which was donated to the university.

MODEL CURRICULA A model curriculum gives order and direction to a profession- al degree program and even helps justify the acquisition of new technology (for example, CASE tools are called for in the DPMA's IS 90 curriculum). Selecting a curriculum poses several problems and related questions.

The first problem is a perceived 'gap' between the expectations of industry and the practices of academia, according one study of academia and industry. Gordon Davis said that a vocational cur- riculum, which some in industry seem to prefer, is closely related to current practices; but that academic discipline has a longer focus emphasizing the direction of the field and underlying phenomena, with a general feeling that it is better to learn current practices on the job. James Manin said that a problem is that academia contin- ues to teach the obsolete languages and methodologies of the past and ignores the technologies of the present. Michael Denouzos, director of MITs labs for computer science, said that the role of a university is not to just train people to be useful upon graduation; but to give them lasting fundamentals of the field so they'll become long-tenn contributors and continue to educate themselves [14] .

Several models or 'standardized' infonnation systems curricula have been proposed by a variety of professional organizations such as the DPMA, the IEEE and the ACM. Similarities in these degree programs have confused the issue and blurred the lines between computer science and data processing so much that neither indus-

try nor academia is completely satisfied with these curricula [14]. Although curricula are central to undergraduate degree programs in CIS/MIs, no single source identifies and compares the available professional degree curricula. One study found that the majority of MCsB accredited schools used the DPMA model curriculum (IS 90) which is considered to be more suited for business applications than the so-called more technical ACM degree program [19].

A 1991 study of American and Canadian schools offering a CIs/MIsdegree program found that 43.5% of the respondents from 161 institutions said that their schools had selected the DPMA model. A different 24.8% used the ACM model; and 31.7% used a local hybrid of the two model curricula [17].

If the DPMA curriculum is selected, as is most often the case, the next question is what applications of the model curriculum are available as examples to help implement the DPMA model? Some examples which can be used include works by Becker and McGuire [2], by McCubbin and Mathews [19,20], and by Wysocki [28].

CONCLUSIONS Enrollments are declining due to fewer college-age students, and to more competition for the fewer numbers of students. Enrollment in CIS/MIS programs is also declining for the same reasons and because of changing interests, poor preparation for technical fields, and lack of awareness of the rewards of the CIS/MIS field.

A reduction in size may be forced upon us by the smaller num- bers of entering students. The eras of great growth are ending and we must compete to survive as a viable degree program.

The curriculum selected for our schools must be supponed by the technology available, and we must seek the best and latest technology to train our students for the careers ahead of them, not just the jobs they get upon graduation.

Budget constraints will force us to seek new sources of funds for adding new technologies to our curricula. Pannerships with industry may become ever more imponant for us to be able to offer the technical packages needed by our students. Other ways of acquiring technology must also be explored.

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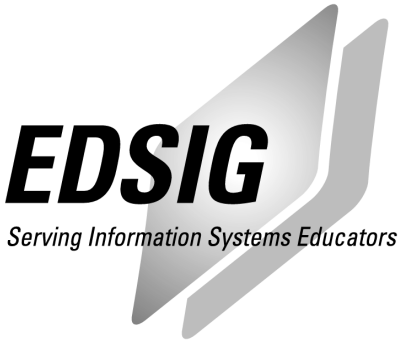

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