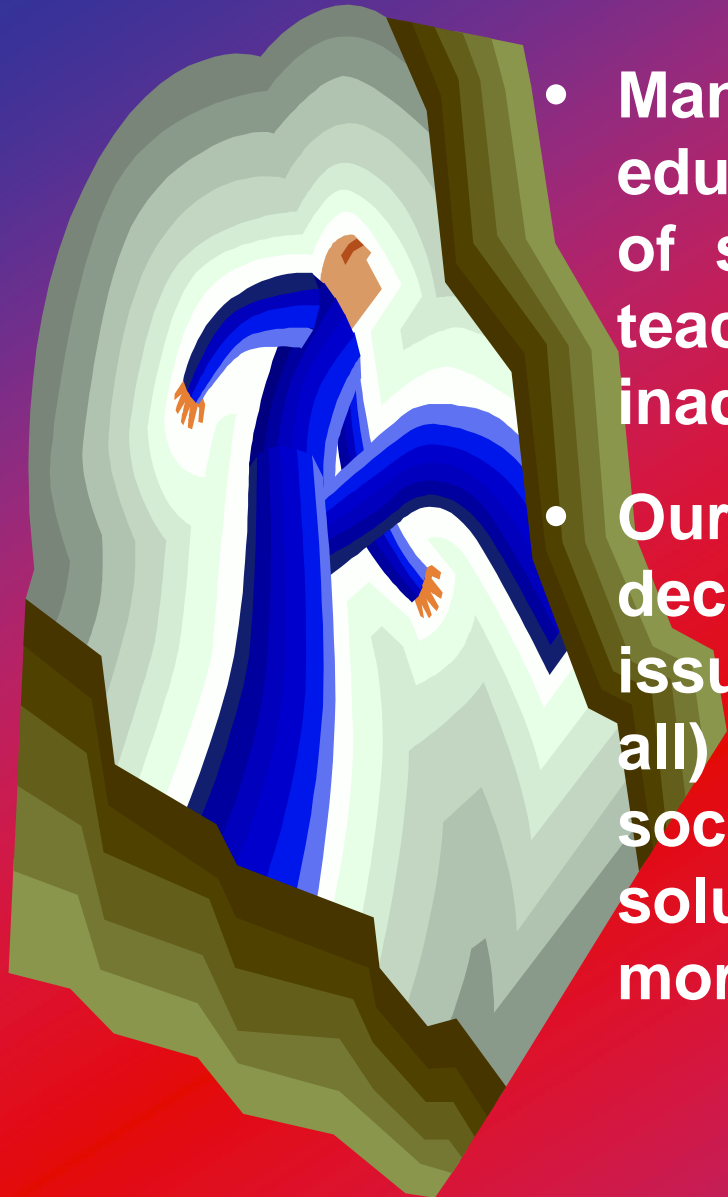


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# BOTTOMLINE MESSAGE

- Many issues have been brought forth in education: poverty to poor preparation of students to poorly prepared school teachers to inadequate resources to inadequate curriculum to ...
- Our view is: it might take many more decades to address and resolve these issues (assuming that it is possible at all) but we have an obligation to the society to provide viable, workable solutions that, in the meantime, will yield more immediate results.

