

LEADERSHIP AND INFORMATION TECHNOLOGIES IN EDUCATION:

*“THE GREAT POTENTIALS AND NEEDS ARE NOT FOR TOMORROW, BUT FOR YESTERDAY,
SO WE HAVE TO ACT WISELY TODAY”*

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Abstract ³/₄ *The new networking and interactive computational simulation and multimedia technologies, known as IT, do not and can not replace good traditional values and methods, like reasoning and cognitive thinking, but do have a tremendous potential to enhance them, by facilitating learning by doing and what-if analysis and simulation, as opposed to talking about doing: “I hear...and I forget! I see...and I remember! BUT, I do...and I understand!” That's where the IT has a decisive competitive edge over classical methods. Since we are in the beginning of the information revolution, it is hard to comprehend that new technology will make another revolution in the 21st century in many areas, the way steam power or electricity made industrial revolution in previous centuries. The IT allows us to do what we thought will never be possible, but also forces us to do what we never wanted to do! That is why IT is often unduly blamed like many other new tools and inventions before. It is wrong to blame technology for the lack of our ingenuity how to effectively use it.*

CHANGES ARE INEVITABLE: “TO BE OR NOT TO BE”

The networking and interactive computational simulation and multimedia technologies (known as Internet or Information Technology or IT) remove space, time, and cultural boundaries, thus bringing in the real global collaboration and competition, which in turn promotes efficiency and quality. (Un)Fortunately, at the same time, those who do not keep up with the new developments will suffer in improving efficiency and quality, will not be competitive and ultimately may not survive. A majority of future jobs will require technological competency. New students and current employees will have to learn and relearn new technological skills in order to succeed at school and work, and enjoy life fuller. Furthermore, they will want to learn these skills at those institutions that provide a quality learning environment enhanced with diverse technological developments, including but not limited to quality multimedia classroom and online presentations, networking with other learning resources, and convenient synchronous and asynchronous communications with their peers and experts alike. They will expect their teachers to be leading professionals in their fields and comfortable in using new technologies online and in the classroom and laboratory.

NEED FOR NEW VISION AND STRATEGY: A DIFFERENT LEADERSHIP

Educational institutions cannot avoid global changes and challenges, which are occurring in every-day life, industry and services mainly due to the unprecedented advent of new technologies [1], [2]. The changes and challenges are enormous and are happening fast, see Table I [3]. The unprecedented changes are fundamental and require radical shift in thinking, use of technology, and culture in general. The classical strategic plans and methods have little value in today's fast-changing world. So, there is a need for new vision and strategy, but they cannot be simply transferred from one institution to another, due to vast diversity of technologies, the users and their objectives. Strategic planning has to be replaced with “strategic thinking process” to accommodate continuously changing needs and technology. It is easier, but misleading, to focus on short-term goals (reducing cost and staff). Strategic thinking must confront and resolve both the short-term and long-term issues. The executive strategic vision is very important to drive the critical restructuring activities of the whole organization. It is extremely urgent and particularly important that the university administration focuses on creating and communicating a broad shared vision in order to generate motivation and commitment of all participants, see Table II. We must be flexible and have multiple contingency plans to choose from, depending on external factors that are changing much faster with the advent of new technology. Impact of new technologies along with economic and competitive pressure and customers' expectations, are forcing universities to restructure themselves [4], [5]. The new technological developments are the prime source of competitive advantage and university administration must make it a high priority to promote and make them widely available [6], [7], see also Table III. Finally, the strategic vision and plans must be results-oriented. Institutional culture and structure should be developed so that all employees will contribute to planning and immediate action and implementation. It is critical that classical administration and management of (a) planning and budgeting, (b) organizing and staffing, and (c) controlling and problem solving, be enhanced with creative leadership of (a) setting directions, (b) recruiting volunteers, and (c) inspiring and motivating, respectively, see Table II and Figure 1.

