Physics First
The Road to a Better Science Education
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Nation At Risk

» 1983
» Other countries are more advanced
  » industry
  » test scores
» Reform!
Project 2061

- American Association for the Advancement of Science
- 1985
- to help become literate in science, math and technology
Standards

“We recommend that schools, colleges, and universities adopt more rigorous and measurable standards, and higher expectations, for academic performance and ... This will help students do their best educationally with challenging materials in an environment that supports learning and authentic accomplishment.”
Project ARISE

» American Renaissance in Science Education
» Leon Lederman
» Change the Science Curriculum
Argument 1

Physics is very CONCEPTUAL. Students can easily APPLY to their lives.
Argument 2

Simple concepts to more complex ideas.

UNIFIES the disciplines
Argument 3

Increase enrollment, increase accessibility, increase successes.
Argument 4

Future will be science literate.
BODY
Argument 1

Physics is very CONCEPTUAL. Students can easily APPLY to their lives.
Scaffolding

“...a Physics First curriculum fosters coherence in education, allowing students to build upon what they already know”
AAPT

“presented in ways that reflect the interests and the abilities of the particular students...”
“Introduction of additional math concepts as they are needed can actually help to improve a student’s understanding of and appreciation for the mathematics itself, when they see it applied to real situations.”

Ewald, Hickman, Hickman, Myers
Argument 2
Simple concepts to more complex ideas.
UNIFIES the disciplines
“Biology is based upon chemistry, and chemistry is based upon physics. Physics is therefore the most basic of these sciences and must be learned if one is to learn chemistry and biology well...”
“The integrity of the three core disciplines is preserved, but now with the disciplines correctly organized, they can be connected to form a coherent and overarching wholeness which we call science.”
“... it works so well because Biology is the explanation of living things which follow chemical and physical laws.”

Nicole Turner
Argument 3

Increase enrollment, increase accessibility, increase successes.
Enrollment

Traditional Curricula
“enrollment dropping off at each step until fewer than 20% of U.S. students ever take Physics”
Elitist

Choose students who are “good enough” to study Physics
UNIVERSAL ACCESS opens subject to ALL students
TIMSS
The Third international Mathematics and Science Study
» 1998
“... high school seniors rank third worst out of all 21 nations studied...”
NAEP

» National Assessment of Educational Progress

» 2000

» “1/5 of high school seniors meet proficiency standards”
Physics First

» Study more science
» Improve standardized tests
» Improve math understanding and achievement
» Balance gender and race enrollment
» Interest in science careers
Argument 4

Future will be science literate.
Universal Access

» AIM of reaching ALL students

» Scientific Processes

» Observable concepts
Logical Sense

» Students see the bigger picture

» Real-world phenomena
Conclusion
National Comparisons

Figure 0. Percentage of High School Graduates Taking Selected Mathematics and Science Courses in High School: 1982, 1987, 1990, and 1994

National Comparisons
TIMSS  Third International Mathematics and Science Study

NOTE: In the United States, the advanced mathematics assessment was administered to students who had taken or were taking precalculus, calculus, or Advanced Placement (AP) calculus; the advanced science assessment was administered to students who had taken or were taking physics or AP physics.


Figure 1-8
Countries whose TIMSS average scores in mathematics and sciences are lower, equivalent to, or higher than U.S. average score, grades 4, 8, and 12; 1995.
Riding a Dead Horse

“When you discover that you are riding a dead horse.... the best strategy is to dismount.”
Riding a Dead Horse

Buy a bigger whip.  
Invest in new technology to try to make dead horses run faster.
Appoint a committee to study the horse situation.  
Redefine basic terms so that it can be said “The horse is not dead!”.
Change riders.
Modeling Scientific Thinking

“Scientific ideas are subject to change!”

-Project 2061
“Introduction of additional math concepts as they are needed can actually help to improve a student’s understanding of and appreciation for the mathematics itself, when they see it applied to real situations.”

Ewald, Hickman, Hickman, Myers