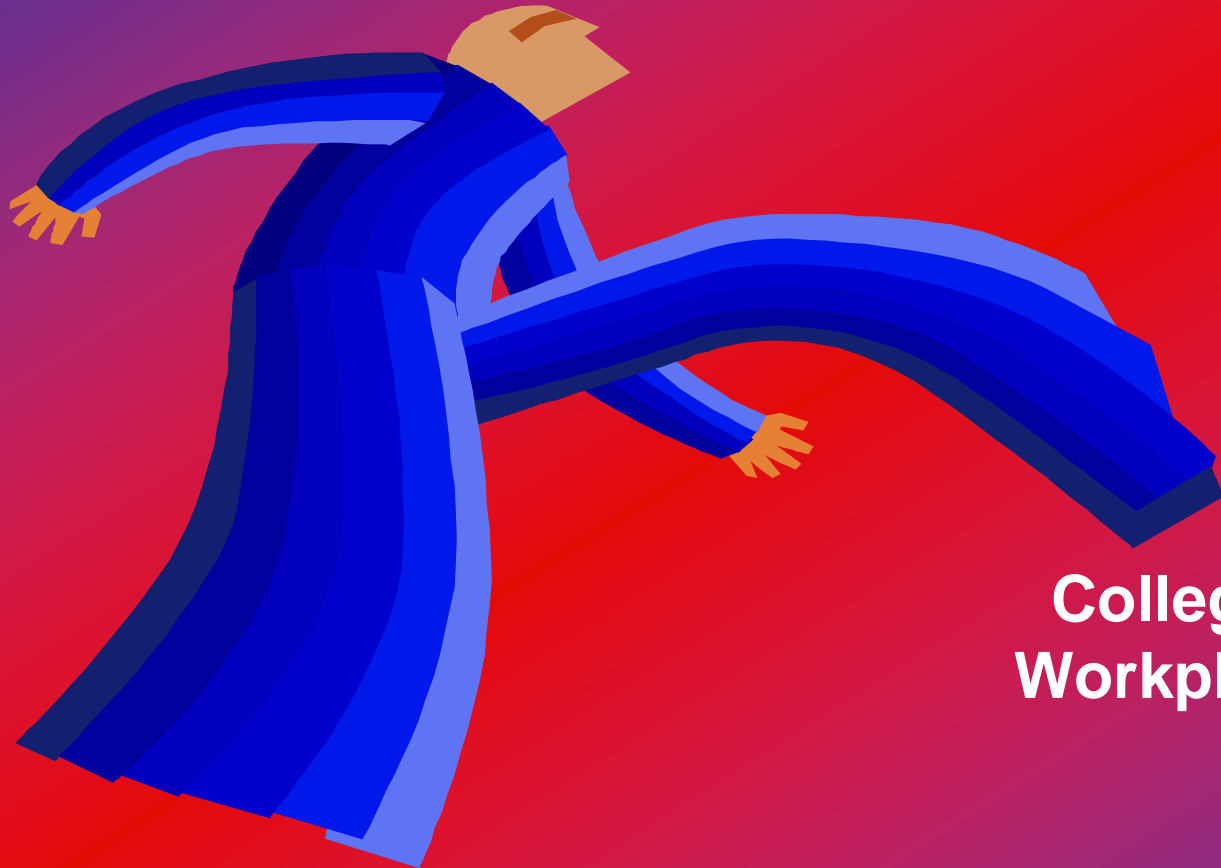


# BOTTOMLINE MESSAGE

- One such approach is for the universities/colleges to provide an “equalization level” for graduating high school students so that they have a comparatively better “uniform startup” at the beginning of their post-secondary education.
- Consistent with several constraints, a potential solution may be to design a more effective and efficient Core Curriculum.



# THE CHASM



**School**

**College/  
Workplace**

# THE ENVIRONMENT - EXISTING PERCEPTIONS



## National Science Foundation (US) survey, 2001

- **25% thought that scientists were apt to be odd and peculiar people**
- **29% thought that scientists have few other interests but their work**
- **53% of those surveyed agreed with the statement “scientific work is dangerous”**
- **Physics is..... old-fashioned, outdated, irrelevant to modern society**

# THE ENVIRONMENT - FUNDAMENTAL EMPLOYABILITY SKILLS

Problem Solving	✓ ✓
Data Manipulation	✓ ✓
Information Management	✓ ✓
Continual Learning	✓ ✓
Teamplying	✓
Adaptivity	✓
Communication	✓

# EMERGING TECHNOLOGIES



The information device of the future will be personal and portable, making it possible to access any person or information, anytime, anywhere.

We already have cellphones, laptops, desktop computers, television, personal digital assistants (PDAs), and tablet computers.

Some combination of these devices might be on the horizon –

- Merger of PDAs and cellphones
- Pairing of televisions and desktops
- Information Appliances combining phone and Internet access, with voice recognition, into one wireless box
- Wearable computers

# EMERGING TECHNOLOGIES

## Various forms of nanotechnology

- Carbon nanotubes
- Resonant tunneling diodes
- Molecular transistors
- Photonics

## Giant magnetoresistance-based memories

## Three-dimensional IC stacking

## Biologically based computing

## Quantum computing

# NEXT GENERATION SKI FACILITY



**Just outside of Tokyo there is now a computer-driven indoor winter sports facility - the largest in the world. Inside a building as tall as the Statue of Liberty, the operating system uses microprocessors to keep the snow falling, the lifts running and the temperature at a cool -3 C.**

# INTEL PENTIUM 4 PROCESSOR



**This whole chip has an area of only 217 square millimeters (about the size of the nail on your big toe) yet contains about 42 million transistors.**

