

TECHNOLOGICAL ADVANCES IN THE ART AND SCIENCE OF TEACHING
Can Improved Teaching Effectiveness Keep American Professors Competitive

by

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ABSTRACT

TECHNOLOGICAL ADVANCES IN THE ART AND SCIENCE OF TEACHING:

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September, 1996

This paper examines the impact of technological advances on American higher education in the coming decade. It is not, however, an encouraging pep talk about how fancier audiovisual aids and classroom video projectors can dress up lectures and impress students. It's too late for that.

The paper begins with a discussion about a very disturbing article from *Financial Times*, which claims that American professors in conventional universities are outdated; that they are selling a product that is ridiculously expensive and ill-suited to the needs of the changing society. The article cites a book by Lewis Perelman, *School's Out*, in which the author predicts the demise of conventional education.

According to Perelman, modern electronic technology--interactive software and multimedia technology--will replace conventional degree programs, permitting the student to begin his professional life earlier, wait until particular knowledge or skills are needed, and then obtain them electronically. This switch to "just-in-time" learning would mean that talented people would no longer spend years preparing for employment. They would begin work early--perhaps in their mid-teens--but continue learning on the just-in-time principle. In such a world "going to college" would cease to be part of the American dream. "Electronic college" would replace present-day heavily-subsidized non-profit institutions, a true market would develop, and electronic education would become a highly profitable business for the so-called "learning companies." As Perelman sees it, technological advances will not prove to be academia's new teaching tools, but their downfall.

The paper examines Perelman's assertions as social issues, and then in terms of learning requirements for the society. Next, it relates these to the ongoing internal issues in higher education, citing the causes for the price, product and responsiveness problems that currently plague American colleges. By introducing a systematic thinking process to analyze the problems inherent in academia, the paper shows how any college or university can identify the policy constraints that constitute the core problems affecting its viability in a changing, high-tech educational environment.

Rejecting Perelman's predictions, the paper explains a balanced solution that takes advantage of the enormous resources already available in the American university. This solution not only exploits the supply-side advantage that conventional colleges possess; it permits a logical approach to the use of technological advances that will enhance the effectiveness of academia's still-viable organizations. By exploiting its weak links and resolving its policy constraints, a college can avoid compromises and develop balanced solutions that bring local (departmental) objectives into focus with the global goal of the institution.

The paper ends with a restatement of the importance of the conventional college in the overall American learning experience. It restates the value of the traditional classroom as the only environment in which a teacher can apply Socratic teaching techniques, come face-to-face with the student and create a relationship which technological advances can deeply enhance.

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HEADLINE: *Financial Times*, November 20, 1995, (Michael Prowse--America):

Endangered Species

Modern electronic technology could mean that the days of academics at higher-education institutions are numbered.

Does the future of the American professor look as bleak as some "experts" claim? Is s/he destined to be replaced by computers, online services, interactive software and multimedia technology because s/he cannot deliver current information effectively or competitively?

This paper assesses the potential reality of a recent article's gloomy prediction about the future of higher education as we know it. Through the use of an innovative logical thinking process often used to analyze business problems, the paper attempts to identify the core problems underlying the undesirable outcomes the article portends. In so doing, the article suggests that teaching effectiveness is much more than just tools and technique; it is a function of the entire system of higher education.

A DIM VIEW OF THE FUTURE

According to Lewis Perelman, president of the Kanbrain Institute and author of *School's*

Out, conventional education is on its way out. (His firm's name, "Kanbrain," is adapted from *kanban*, the Japanese word for the "just-in-time" production inventory system.) Perelman asserts that present-day electronic teaching techniques will make traditional college learning obsolete. The "old approach," as Perelman calls it, was to start life by trying to accumulate a large stockpile of knowledge through the formal channels of academe, never sure that what we have learned will be relevant in the rapidly-changing real world of work. "Going to college," as it has persisted since the time of Socrates, with lecturers standing in the front of spacious classrooms, should be replaced by more economic, more timely and relevant offerings via one's home computer or television screen--at a small fraction of the cost of traditional classroom courses. Or so it seems to Mr. Perelman.

Is a better strategy, then, to wait until one needs specific knowledge or skills and then obtain them electronically? Can "just-in-time learning" free talented people from

years of preparation for employment and permit them to begin work earlier, possibly in their mid-teens, and then continue learning as needs arise--just in time? Are the price, currency and quality differences going to eliminate the "halls of ivy" we have come to respect?

Perelman observes with some accuracy that compared to other information-based industries, academia is increasingly unable to offer competitively-priced products. While prices for software and hardware continue to fall, higher education offers no relief from a trend that is, I fearfully observe, showing no signs of improvement. The price of college tuition has been on a ten-year rampage--an increase of 174 percent--since 1985. In just the past five years, borrowing to pay for college has doubled, to the tune of about \$25 billion per year. At the same time, nontraditional education systems have shown a tremendous growth; customers (students, if you prefer) are finding that state-of-the-art knowledge in many disciplines is more economically available through nonaccredited sources such as video tape training programs, online publishing and in-house management courses given by very credible providers. According to Perelman's view, technology will inevitably win out over tradition.

If technological advances are all that matter, then the competitive race between traditional academia and the electronic classroom is merely a question of who has the most toys. The one, it is said, who dies with the most toys--wins. But he also dies.

Teaching effectiveness, therefore, requires more than technological enhancements to the art and science of teaching. There are inherently three levels of issues affecting this

question:

1. **Social issues** which determine the knowledge requirements of the society,
2. **Requirements issues** which determine the nature of the delivery system that provides that knowledge, and
3. **Internal issues** within the delivery system which determine how it operates and delivers the knowledge required.

SOCIAL ISSUES CANNOT BE IGNORED

Aside from the academic issues raised by Mr. Perelman, there are some serious social implications associated with his prediction that more young people will postpone higher education and go directly to work after high school. First and foremost, are teenagers ready for earlier-on career initiation? Do they have the maturity to buckle down and become productive employees at the age of, say, eighteen or twenty? Will anyone want to employ them?

