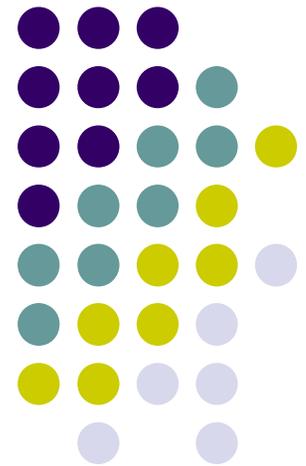


How We Teach Students Who Don't Have Math Background

Introductory physics for life-
science majors and our
challenges

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Purposes of Learning Physics



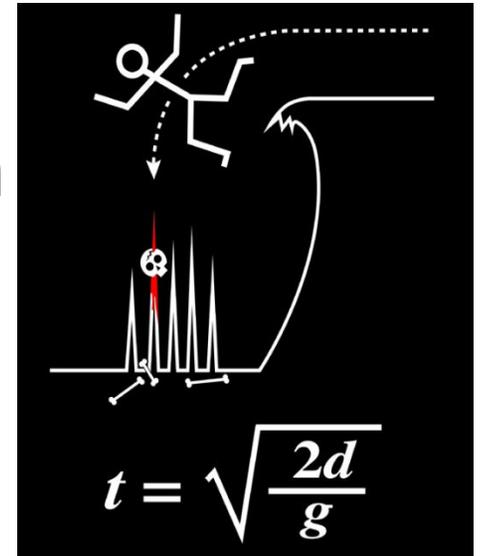
- To learn fundamental perspectives of natural phenomena
- To acquire problem solving skills
- To obtain logical and theoretical ways of thinking
- To learn the sense of accuracy (error analyses)

→ **Math plays an important role in physics.**

What happened in physics class at Univ. of Southern Mississippi?



- Students had hard time in solving textbook problems.
- Students couldn't finish the exam in time.
(The exam was successfully given at a different university before.)
- Quite a few students left them blank.



The Reasons by Students



- **“The formulas are confusing.”** (Which letter is which variable?)
- **“I need more time, and I’m able to complete!”** (I am a research-type person who always spends more time to solve problems accurately.)
- **“I should have done more practice.”** (I want more problems to solve.)

“Reformation”



- Each exam split into two parts:
 - 25-problem in-class exam (to study the formulas) [← “50 minutes”]
 - 2-day take-home exam
- Create my own homework problems. (to adjust the difficulty)
- Provide practice problems with study sessions.



The Results 1

- Good outcome:
 - Students were able to solve problems more quickly and accurately.
- Unexpected outcome:
 - Almost all of the students failed in the final exam... (The problems were similar to those of the take-home exams.)



- Why did they still NOT do well??
 - Students' background $<$ the problem level ?
 - Ability of algebra?
 - Still don't know how to study. Don't know how to get started...
 - Students focus on grades over understanding the subject.
 - Copying answers from others.



I had to give them an oral exam to see how they do the problems!

Discoveries



- Students tend to conceal their weakness.
- Math incapability influences performing physics.
- Students lack the study skills.
- Students tend to recognize that physics is exactly equal to either math or concept.



Another “Reformation”

- An in-class exam becomes main evaluation to see students’ problem solving skills.
- The take-home exams became more interactive, conceptual, and interdisciplinary projects.
- Web-based assignments were employed.
- The attendance and more consultation were reinforced.



The Results 2

- Most students have improved overall skills for physics.
- It becomes easier for students to evaluate their improvement. (Gain the study skills.)
- The study sessions and the on-line homework reveal more students' background.



Conclusions

- Students do not know their level of background.
- Grasping the students' level makes class run more effectively.
- It was a “war” for me to keep the conscience of education.





Thank you

Math Incapability



- Math rank: Mississippi = 51st
Idaho = 25th