**In 1996, the microprocessor had more than 5.5 million transistors performing hundreds of millions of calculations each second.**

**In 1971, Intel introduced the world's first commercial microprocessor, the 4004. It contained 2,300 transistors and performed about 60,000 calculations in a second.**

# WHAT ARE WE DOING AT PRAIRIE VIEW A&M UNIVERSITY TO ADDRESS THIS PROBLEM?

# IMPACT OF THE ACADEMIC ROADMAP EFFORT AT PVAMU



- 1. Curricular alignments among PVAMU, HCCS, SJCS, and Eisenhower HS**
- 2. Innovations in the curriculum and degree program in the Physics Department**
- 3. Installation of new physics laboratories**
- 4. In process: Curricular alignments among PVAMU, Royal HS, Hempstead HS and Waller HS, Elkins HS, Elsik HS, Cy-Fair College**

# THE PHYSICS LEARNING CENTER

QuickTime™ and a TIFF (Uncompressed) decompressor are needed to see this picture.



# THE SCIENCE EDUCATION LABORATORY

QuickTime™ and a  
Photo - JPEG decompressor  
are needed to see this picture.

**NOTICE**  
NO FOOD OR  
DRINK IN  
THIS AREA



# **SCIENCE EDUCATION LABORATORY (SEL)**

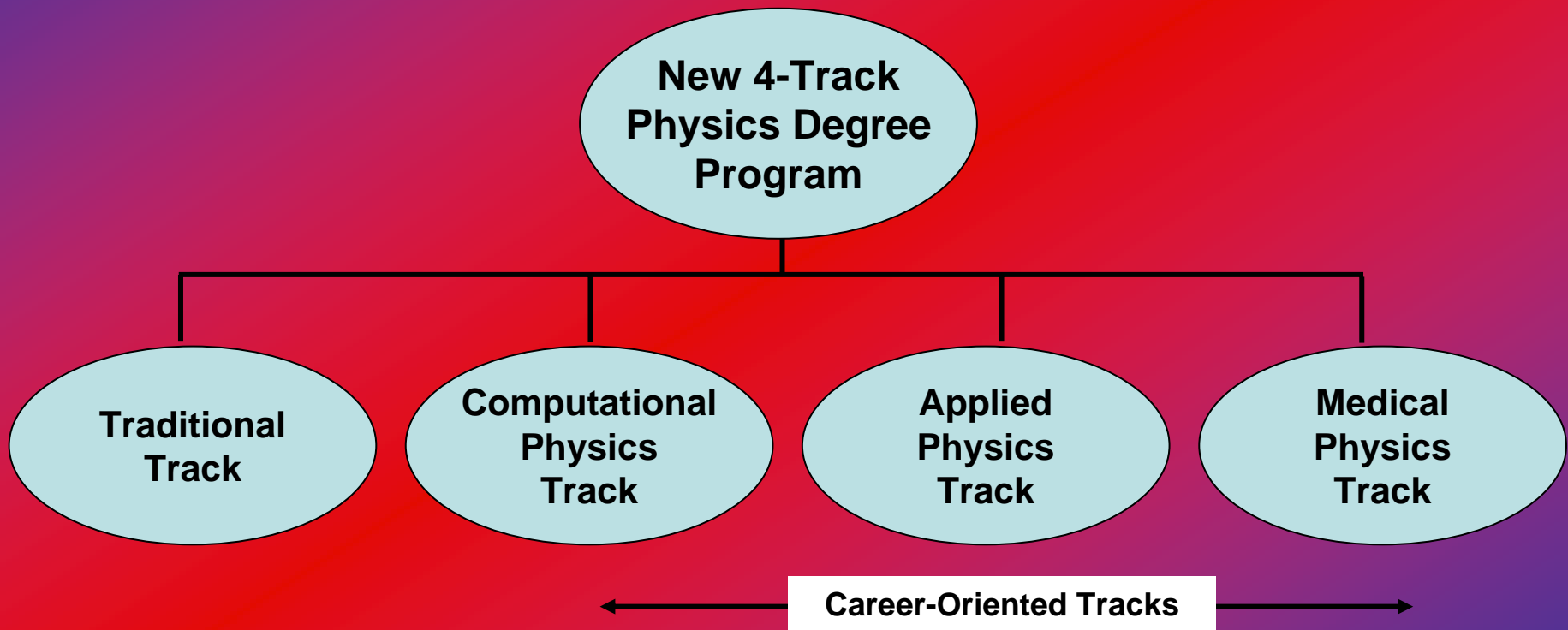
An innovative learning environment



- An innovative learning environment for high school teachers and students.
- The main thrust is to make science interesting and fun for the learner as well as encourage scientific and critical thinking practices.
- SEL will provide multi-media equipment, hands-on gadgets of learning to stimulate interest in the physics and physical sciences via a number of digital experiments, novel demonstrations and computer simulations.
- One example of a “digital experiment” is the Virtual Environmental Science Lab, in which the student plays environmental scientist and explores some of the problems facing the environment in a specific eco-system.

# NEW 4-TRACK PHYSICS DEGREE PROGRAM

The new four-track degree program is an innovative approach with potential to attract more students to physics.



# ***CHANGES IN THE PHYSICS CURRICULUM***



- Introduced a new course - PHSC 2103: Quantitative Physical and Biological Sciences - to provide a more extensive and in-depth content for science teachers teaching Integrated Physics and Chemistry (IPC) courses.
- Introduced a new Online Weather Course that may be used as an excellent forum for bringing together elements of fundamental science in an applied setting.
- Introduced a capstone course - PHYS 4473: Senior Research Project - that should provide potential science teachers with teamwork and classroom management skills.
- A new Physics Education Track is being discussed with the College of Education for possible implementation towards producing physics teachers.
- Member of the Texas Electronic Coalition in Physics (Texas A&M University-Kingsville)