A second social issue likely to be induced by a flood of young people streaming out of high schools looking for work is the stream of young people streaming out of high schools looking for work--with no education whatsoever. Maturity and marketable skills issues notwithstanding, these folks may present society with an entire new set of welfare, health care and transportation problems. Perhaps a few would become taxpayers a few years sooner, but it's questionable whether the average "early starter" will move up the pay ladder and ever catch up with the alter ego that would

have attended college and started at a higher salary.

Perelman raises yet another social issue, one that has even more serious implications for higher education. What if the job market adjusts to such an influx of uneducated persons only to the extent that a select few are eventually sent to college, formal or electronic? On the other hand, how many of them will be willing to make the effort, spend the money and take the time to go to school after a few years of work and a few new personal commitments (a spouse, two children and a car payment)? What affect will this have on the society as a whole, not to mention the education of it?

There is also the macro-social question: will higher education--in whatever form it takes in the future--provide for the needs of its students as parts of the total society? Amid the growing popularity of interactive software and multimedia technology, can higher education insure that its product is indeed offering an entire nation of customers unique products they really need, at a price they believe it is worth? Perelman thinks not.

At the same time, will higher learning continue to be recognized for what it uniquely is: **higher** learning? Will it still provide knowledge and thinking skills that cannot be acquired easily in work environments or via the picture tube. Are academics at risk of being perceived as "professaurs" trying to preserve a buggy-whip industry merely for the sake of our own jobs and egos? Or is it safe to assume that certain aspects of traditional college learning will never be replaced by

nonthinking machines, and that for these educational products there will always be a demand?

With or without Mr. Perelman's assertions, we must be concerned about what higher education is and ought to be. We're wise enough to check our assumptions occasionally and confident enough in our own abilities, so let's get back to the issue raised by Mr. Perelman: can everything now offered in traditional college programs be replaced effectively by electronic learning, just in time for its application in the workplace?

To compete effectively with the "electronic educator" of tomorrow, formal higher education must satisfy the knowledge requirements of the society. Perelman suggests that we have already failed and that replacement is inevitable. This is what society will choose in the marketplace; ours is a demand-driven system like any business, and the customer is the final decision maker. By invoking the valid example of supply and demand, Perelman concludes that academia has no control of the market forces acting upon it; to survive means meeting the demand. What he has overlooked is that while demand fuels the engine of supply in any industry, the engine is not built in one day (or one semester).

The problem for higher education is delivering the requirements demanded; this is a three-dimensional problem involving three interrelated issues--the same three issues that every business faces.

**THREE PARTS OF THE PROBLEM:
THREE REQUIREMENTS ISSUES**

If academia is unable to answer the demand issues with actual performance, then Lewis Perelman will be proven right and all that he predicts will come true. The issues for the business of higher education are exactly the same three issues that affect every business: **Product, price and responsiveness** in the market.

The **price issue** is already well-known. If academia is unable to level its price curve while other information-based industries continue to offer lower and lower prices for more attractive products, then our customers are sooner or later going to rethink their personal and organizational needs for knowledge and seek alternatives to the traditional campus. These economic issues cannot be ignored.

The **product issues** are equally well-known. This is the era of "quality everything." If academia as we know it does not compete on the basis of product quality, then no matter the price, our customers will even sooner than later seek other sources or simply postpone learning until they find what they want. The quality of educational products delivered to the student is measured in dimensions that add up to student satisfaction. That quality measurement is deeply affected by the students' perceptions of curricula, teaching skills, availability of courses and relevance to need. Higher education is no less demand-driven and customer-controlled than any other industry.

The third issue--**responsiveness** (timeliness) of knowledge delivered--cannot be ignored. In fact, this may be the problem higher

education is most unwilling to solve. Educational timeliness is measured in two dimensions--currency of knowledge and delivery when the customer wants it. On the surface this sounds like a simple task, until we consider the fact that the content of many college curricula relies heavily on the content of available textbooks and the theories, processes and applications therein. The American college textbook system encourages little change from edition to edition, even in books whose disciplines address real-world competitive markets in which obsolescence means death. One wonders why textbooks in dynamic disciplines such as production operations, marketing and accounting read more like history books than state-of-the-art knowledge. One wonders why schools that tout "state-of-the-art" computer applications still adhere to publication style manuals designed for manual typewriters, in which the only updates address recent politically correct language issues.

We already know that mainstream textbook publishers are unwilling to invest in paper and ink for textbooks that have received "thumbs down" by the professors who review manuscripts; a bad review means the proposed text will not be adopted and therefore not sold. If the good-old-boy professors at prestigious institutions don't want the textbooks to change, then neither do the publishers. New editions that survive this process are too often nothing more than redated and rejargoned reiterations of the same old "tried and true" material. "Tried" material is comfortable for them; "true" is not important, or worse, threatening to them when it means that "tried" is obsolete.

Good Cause for His Predictions

Perelman touches on all three issues in his assertion that employers are more and more interested in what an employee or prospective employee can do for the firm and less and less interested in what degree s/he has obtained some years ago. Business is business, now and always. (Perelman didn't invent this concept.) Regardless of how and where a firm's employees are educated, the cost of getting them educated involves a business decision; the cost must be justified by benefits. The sequence of logical connections in this matter is quite simple:

- . **If** designers and managers have state-of-the-art skills and knowledge, **then** their firms can produce and deliver more competitive products to the market.
- . **If** these firms deliver more competitive products to the market, **then** the firms earn higher revenues.
- . Finally, **if** these firms earn higher revenues, **then** they are able to remain in business, reward their employees, and return an attractive profit to their investors.

Modern electronic technology, according to Perelman, has already made "just-in-time learning" eminently feasible. The "electronic college," as he sees it, would consist of courses supplied by cost-effective "learning companies" competing for business in a true market, while highly-subsidized,

inefficient nonprofit institutions would probably decline dramatically. His conclusion is that traditional academia will be unable to compete in this market and will therefore be replaced by computers, online services, interactive software and multimedia technology.