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TABLE I
EVEN THE VISIONARIES COULD NOT HAVE IMAGINED CURRENT IT
DEVELOPMENTS [3]

Year	Predictions are grossly underestimated and it appears that we never learn
1943	"I think there is a world market for maybe five computers." (Thomas Watson, Chairman of IBM)
1957	"I have traveled the length and breadth of this country and talked with the best people, and I can assure you that data processing is a fad that won't last out the year." (The Editor in Charge of Business Books, Prentice Hall)
1977	"There is no reason anyone would want a computer in their home." (Ken Olson, President, Chairman, and Founder of Digital Equipment Corporation)
1981	"640K ought to be enough for anybody." (Bill Gates)
2002	"A new DVD format of 27 GB and 17 hours of full motion-video recording was approved by a consortium, but who will need to record video for that long." (A public radio commentator)
2002	New PCs outsold new TVs, most homes have PCs, RAM and HD memory is measured in MB and GB.

Since the new vision and strategy need to be result/action oriented and implemented immediately, the universities need to restructure and refocus its resources accordingly by establishing top-level position, like "vice-provost for new technologies" or similar. That position should be in charge of unifying and promoting all institutional activities related to implementation of all new technologies for teaching and learning, such as faculty development units, computing services, photo/art/media services, external programming, division of continuing education, audio-visual and distance learning services, and others. Similarly, associate dean for new technology positions should be established in colleges. Establishing critical, top-level leadership positions and streamlining of the available services will strengthen priorities and provide vision, strategy and facilities to motivate and assist faculty in enhancing their activities (*"it is all about vision, enthusiasm and devotion, dummy!"*). Then, appropriate supporting organization should be developed and implemented. There should not be any dictated or mandatory activities: that would be inappropriate, since there is no "the best way"; and counterproductive, since the faculty should be motivated and facilitated to creatively develop diverse teaching and learning aids as they see it fit for their disciplines and audiences. The new vision should help create new culture, not establish new procedures. The latter should be left to be done by faculty in a

TABLE II
MANAGEMENT VERSUS LEADERSHIP
[The Harvard Business Review on Leadership (1998)]

<i>Management...deals with "coping with complexity"</i>	<i>Leadership...Deals with "coping with creative change"</i>
<ul style="list-style-type: none"> • Planning and budgeting • Organizing and staffing • Controlling and problem solving 	<ul style="list-style-type: none"> • Setting directions/vision • Recruiting volunteers • Inspiring and motivating

challenging and competitive environment with appropriate institutional support and incentives. The new vision and results-oriented strategy should provide and promote: (a) curiosity, trust, and motivation, (b) institutional support structure, (c) access to hardware and software, (d) quality training and development, (e) time to learn and to develop materials, and (f) administrative recognition.

**THE NEW TECHNOLOGIES ARE AHEAD OF US:
THE QUESTION IS NOT "SHOULD WE USE THEM,"
BUT "HOW"?**

The new technological developments are already available and powerful, becoming user friendlier and less expensive. The PC hardware and software are so advanced due to rapid development of new technologies, mass production, and fierce competition. For example, one could hardly find a more advanced and powerful tool, for any price, than today's Personal Computer (PC). For about \$2000 today (year 2002), one may buy a 2 GHz Pentium 4 multimedia PC with 1 GB RAM memory, 120 GB hard drive and recordable DVD drive. Many of the most advanced devices, costing tens and hundreds of thousands of dollars, do not have such a powerful processing speed nor storage capacity. Good performance scanners and motion-video capture boards are below \$200. Re-writeable CD and recordable DVD drives are about \$100 and \$500 respectively. One may buy almost any software for an educational or "street" price of around \$50-100. We may not like Microsoft's (MS) monopoly, but its latest version of Office (Outlook, Word, Excel, PowerPoint, Access, as well as Draw, Image, Chart, Equation and other utilities) and FrontPage (with Web Explorer, Web Page and Image Editors) are so sophisticated that most users will never need most of the available features. The competitors' products are equally good. If it weren't for the MS Encarta and other electronic encyclopedias, The Britannica on DVD with multimedia, search and interactive application engines (which happens to have more materials, much better and effective than its printed volumes), would not be about \$50 (even sold in Wal-Mart and other discount stores). Professional software are equally sophisticated and inexpensive. For example, the MathCAD, general purpose math software, has so many numerical and symbolic features that we may forget about the procedures for

