

DEEP Applications: Findings from the Pilot Test

Integrating applications into the teaching of fundamental concepts increased women's recruitment and retention at Carnegie Mellon in computer science and at Drexel in engineering (Margolis & Fisher, 2002; Fromm, 2003).

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Testing DEEP Applications



The Courses:

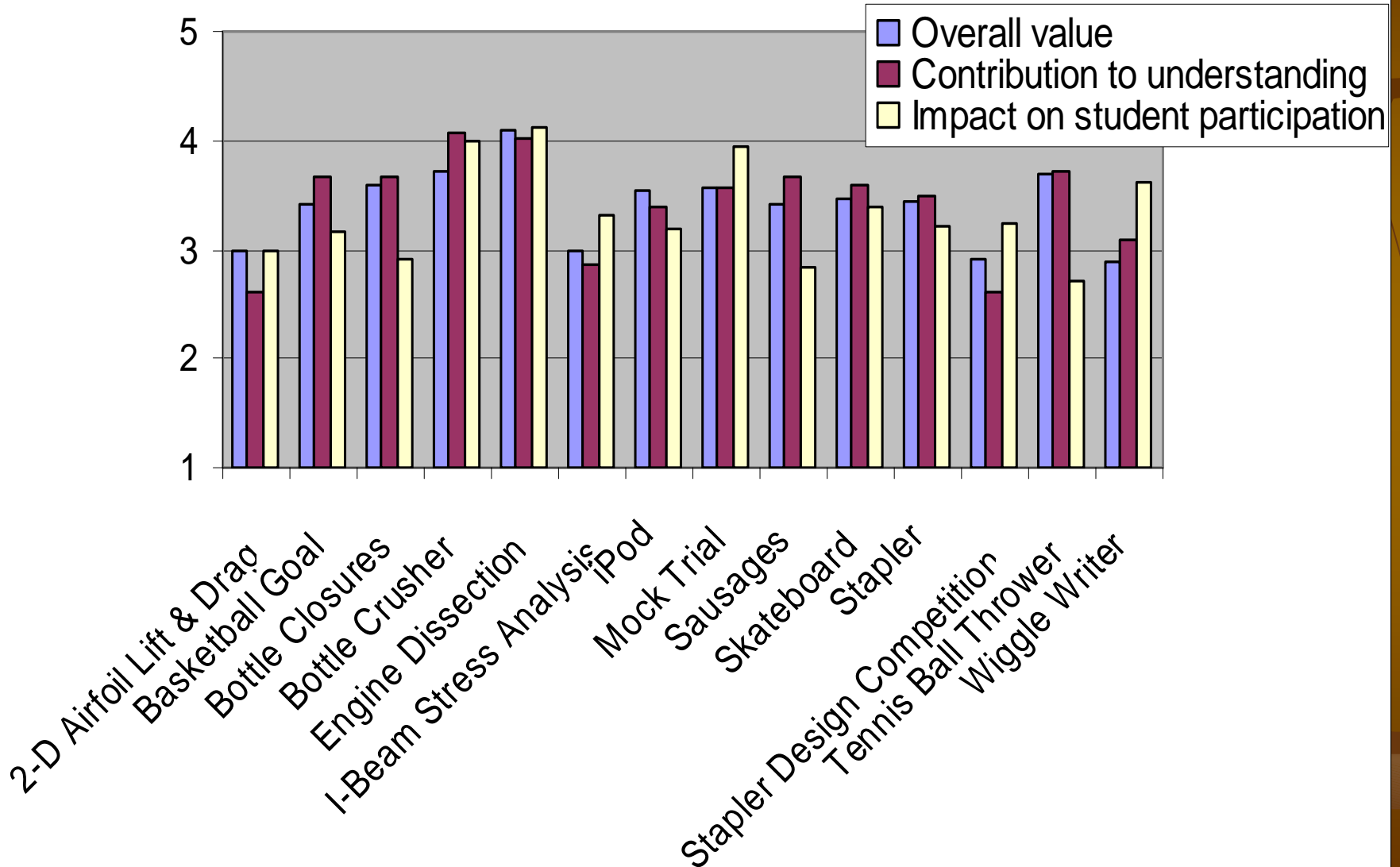
Design
Freshman Experience in Mechanical Engineering

Mechanics of Solids

The Applications:

2-D Airfoil Lift & Drag
Basketball Goal
Bottle Closures
Bottle Crusher
Engine Dissection
I-Beam Stress Analysis
iPod
Mock Trial
Sausages
Skateboard
Stapler
Stapler Design Competition
Tennis Ball Thrower
Wiggle Writer