Is He Correct?

Perelman is intuitively correct about one thing: the **requirements** issues--product, price and responsiveness--with their implications for higher education--must inevitably be addressed as **internal** issues for higher education.

We must assess Perelman's assertions **inside** higher education--where what we do happens--and examine them first as internal issues, and then as competitive issues in the marketplace. Perelman does not discuss the internal problems of academia, only the perceived effects. Academia has created internally its own external problems, but we must remember that these problems are borne out of internal issues which are capable of being addressed and solved internally. Here is the key to the solution, if we are able to examine these internal issues systematically (using cause-and-effect logical analysis) to find and fix the core problems that have led us to the external issues Perelman describes.

THE INTERNAL ISSUES: DEMAND, THROUGHPUT AND DELIVERY

Private colleges and universities still have a fairly intact reputation for offering marketable skills and certificates despite

higher tuition rates than government-owned schools. Regardless of circumstances, there exists a very clear perception that private schools are better because they generally offer smaller classes and more tailored, state-of-the-art programs. If this perception dims for whatever reason, then these schools will experience disastrous declines in enrollment (and tuition). Moreover, the overall thrust of Perelman's assertions casts an equally-dark shadow on government-owned institutions, although these public-funded schools could survive longer since their expenses are not as immediately dependent on tuition revenues.

The First Internal Issue: Demand

Why are so many colleges currently having increasing difficulty trying to keep enrollments up? It's possible that what these schools perceive as problems are only the **undesirable effects** of things more deeply rooted in the academic culture--policies that do not lend themselves to quantification or even direct identification. Perhaps these policies can be identified.

When viewed from the customer-demand side of the problem, the external issues Perelman cites concerning product, price and responsiveness are entirely valid. Higher education is indeed facing severe competition from the electronic classroom of the future. Colleges might improve their internal conditions, but most market factors are functions of what the competition offers and the demand for it. We can safely assume that if higher education is going to avoid the outcomes Perelman predicts, then it will have to come up with **internal** solutions to the **internal** problems that prevent us from competing in the demand-

driven competitive marketplace.

The above assumption forms a key point of this paper.

College people aren't stupid or ignorant; we are very capable of logical thinking. But it is entirely possible that some of us haven't thought recently about colleges as systems. We've been operating comfortably in our local departments and schools, classes and courses, disciplines and programs. We have **not** been sufficiently concerned about the demand for what we offer. Moreover, we apparently don't know how to analyze the system we are all parts of, especially when it is in trouble.

I'd like to introduce a logical analysis technique many businesses use to identify and correct root causes for their problems--a technique generically known as the systems Thinking Process (TP). If it works for business, it can work for higher education. (Several good books describing the use of the systems Thinking Process for business decisions are available, including Dr. Eliyahu M. Goldratt's latest, *It's Not Luck* (North River Press, 1994), and H. William Dettmer's *The Theory of Constraints* (ASQC Press, 1996).

First, let's identify some of the internal issues of higher education that are related to the changing demand for higher learning. Numerous "**UnDesirable Effects**" (Let's call them **UDEs**) come to mind, even if we cannot identify their causes right away. Several UDEs are clearly suggested by Perelman's assertions:

UDE No. 1: Colleges do not accurately measure the demand for courses.

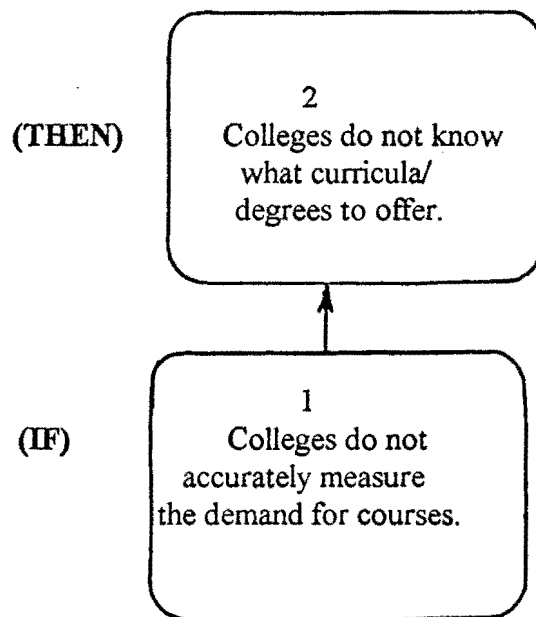
UDE No. 2: Colleges do not know what curricula/degrees to offer.

UDE No. 3: Colleges devise ineffective product-price-responsiveness strategies.

UDE No. 4: Colleges offer many courses for which there is declining demand.

UDE No. 5: Colleges do not offer many courses for which there is growing demand.

There are undoubtedly more UDEs as well as positive entities within higher education, but let's see how these five relate. Suppose we identify a causal relationship between two related UDEs, place them in boxes and add an arrow to show the cause-and-effect relationship:

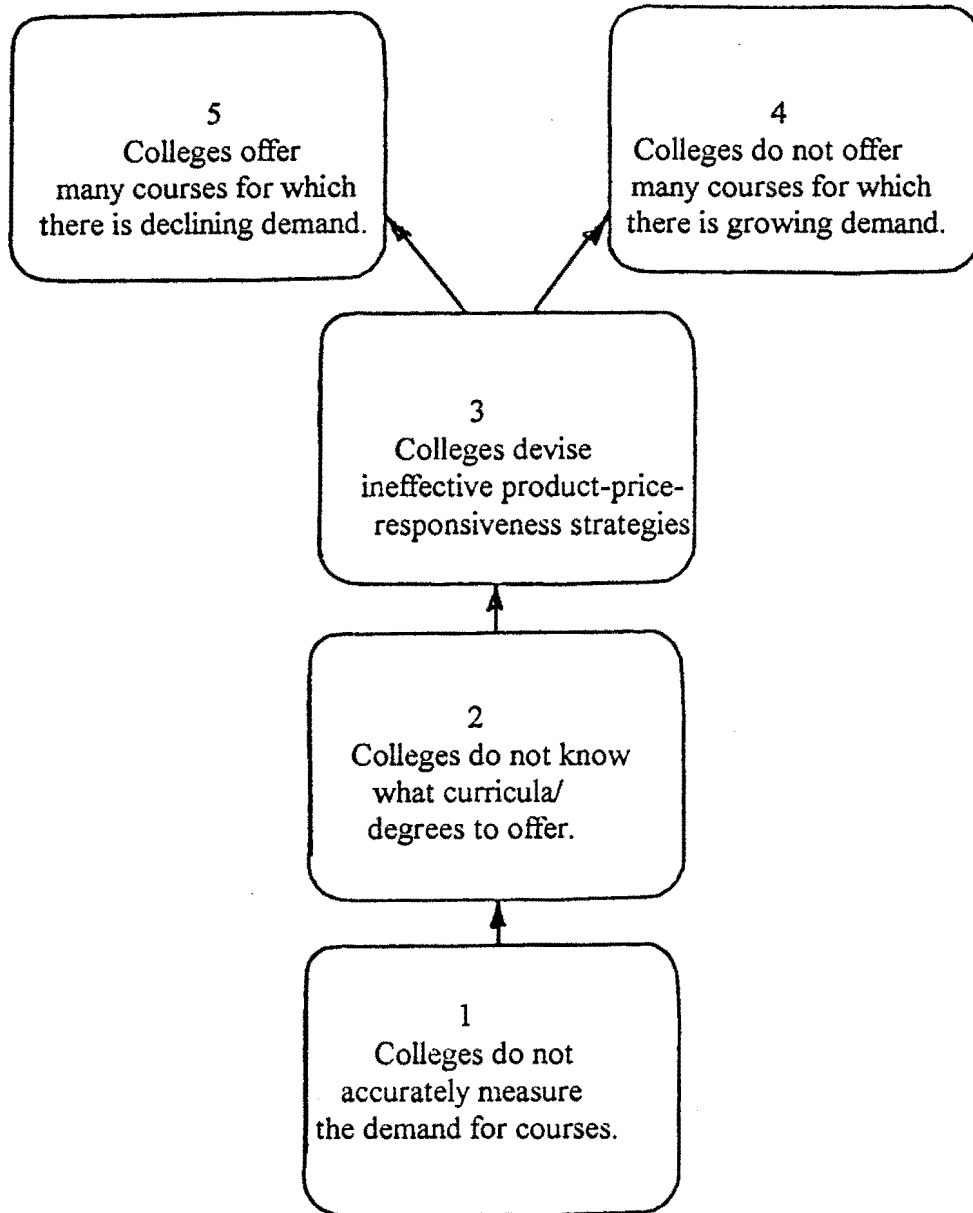


This logic diagram is read from the bottom up as:

"IF: Colleges do not accurately measure the demand for courses . . .

THEN: Colleges do not know what curricula/degrees to offer."

That was easy; it makes sense. But we don't really need a diagram to understand or communicate a relationship between only two entities. With or without the diagram, one can easily understand the causality in this statement. It is also possible that the other UDEs have causal connections with the first two:



The logical conclusion established in any one relationship extends upward to all the relationships above it. If colleges do not accurately measure the demand for courses, then all the other entities above it in the diagram exist as well. A classic Greek syllogism is formed when three or more entities are linked together.

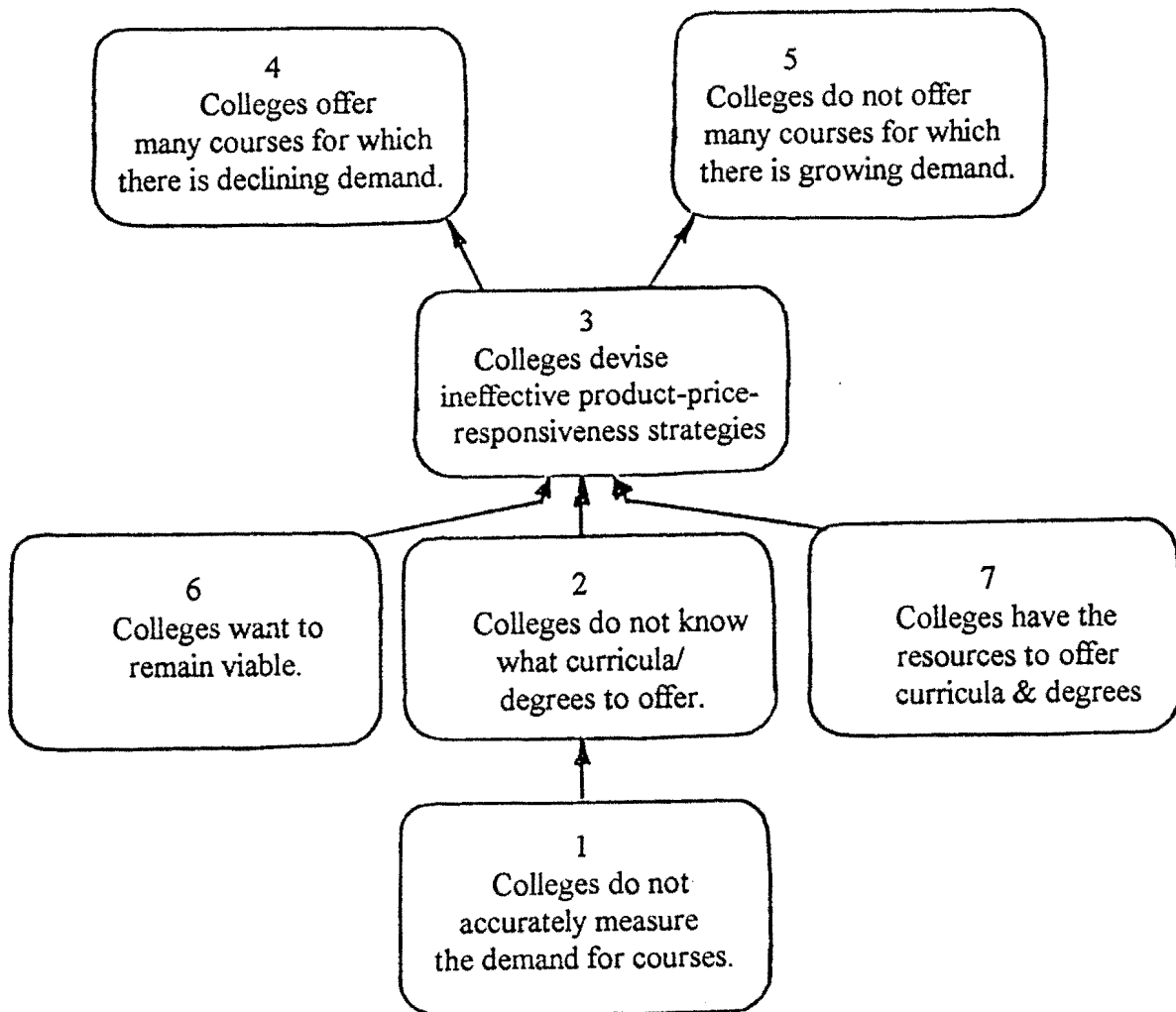
As the number of entities increases, the ability of mere mortals to interpret the many causal connections becomes very difficult. For five entities, there can be as many as 120 different causal relationships (5 x 4 x 3 x 2 x 1)! It's like trying to understand a computer program by reading all the lines of code every time we want to know what it does. The above "**current reality tree**" not only contains the UDEs and other entities we've identified; it also shows the causal connections linking them in a way that mere prose cannot describe.