TABLE III

IT BASIC TOOLS AND FUNCTIONS FOR EFFECTIVENESS AND QUALITY

1. Personal computer with fast Internet access and comprehensive Web browser
2. Asynchronous & synchronous communication applications
3. Standard office and professional software applications
4. Streaming multimedia authoring applications (audio, video)
5. Course management applications (Blackboard, WebCT)
6. Networked data-base servers with efficient search functions
7. Networked multimedia and multi-unit quality-projection systems with wireless sub-networks in classrooms (not a single projection unit, which is like having a single write-on board in classroom)

evaluating and solving equations, and instead, concentrate on developing and optimizing conditions/correlations/equations (i.e. “setting-up” problems) which the software will solve for us. Everything is qualitatively different from what we used to know in the past. Furthermore, many of existing computational machines (PCs, known as micro-, but also servers and macro/super -computers, etc.) are connected together in different networks, topped by Internet. That means that most of the people and organizations have easy, fast and convenient access to synchronous and asynchronous communications and each other's resources, which are growing fast in quantity but also in quality, as well as more efficient and diverse “search engines” [8]. The conclusion should be self-evident.

PERSONAL EXPERIENCE: THE FIRST STEP COMES BEFORE WALKING AND RUNNING

I have been actively learning and using (also “living with and fighting”) new technologies in last number of years. I developed thousands of files within my Web site, www.kostic.niu.edu, as motivational and learning aids for our students and public. After attending past Illinois Faculty Summer Institute at UIUC and ASEE's National Engineering Education Conference, I realized then, that many are lagging behind the leading institutions or leading individuals in this area. That motivated me to be increasingly involved with versatile potentials of new technologies in the classroom and laboratory. Actually, I consider this as the most important task for my institution and my career, so that I completely and enthusiastically have devoted most of my energy and time in implementing new technologies for teaching and learning [9]. I did most of the work myself with a little help from (understaffed) supporting staff, which in turn exposed me to many facets of the new technologies. It was not easy and it took a lot of time, but it was satisfying to see the developed learning aids working online [10], and in the classroom and laboratory [11], see Figure 2. Of course, the institutions have now different resources to support faculty in using new technologies, but many of these services need to be improved for new needs, see Table III. Also, the faculties need to keep up with new developments in order to be able to utilize not only technology itself, but also available institutional supports. It is a misconception that digitizing old learning aids will be all that is needed. It is very important to realize that new technology opens up many new opportunities and possibilities, but also new challenges. Therefore, it is essential to realize that new learning aids must be created specifically for the new technology [9], [12]. That is a reason I have spent a lot of time learning visualization and multimedia art, like graphics (vector and bitmap), animation (interactive computing), and audio and video software applications. Visualization with interactivity and multimedia are the new technology features that utilize all human senses to enhance the overall perception (experience) and thus learning environment.