# TECHNOLOGY INTEGRATION



***“Much of a student’s learning takes place at times and places outside of the school. Today's students spend 14% of their time in school and 53% at home or in the community where a third of the time, not counting sleep, is spent watching television. Increasing amounts of time also are devoted to surfing the Web and chatting with friends online.”***

**Bransford, Donovan, Pellegrino (1999)**

# ***TECHNOLOGY INTEGRATION INTO PHYSICS***



- Physical Science course sequence - PHSC 1123 and PHSC 2103 - is using Hewitt's Conceptual Physical Science which also has a fully integrated web-based course management.**
- Engineering Physics course sequence - PHYS 2513 and PHYS 2523 - is using Serway and Jewett which also has a fully integrated web-based course management.**
- Two laboratory rooms are equipped with Smart Boards.**
- Physics Learning Center is fully networked to Internet II. The computing environment coupled with the audio-video equipment should provide a enhanced high technology-aided learning environment.**
- New Science Building is ready for wireless operation.**
- “Electronic communities of Practice And Learning (E-PALs)” among Academy Members, partnering high school students and other schools is being planned.**

# ***PENDING FUNDING EFFORTS***



- ❑ **“Physics in STEP” - Proposal to NSF - PVAMU + Hempstead HS and Royal HS (5/03)**
- ❑ **“Project LEAP - Learning Enhancement and Advancement with Physics” - Proposal to NSF - PVAMU + Tarleton State University (6/03)**

**BUT ...**

**These efforts in themselves will not help us  
achieve our goals: Closing the Gaps and  
the Chancellor Graves' Azimuths.**

**Also, implementation must be discussed in  
detail and executed.**

# WHAT'S MISSING?

- Appreciation of arenas of influence
- Coherence in the curriculum - courses/ sequences too fragmented
- Awareness/lack of interest on part of faculty to update teaching techniques, incorporate assessment
- Emphasis on transferable skills
- Feedback followed by continual quality improvement

# INTERPLAY OF SOCIAL, POLITICAL, TECHNICAL, ETHICAL, COMMERCIAL, ..



- What causes industries to fail in the first place?
- Did deregulation cause or solve problems?
- Did the telecom industry fail because of overbuilding and paying too high a price for speculative assets?
- Can the deregulation of the energy industry, coupled with the alleged business ethics shortcomings of prominent players in this sector, hamper strong recovery of the industry?
- How is the technology recovery influenced by geopolitical events?

# The Bigger Picture



*There is hardly a walk of life in which physics does not play a part in or impact.*

*From the American Institute of Physics*

# CORE CURRICULUM

An updated Core Curriculum should be the cornerstone of education for tomorrow.

The goal should be to provide all students, regardless of their major or concentration, with wide-ranging perspectives on significant ideas and achievements in literature, philosophy, history, music, art, and science.