Obviously, there are many other causes and effects than the four we've shown here. For example, we know that:

[6] Colleges want to remain viable.

[7] Colleges have the resources to offer desired curricula and degrees.

These can easily be added to the **current reality tree**:



The **core problem** in this analysis is still entity [1]: Colleges do not accurately measure the demand for courses. Real improvement can only occur if something better replaces it. No amount of “attacking the UDEs” (band-aid management) of higher education can solve the myriad of problems.

The demand issue clearly revolves around whether colleges accurately measure the demand for courses. Do we really know what students of the future will need from higher education that they cannot get from the electronic classroom, just-in-time? If we don't, then Perelman's predictions will come true.

Any process of ongoing improvement requires change; all improvement is change (Not all change is improvement, sadly). And all change begins with a decision about **what to change**. For any real improvement, change must address the degree and manner in which higher education measures the demand for courses in the future.

If **what to change** (the core problem) is the fact that “colleges do not accurately measure demand for courses,” then **to what to change** should logically be the opposite of that core problem: “colleges accurately measure demand for courses.” That's common sense, but it isn't that easy! If we could make this an objective for change, we would quickly discover that in order to actually achieve accurate measurement of demand for courses, several requirements and prerequisites would have to be identified. Also, the conflicts between them would have to be resolved by exposing any flawed assumptions about what is needed. Fortunately, the Thinking Process also

contains a logical technique for resolving conflict and dealing with flawed assumptions.

The second internal issue: throughput

The economics of higher education always count. Higher education is a service industry, mostly a fixed-cost operation. Marginal cost for one more student is near zero. But when one less student enrolls, marginal revenue drops--even in a public college. The total cost must be applied to the remaining students by raising their tuition. Add to this the combined dilemmas of the last of the baby boomers past college age and a serious decline in the quality of primary and secondary public education (both affecting the number of qualified college enrollees), and we have something that challenges traditional cost accountants: how to allocate increasing “fixed” costs to decreasing sales volumes? In other words, as teaching salaries and other operating expenses go up while enrollments go down, how can schools keep tuition rates from increasing? The challenge cannot be met by lowering admission standards and graduation requirements; the schools attempting that are already facing credibility crises. The challenge cannot be met by raising tuition much more; the schools attempting that are now facing affordability crises.

Colleges can and occasionally do learn something from the business world about finance and accounting. Many businesses have discovered that cost accounting is useless as a decision driver when 80 or 90 percent of total expenses for a typical business are fixed costs--not a function of sales or production volumes. Businesses are

learning that they must take a “systems” view of their firms, identify the primary **constraints** to goal achievement and then work to improve the constraints--first. The folly of “making more so that each one costs less” is an accounting exercise with disastrous results because value is only added to a firm when something is sold and the money is collected.

Manufacturing inventory that isn't promptly sold is the reason for more business failures in the 1990s than any other cause. Ignoring the liability of inventory can be even more damaging than focusing on cost-cutting as the primary means of improving bottom-line results. The same occurs in higher education. Large inventories and cost-cutting are symptoms of a common underlying flawed paradigm: “cost-world thinking:” the tendency to try and improve the bottom line mostly by looking for cost savings in either the organization's resources or in the way they calculate the cost of producing what they sell.

We hear more about cutting costs nowadays than about any other tactic in business--or higher education. What's wrong with cost-cutting? Isn't a penny saved here and a penny saved there worth something at the bottom line? Other than two cents, perhaps not. Cost-cutting has become the halcyon cry of many business managers as they “downsize,” “re-engineer” and spend most of their effort trying to increase profit by finding new little corners where some costs can be reduced. One thing is mathematically certain: cost-cutting cannot provide **continuous** improvement, because sooner or later, a firm runs out of costs to cut. Continuous improvement can only be

sustained on the revenue side of the equation! And what happens when a so-called cost savings (like firing some of the sales department) results in a reduction in revenue?

According to Dr. Eliyahu M. Goldratt, the real answer lies in the system's ability to generate **throughput**--the rate at which the system generates cash through sales. In his 3.8-million-copy bestseller, *The Goal*, Goldratt maintains that it doesn't take a rocket scientist to see that there is far more room for improvement on the revenue side of the equation than on the cost side. He also shows that this is just as true for nonprofit organizations as it is for business; the book even demonstrates its application in a troop of boy scouts!