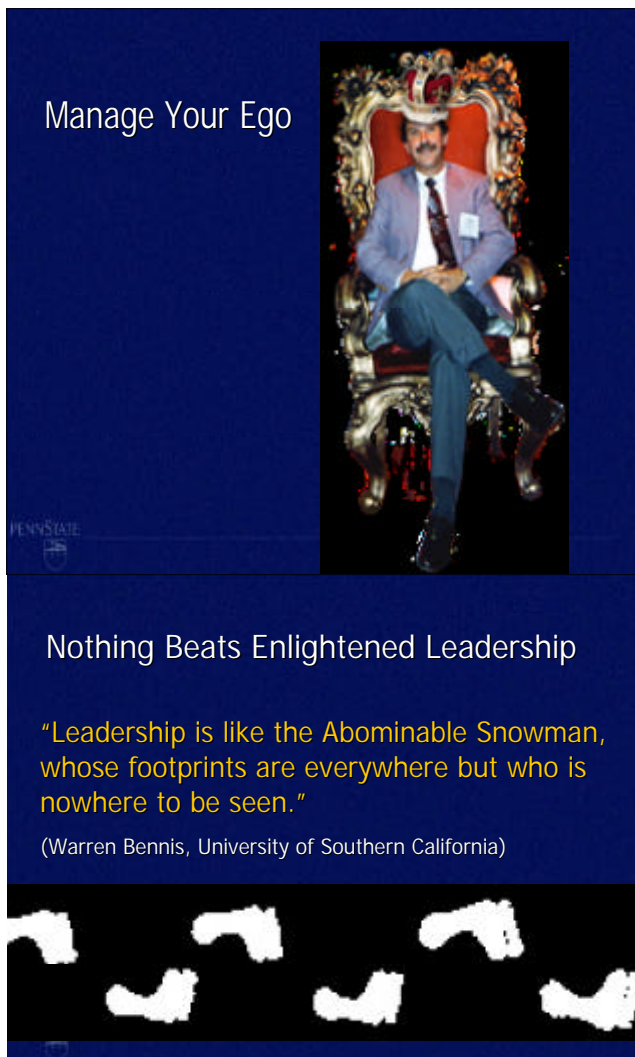


FIGURE 1

TRUE LEADERSHIP IS TO MANAGE EGO AND TO PRODUCE MORE LEADERS, NOT MORE FOLLOWERS [1]

TABLE IV
CHALLENGES, CHANGE AND LEADERSHIP [1]

<p><i>“Control over change would seem to consist in moving not with it but ahead of it.”</i> (Marshall McLuhan)</p>
<p><i>“The greatest challenge is leading change.”</i> (Carol Cartwright, President, Kent State)</p>
<p><i>“Leadership is like the Abominable Snowman, whose footprints are everywhere but who is nowhere to be seen.”</i> (Warren Bennis, University of Southern California)</p>
<p><i>“The function of true leadership is to manage ego and to produce more leaders, not more followers.”</i> (Ralph Nader)</p>
<p><i>“The people who are crazy enough to think they can change the world are the ones who do.”</i> (“Think Different” The Apple campaign)</p>
<p><i>“The scenery only changes for the lead dog.”</i> <i>“The speed of the leader is the speed of the pack.”</i> (Yukon saying)</p>
<p><i>“Leadership, after all, is more than just reaching a goal. It is about spurring others to achieve big things, and giving them the tools and the confidence to continue achieving.”</i></p>

If new technology is used in traditional ways to achieve traditional objectives, it will usually require extra time for adaptation, thus being less effective. Furthermore, if the learners are not much involved and challenged, but use new technology for quick and easy simulation, they'll be fascinated observers of its “bells and whistles,” learn little, and may be hindered in the process. That is why so many people are justifiably skeptical about technology's use in teaching. However, if new technology is used for purposeful and interactive what-if-analysis, with multimedia animation, and with a challenging learners' involvement and participation [9], [10] it will provide a much more comprehensive presentation and virtually realistic experience of physical phenomena, particularly when integrated with lab experimentation, in-depth analysis and with a focus to reinforce fundamental physical concepts, see Figure 2 as an example. It will take a lot of effort and time of many dedicated people, but it should result in new and more effective methods, possibly in a new paradigm. For many, since we are in the beginning of the information revolution, it is hard to comprehend that new technologies and interactive/computational simulations will make another revolution in the 21st century in many areas, the way steam power or electricity made industrial revolution in previous centuries.

CONCLUSION: WE CANNOT AFFORD TO WAIT

Learning by doing/practicing is natural and has many advantages over classical studying which is usually boring for students. Let us reiterate again the familiar phrase: “I hear ...