Student Ratings of DEEP Applications



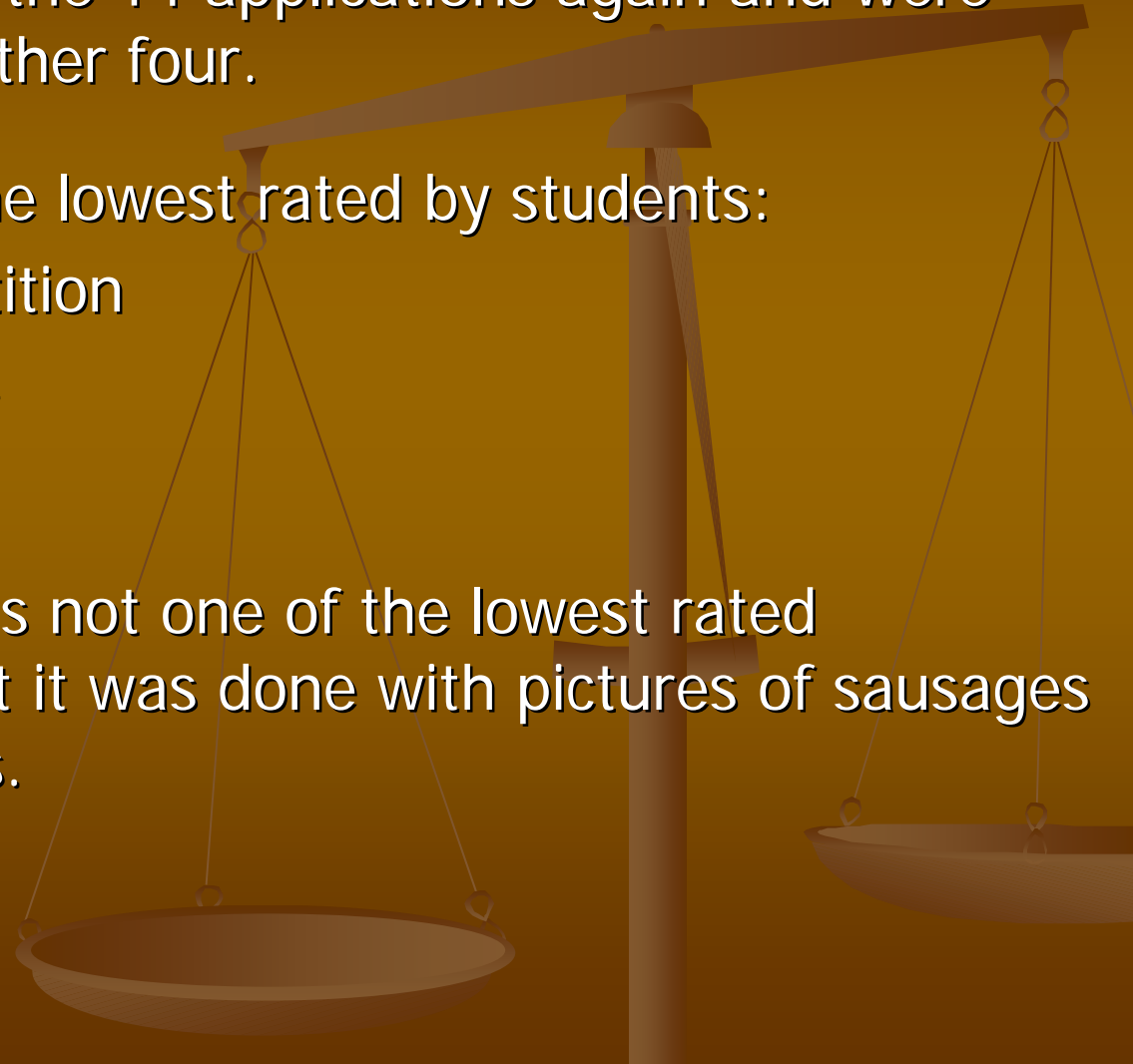
Faculty Ratings of DEEP Applications

Faculty plan to use 10 of the 14 applications again and were unsure about using the other four.

Three of the four were the lowest rated by students:

- Stapler Design Competition
- I-Beam Stress Analysis
- 2-D Airfoil Life & Drag.

The fourth, sausages, was not one of the lowest rated applications even though it was done with pictures of sausages rather than real sausages.



DEEP's Impact on Student Learning

55% of the students listed activities that increased in their knowledge including Engine Disassembly, Bottle Crusher, Mock Trial, 2 D Airfoil Lift and Drag and Sausages. Others wrote about the value of labs, real life examples and practical applications.

Solids students in the applications course rated their learning of the concepts covered by the applications significantly higher than students in the instructor's non-application course. Their ratings for other concepts were equal to or lower than other students.

Freshman Experience in ME students in classes with applications rated the overall quality of the course significantly higher in other students in classes taught by the same instructor. Their higher ratings of instructor teaching effectiveness and course intellectual challenge approached significance.

There were no significant differences in student grades in courses, taught by the same instructor with and without applications.