In the Core Curriculum the pursuit of better questions is every bit as important as the pursuit of better answers. The Core Curriculum classes should provide students with the opportunity to develop intellectual relationships with faculty early on in their college career and to participate with them in a shared process of intellectual inquiry.



# REDESIGN THE CORE CURRICULUM



**While the goals of the core curriculum at various colleges and universities have a good deal in common, there is enormous variance in the structure of the programs designed to meet them, beginning with the actual size of the core requirement (i.e. the percentage of the degree program it represents).**

**Institutions which have expanded their core requirements have generally done so at the expense of the elective component of the program.**

# CORE CURRICULUM-EXAMPLES



**Harvard: Core is fairly small, amounting to roughly one-quarter of the degree program.**

**Princeton and Dartmouth: Core represents the standard one-third.**

**University of Chicago: Core is about 50%.**

**Cornell: Core is only one-quarter of the total program – half of the courses taken in the last two years of study, no more. Developing a core necessarily entails rethinking the major.**

**Evergreen State College: Core is a tightly-focused thematic approach with the goal of a coherent and integrative educational experience.**

**Fairleigh Dickinson University: Core is a sequence of four courses: "Perspectives on the Individual," "The American Experience," "Cross-Cultural Perspectives," "Global Issues."**

# BOLD & WELCOME MOVES - EXAMPLES



**Rice University - Electrical Engineering Program**

**Carnegie-Mellon University - Electrical & Computer Engineering Program**

**Case Western Reserve University - M.S. in Physics Entrepreneurship**

**University of Houston - Ph.D. Econophysics**

# CORE PROGRAMS AND COURSES - GENERAL CHARACTERISTICS



- Integration of skills development with course content
- Integration of new approaches to scholarship
- Emphasis on assessment
- Emphasis on small-group teaching
- Emphasis on primary texts
- Designated Core Courses
- Thematically-Focused Interdisciplinary Courses
- Course Clusters (or Learning Communities)
- Capstone Courses
- Emphasis on creative problem-solving processes
- Global perspective on diversity and dilemmas of human experiences

# EMPHASIZE RELEVANCE

Prepare the students for the world they will be graduating in, not the world we are in now.

EMPLOYABILITY/  
CAREER SKILLS

1

2

3

4

We need to work “backwards” - where we need to be in five years and what we need to do now to get there - rather than imposing our current mindsets on our students.