Many businesses have discovered it's time to do some “**throughput world thinking.**” They now realize that throughput (sales revenue minus raw materials and parts) is the only source of fresh money coming into the system. In the throughput accounting view, direct labor is considered a periodic (“fixed”) operating expense, along with inventory carrying costs, rent, interest, insurance, taxes, etc. Throughput and operating expenses for a given period can be measured accurately, therefore, profit calculations based on these dimensions are much more accurate than traditional cost accounting measurements that attempt to allocate fixed costs to production units--using questionable formulae--that usually result in inventory growth and longer production cycle times.

Higher education must live with the same dimensions as business. Remember that a

college is an economic system as well as an institution of learning. In a college, there are actually two separate (but related) throughputs; one is the inflow and outflow of people (inside, they are called students) whose knowledge levels are increased during their stay. While inside, these people are really a kind of inventory. The school incurs "carrying costs" for having them there; the longer they stay, the greater the carrying costs. Throughput of people is the rate at which a school turns students (inventory) into graduates.

The second throughput in a college is the money flowing through the system. The source of all money throughput is cash received from tuition, fees and external funding.

Throughput measurement works the same in universities as it does in manufacturing firms. The advantage of Throughput-Based Manufacturing (TBM), as Bethlehem Steel Corp. calls it, is that the effect on the firm's bottom line of every action and decision throughout its production, marketing and distribution functions can be measured. "Local" optimizations and efficiencies are not allowed to overshadow the "global" goal of the firm: making more money now and in the future. Even in not-for-profit institutions of learning, **departmental objectives must always be measured against their support of the overall educational goal of the institution.** To achieve those ends, we must measure and enhance both kinds of throughput--people and money.

If we fail to recognize the throughput aspect of our economic issue, then another UDE will eventually replace entity No. [7] in our current reality tree:

[7] Colleges do **not** have the resources to offer desired curricula and degrees.

The third internal issue: delivering the product

Demand assessment is not the only task that must be accomplished. No business or college can survive without delivering the product demanded by its customers (students). In academia, effective delivery requires effective teaching, and teaching effectiveness can certainly be enhanced by using technological advances. Classroom video projectors, pentium computers, internet communications, worldwide web, word processing and data management software are only a few of the tools already available to support the strategies of any college or university. In some cases, however, these technological advances are absent--not because they are unaffordable, but because those who should use them do not use them. It appears that certain elements within academia are either unaware of the overall strategy of their institutions, or are unwilling to support it.

Do "local" elements within colleges willingly support "global" strategies? Do they know what is required from the various disciplines and departments of a college so that the overall strategy can be accomplished? Without assurance of that support, there is no assurance that the college can achieve its goal, even if demand assessment is accomplished correctly. System strategies require system-wide support; if there is a weak link or bottleneck, we must find it and deal with it--**first**. This is another potential UDE in our current reality tree; wherever it exists, it will be devastating.

Here's where we go into the lion's den--the organization's culture! We may know **what to change** and **to what to change**, but we must also determine **how to cause the indicated change**. In any organization, change comes not without resistance.

The general areas that first come to mind in this context are (1) curriculum, (2) textbooks, (3) organization and (4) faculty. Each of these involves long-established **policies** governing everything from course design and student performance to promotions, academic rank, tenure and faculty performance evaluation.

Add to these general areas the political environment of the college. I'm not referring to Republicans and Democrats or capitalists and socialists. To be sure, there is plenty of externally-motivated political activity on American campuses; proponents of everything that is politically correct or incorrect abound! But Washington DC often takes second place to the political infighting, turf protection and backstabbing that occur daily inside some ivy-covered walls of higher learning.

Any change that has a chance of being accomplished will first have to be accepted by those in power. And for them to accept anything, they must first understand it. Otherwise they'll see it as a threat to their personal security and comfort, to which they will respond with strong "defenses" of their academic freedom, professional disciplines and continuity of curriculum--for their "students' sake."

If you ask most ivory-tower academics, they'll tell you they're well aware of "the facts." They'll assure you that their

departments and they, personally, are comfortable with the progress they've made as new teaching tools and technologies have come into popular usage. "Evolution," as some call it, "is inevitable and we are ready for it." Urgency seems to have no place where "tried and true" academic disciplines are concerned; anything not understood is branded a "fad." But urgency does exist and it screams for effective teaching.

If there was one totally understandable description of the word 'urgency,' it was the realization in 1941, not longer after we entered World War II, that "we were losing the war." History has taught us (if we learn from history more than that we don't learn from it) that production is the absolute necessary condition to winning a war: more airplanes, tanks, ships and bullets--plus the ability to deliver them to the conflict. Redistribution, conservation and economization won't work. In the urgency of the present academic struggle, we must insure that we produce and deliver effective academic programs to the social arena.

Some academic leaders see the current reality as demand-driven urgency and increased competition for enrollments and tuition. Their perceptions are supported by the following facts:

Fact: competition for student enrollments is fiercer than ever. Academic leaders are not blind to the market conditions, and thus . . .

Fact: Almost every college is thoroughly convinced that it must embark on a **process of ongoing improvement**. And so . . .

Fact: Almost every college has already embarked on a process of cost-cutting, to the extent that some reduction in quality has resulted. This, in the name of "improvement." These cuts have gored a few 'oxes' already, and so . . .

Fact: Many colleges are reluctant to initiate additional improvement projects, but rather are determined to make the existing "improvements" work. This is the scariest one, because it reflects a closed mind to the bigger threats that are coming--those that Perelman predicts.

Clearly, these actions have failed to stem the tide of rising tuition needs. Worse, they have failed to generate significant improvements in product or responsiveness. Instead, many colleges have become internally competitive, intensifying departmental efforts to attract more (not better) students while intensifying current efforts to increase efficiencies and cut costs further. Few are intuitive enough to seek throughput-based solutions, especially those that threaten small empires or challenge the status quo.