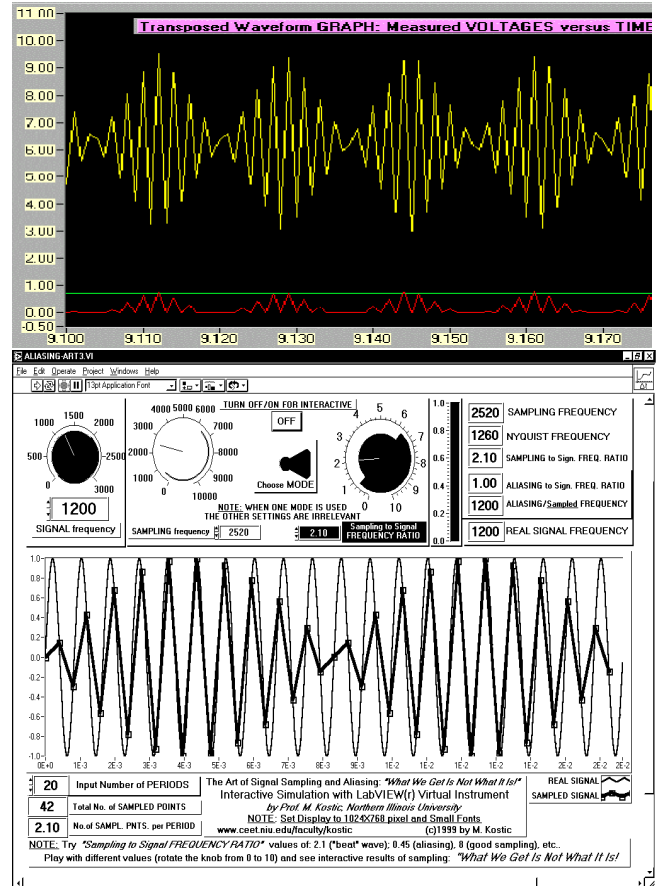


FIGURE 2

INTERACTIVE ONLINE EXPERIMENT: IF THE SAMPLING TO SIGNAL FREQUENCY RATIO IS CLOSE TO 2 (I.E. 2.10), THE SAMPLED SIMPLE PERIODIC SIGNAL WILL APPEAR AS A VERY PECULIAR, SO CALLED "BEAT" WAVE SHAPE (SIMULATED AT THE BOTTOM), SIMILAR TO ONE OBTAINED IN REAL MEASUREMENT IN THE LAB (TOP) [10].

and I forget, I see ... and I remember, BUT I do ... and I understand!" New technologies offer effective opportunities for “doing,” such as interactive multimedia simulation, what-if-analysis, virtual and real experimentation, etc. That's where the new technology has a competitive edge over classical methods. Due to intense developments for global use the new technology is becoming user friendlier and less expensive. Those who take the lead will succeed; others will stay behind and fail. The need is not for tomorrow, but for yesterday, so we have to act today. What is needed is a new vision and strategy, which should result in creation of new institutional culture and plans, which in turn should be under perpetual development and implementation by all involved, see Table IV. The leaders should lead by example and by promoting good examples. The inherent feature of the Internet, that its content has no time or geographical boundaries, makes it directly available at any place for “Distance Learning,” and self-learning aids at any time and for any learner. Some important things to remember:

- Do not buy anything unless you plan to use it today, as it will become obsolete tomorrow. Do not buy yesterday's technology like a \$1000 PC, go for today's \$2000 ones.
- Do not imitate old methods with new technology, be creative and develop new learning aids (scanning alone is not the solution but a first step).
- Talk is cheap, plans don't mean anything unless put in action. Learn by doing and be results-oriented.
- The new technology should be widespread to empower all, and thus the PC technology should be promoted.
- Setting up expensive technological units empowers only a few, is time consuming, and often becomes obsolete before it is being used.
- New Technology is not to replace the traditional values and methods, but to enhance and complement them.
- Substance is much more important than form: what you post on the Web is more important than form itself. Content is more important than colors. Substance and quality are even more important with new technology than before.
- It should be clearly stated that use of new-technology should not be to promote the new technology per se, but rather to use it to be more effective in achieving the objectives.

Although some argue that precious time is wasted if computers are used for basic science/engineering courses, computer use (but "wise") can expand our problem-solving ability, what-if analysis, not to mention tedious tasks like interpolation, graphing, etc. Therefore, computers should extend our capability and help us do more and better in less time, even in basic science courses. Nobody now calculates square root of two, for example, we press a button on a calculator for it. The same could be extended to "mechanics" of solving equations (algebraic, differential, integral, etc.). As long as we properly define the governing equations and boundary conditions, and understand their meaning, relations and limitations regarding a real-life problem they describe (which is often not a case!), no intellectual or educational inferiority should result from using a tool with a "solution button." We always may and should challenge our intellect for something more creative. Powerful tools free us from "mechanical," time consuming processes, can be used for extensive and purposeful what-if analysis etc., leading to more effective learning by accelerating and enhancing students' experience, and thus better understanding of physical phenomena. However, if new modeling and measurement tools solve everything easily and nothing is left for students, for example, that proves that learning methods are inadequate and should be qualitatively changed -- need for new paradigm. *With new tools, new challenges may and should be established, and new methods may and should be developed to raise learning environment to a qualitatively better level.*

It is compelling that enthusiastic, knowledgeable and mission-oriented individuals in a responsible leadership positions, with a clear vision and know-how for implementing new technologies in education, will make the difference and could contribute significantly for the betterment (and yes survival!) of an educational institution of the highest learning.

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