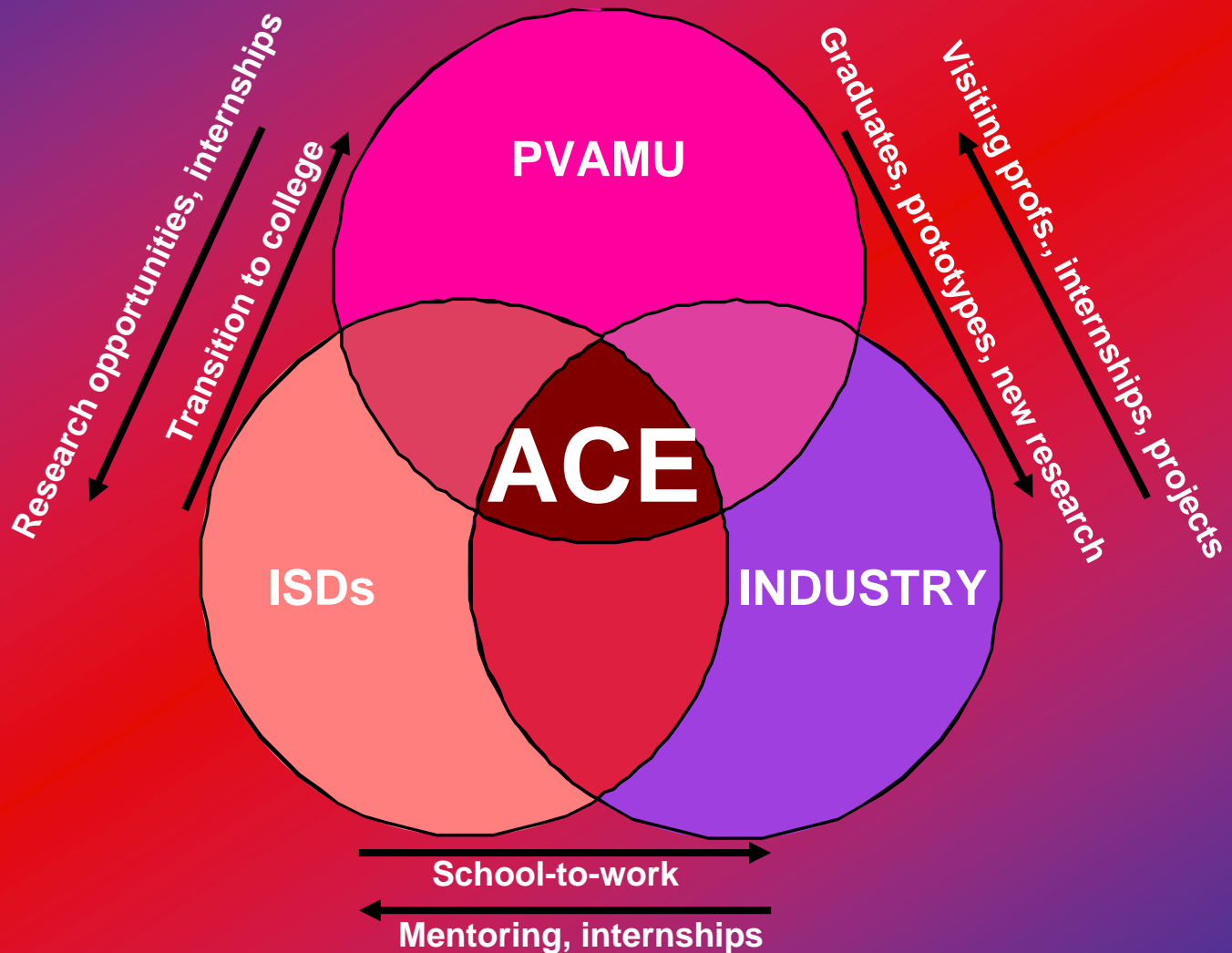
CURRICULUM

**AGAIN,  
WHAT ARE WE DOING AT  
PRAIRIE VIEW A&M UNIVERSITY TO  
ADDRESS THIS PROBLEM?**

# PROJECT ACE - AWARENESS FOR COLLEGE EXPERIENCE



## A Novel Plan For K-12 Student and Teacher Preparation



# CONTINUING INNOVATIONS



- A “Scenario Laboratory” - simulations of potential careers and tutorials on “roadmaps” to professional careers
- Courses in history of science and technology with “what if” scenarios - recreate the subject in student’s mind
- Art/drama interpretations of history of science/ technology
- Multi-disciplinary projects at schools
- Interactive e-mentoring
- Summer internships in industry
- Writing projects

# ***EXPANSION OF OUTREACH & COLLABORATIVE ACTIVITIES***



- **Organize a regional/national workshop/ conference - *Systemic Approaches to Science Teacher Development* - for comparing science teacher preparation efforts.**
- **Enhance the partnerships to collaborative research initiatives on new dimensions and practices of teaching.**
- **Prepare and publish papers on specific efforts by the Science Curriculum Partners, especially in the Institute's on-line electronic journal.**

# ***PARTING THOUGHT***

**“By 2010, the pace of change will have accelerated to the point where only the most flexible organizational structures will be able to withstand the stress. Success will hinge on a highly skilled workforce capable and motivated to exercise their professional judgement and initiative rather than on waiting for management directives.”**

**- Ian Napier, Managing Partner, of Sydney-based Andersen Consulting**

# DANGERS IN NOT BEING ADAPTIVE



**“By the year 2000, the nation's 3,600 or so accredited colleges and universities will have sorted themselves - or will have been sorted by external forces - into just a few categories.**

**Some will continue to do business as usual instead of addressing the new realities - 1) growing demand, 2) changing markets, 3) limited resources and 4) unprecedented competition. They will have lost status and will be extinct.**

**Some will have taken only small incremental steps to address the realities. They will constitute the undistinguished middle of the academic pack - "hanging on, but nothing special."**

**And some will have responded with wisely-chosen, bold, and radical changes of direction. They will form the new vanguard of higher education.”**

**- Donald Langenberg, Former Chancellor, University of Maryland System**

**WE INVITE YOU TO WORK WITH US  
SO THAT  
TOGETHER  
WE CAN MAKE A TRUE DIFFERENCE!**

**FINALLY!**



**We need to view educational reform in a SYSTEMIC fashion.  
Each stage must be seen as an integral part of a WHOLE.**

**Otherwise,**

**We will be sitting here in 2023 asking**

***“Why Are We Still At Risk?”***