It's time for yet another UDE! The facts above strongly suggest that:

[8] Many "local" elements do not support a "global" strategy of improvement.

COMPROMISE, CONSENSUS AND OTHER HALF-BAKED SOLUTIONS

Before we return to the challenges invoked by Lewis Perelman, it's important to understand the nature of academic decision-

making.

Calvin (in a recent *Calvin & Hobbes* comic strip) asserts that "a good compromise leaves everybody mad." Calvin and his almost-live pet tiger had just settled a dispute by reaching a compromise that neither of them liked. But worse yet, the right solution was never achieved. Each wanted more, each got less, and neither got it right.

Politicians gallop around in the world of compromise, retaining their posts by somehow convincing 51 percent of the voters that they had hammered out the best deal the taxpayers' money can buy. In legislative sessions, politicians yield to their opposing numbers whatever is necessary to close the deal and get to the next issue. They support the flawed assumption that for something to work better or be finished sooner, it has to cost more, and vice versa. Price, product and responsiveness (cost, performance and schedule--the government names for these) are seen as "tradeoff dimensions;" to achieve one, another may be sacrificed. At best, two of the three dimensions are achieved satisfactorily. At worst, it's another Denver International Airport: serious physical problems, 19 months late opening and triple the original price. Compromising is planning to fail in at least one dimension. It is failure by design. Higher education is not excused from this fact.

Every major new strategy in academe today demands the cooperation of every school and department within the institution. And these require the understanding of every decision maker in each of these units. What really underlies Perelman's predictions is the inability or unwillingness of so many

traditional academists to look at the future of their institutions from a systems perspective. Without a systems view, cooperation with the global strategies of a college will not come forth; departments will hold their ground while the university around them crumbles under the weight of unanswered challenges from the electronic classroom. The problem is not the unavailability of modern teaching tools, it is the unwillingness to learn how to use these technological advances and enhance teaching effectiveness.

Lewis Perelman merely cites a gauntlet already thrown down by the purveyors of new learning tools already invented. The challenges he describes are real; they're already here and they will increase dramatically. Meeting these challenges will require the collaboration of faculty members, department chairs, deans, administrators, boards, trustees, presidents and chancellors. Consensus solutions will not work in this circumstance; a simple majority is just not enough. It will require everyone's consent and systematic cooperation--no one can give just lip service and trudge back to his department to do things as before. It's too late for that. And it will take more than moderate internal improvements--overhead projectors and VCRs--to compete effectively with screen-based education. This is the worst of compromises: icing on a stale cake.

If consensus and compromise are half-baked solutions that fail to produce effective change, then what can be changed that will enable higher education to serve its customers and thereby survive in a world full of video monitors and online lectures?

THREE ALTERNATIVES

Suppose today's institutions of higher learning are actually able to successfully address the core internal issues indicated by the preceding analysis--demand, throughput and delivery. Suppose, in some **future reality**, we could accurately measure the demand for courses and cooperate systemwide to produce and market formal degree programs of the type that have defined "college education" for over a hundred years? What would it take to make this happen? It appears we have three alternatives:

- (1) figure out a way to make these degree programs viable in the new marketplace in their present formats, or
- (2) abandon the old formats completely and join the movement to an electronic classroom that offers students just-in-time education, or
- (3) change them so as to make them viable while still preserving their proven value as formal credentials of knowledge gained, skills acquired and learning abilities demonstrated.

The first alternative--keeping the present format--implies total rejection of the validity of Perelman's predictions. This is, in other words, an assumption that mastery of the internal issues in higher education today could constitute a complete solution not only to academia's current problems, but to those problems about to be generated as more electronic classrooms spring up to seduce away tomorrow's students and their employers.

The second alternative--abandoning the old formats and joining the electronic movement--implies a total rejection of the system that has endured for decades and outlasted many past challenges. This is, in effect, a total acceptance of Perelman's predictions and a callous disregard for the intrinsic values of a cohesive, structured educational system.

The third alternative--changing higher education in ways that preserve its formal credentials and yet keep it viable amid the onslaught of computers, online services, interactive software and multimedia technology--implies that a process of ongoing improvement can be devised and instituted that will take advantage of emerging technological advances, but do so in a framework of traditional program structures offering state-of-the-art courses. This would require both the acknowledgment of Perelman's implications and a determination to preserve the credibility of a well-run, well-disciplined institution whose graduates can perform as professionals in the fields in which their degrees are awarded. This is not compromise; it is the realization that the **goal** of higher education is the delivery of organized knowledge now and in the future, and that technological advances are **means** of achieving that goal.

The first alternative is naive; we already see the changes and challenges of Perelman's predictions increasing all around us. If we do what we've been doing, we'll get what we've been getting--farther into debt and more out of step with reality. There is no logic in this approach.

The second alternative is cowardly: "if we can't lick them, join them." It would also be

an irresponsible abandonment of the values and educational processes we intuitively know are effective in any society.

The third alternative is neither naive nor cowardly, which means it requires wisdom as well as courage of those who would attempt it. And it has one exceptional merit, something often overlooked: a balanced solution that permits both our logic and our intuition to work together. When logic and intuition are in accord, the solutions are usually correct. It is far above compromise; it is a win-win solution.

THE SUPPLY SIDE IS OUR SIDE

Lewis Perelman misses the real point; he fails to see the supply side of the economic equation in higher education. About twelve years ago, the "supply side" economists made their point politically, but they failed to educate most Americans about what they meant; that while demand dollars drive the economic system, they fuel the huge engine of production and delivery that wins wars and stimulates that "good old American know-how."

Logic and intuition are clearly on the supply side. Customers may decide what they will buy, but the product will only be manufactured (and the academic programs developed) when the manufacturer invents an effective product-price-responsiveness strategy and gets every part of the organization aiming at the goal of the organization.

Perelman misses still another point when he asserts that the electronic classroom can meet instant demand changes with instant supply changes. Course and program

development is an evolving process. Even football's famous "hurry-up offense" takes months of pre-season training and practice to work effectively. Only the huddles are skipped to save time when the clock is ticking and more points are needed on the scoreboard.

Higher education's clock is indeed ticking. We can't supply "instant Einsteins," but we can certainly avoid the "huddles" that have traditionally kept course and program development at a snail's pace. We already have the resources and experience that can create "hurry-up" educational development and enhanced teaching effectiveness; we are inherently better equipped to meet demand changes than the emerging purveyors of "instant education." These online experts will likely find that the courses they offer don't fit together; they may even compete with each other in both theory and process to the extent that the outcome is unorganized for them and totally confusing for the student. This is their supply-side dilemma.

THE DEMAND SIDE IS OURS, TOO--IF WE WANT IT

The emerging army of electronic classrooms has no requisite organization structure that will determine what each of them should produce. As a result, most of them will overlap frequently in search of market niches. Without organization, a spate of "instant education" programs will routinely emerge; some will prove successful and the rest will fade away to be replaced by others. Moreover, these programs will never add up to recognized degrees and credentialed students who can market their knowledge to future employers as they head down the road

of professional life.

In manufacturing, a "just-in-time" inventory level is just one more unit than "not-in-time"--a dangerous approach when applied throughout the factory. When a capacity-constrained resource (the slowest machine) is idled because it has nothing to work on, time is lost to the entire system. Wise production managers avoid this problem by placing protective (buffer) inventories in front of constrained resources (contrary to JIT concepts) and then scheduling the input of materials into the first process to keep inventories from growing all over the system.

JIT is a good "pull" or demand-driven process, but it is inherently unable to handle unforeseen problems with supply that are caused either by increasing demand or interruption of supply. For Perelman's "just-in-time educational programs," the chances are very high that the suppliers will not be able to manufacture instant education as demand changes occur; neither will they be able to correct for any lack of capacity to meet demand.

Current higher education concepts cause almost the opposite problem. Because we are driven by entrenched forces including tenured faculty and strong cultures, we tend to remain a "push" system. Like older "push" factory scheduling systems, we tend to build inventories of students that act like inventories of unfinished product. Some are lost, some are diverted to other outcomes and some never make it through. This has been our demand-side dilemma. The good news is that our capacity to deliver is still in place! What is lacking is a systems thinking

process that identifies the underlying policy constraints currently preventing us from offering courses for which demand is increasing and phasing out courses for which demand is decreasing. As the supply-siders insist, it is easier to satisfy demand with resources we already possess than to try and develop the resources only after the demand is identified.

COMING FULL CIRCLE

This paper started with predictions by Lewis Perelman about higher education's inability to compete with a plethora of oncoming low-priced high-tech educational offerings. That these offerings are present and increasing is not contested.

Perelman's assertions stem from his belief that American professors cannot compete because "they are selling a product that is ridiculously expensive and ill-suited to the needs of a rapidly changing economy." He supports his assertions with valid financial data about the price of higher education, but he offers only opinions about what students should learn and when their employers want them to learn it in the age of the Internet.

Perelman infers that the professors in today's higher education institutions are incapable of enhancing their teaching effectiveness, and that the art and science of teaching as we know it will give way to technological advances which traditional academia cannot or will not use. According to Perelman, we are no match for the images on the computer screen, video tapes and multimedia technology of the future.

The foregoing discussion revealed some serious flaws in Perelman's logic. However,

it also revealed a serious lack of logical systems thinking within academia about the internal core problems that cause the undesirable effects Perelman cites. This paper has shown that any institution of higher learning can use a businesslike systems thinking process to analyze its internal problems logically and create effective solutions. It concludes that delivering a timely educational product at a market-driven price is well within the capability of almost every American university, provided that all involved persons are ready to identify and correct the policy constraints that currently exist.

SOLVING THE PROBLEM WITH TECHNOLOGY

This paper serves to remind us that technological advances in the art and science of teaching are just as available to traditional academists as they are to the "commercial learning companies of the future." But application of these tools by today's professors will not alone solve academia's problems. We can extend the reach of our campus with them. We can enhance our lectures, duplicate ourselves magnetically, demonstrate, calculate, communicate, compute and display with them. We can reach additional people--especially those who cannot come to us--with these tools. We can even use them to make ourselves better educators. But then so can anyone else who decides to get into the teaching business and offer "just-in-time" education.

Simply matching these so-called "learning companies" keyboard-for-keyboard and screen-for-screen isn't enough. Let's not forget the supply side resources we already possess: credentialed degree programs and

established organizations with the capacity and experience needed to measure demand, create new courses and deliver them in structured degree programs. But that was never the question.

The real question (and the final question for this paper) addresses both the organizational and technological aspects of higher education:

“Will today’s academists be willing to subordinate local (departmental) objectives to the global (university) goal, learn to incorporate technological advances appropriately into their teaching activities, and use them effectively as tools for improving learning outcomes?”

If the answer to the above question is “yes,” then academia will continue to be the primary foundation for learning. There, and only there, will abstract subjects like mathematics and basic subjects in the sciences--which involve many years of learning without direct application in the business world--be taught. The availability of advanced teaching tools isn’t enough to create deep interest in these topics that can never be learned “just in time.”

Oliver Wendell Holmes once said, “trouble brings with it the capacity handle it.” Academia has the option of fighting the UDEs and ducking the incoming shots from so-called “learning companies,” or of focusing on global goals and using these remarkable new tools in even more inventive ways than they do.

Education is not a revolving sequence of current topics, it is an ongoing evolving

service to mankind to be preserved and protected by institutions that can foster the axiomatic discovery of principle, teach people how to think, and inspire each student to be a creative person who gives something to this world.

The university is also a place; a physical location in which student and professor interact eye-to-eye, where students can question the clarity and accuracy of the teacher’s words. It is a forum in which teachers can lead the students to discover and invent knowledge through Socratic teaching methods that can only be used when the teacher can see the faces of his students, assess the meaning of their expressions and questions, and draw on their reactions to choose the next words s/he uses.

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