DEEP's Impact on Student Interest

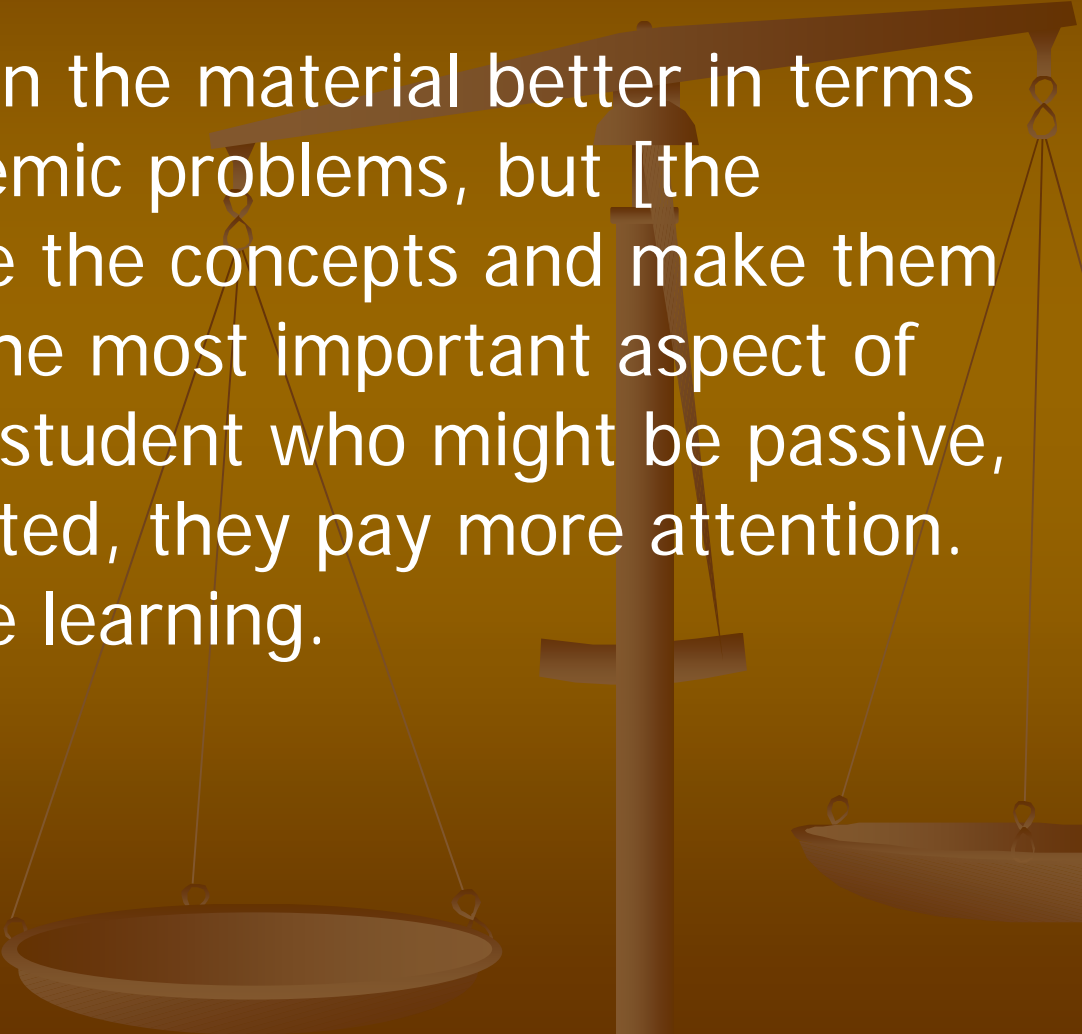
79% of students listed activities that increased their interest in ME. While most students listed general activities like design products and labs, also listed were Engine Dissection (with a lawnmower engine) (6) Tennis Ball Launcher (3), Bottle Crusher (1), Mock trial (1) and Wiggle Writer (1).

Student enthusiasm, engagement and interest are why faculty will continue to do:

- Basketball Goal
- Bottle Closures
- iPod
- Skateboard
- Tennis Ball Thrower
- Wiggle Writer.

DEEP's Impact on Student Interest

I'm not sure they learn the material better in terms of how to solve academic problems, but [the applications] reinforce the concepts and make them interesting. – this is the most important aspect of [the applications]. A student who might be passive, dreaming, not interested, they pay more attention. [There is] more active learning.



The Relationship of Learning and Interest



Students' ratings of their learning in a course correlates:
dramatically with their level of interest (.83)
highly with their level of class participation (.58)
not at all with their rating of the course's difficulty.

Students' ratings of the degree to which an application contributes to their understanding correlates:
very highly with their rating of the value of the application (.77)
highly with their level of participation (.57)
not at all with their rating of the application's difficulty.

DEEP's Impact on Faculty Teaching

"Any time you do something different, experiential teaching, it reveals various aspects about one's teaching... by getting involved with these real life applications, it reveals things about the teaching and learning styles, so it helps in that way, helps one adjust the strategy and technique used for learning. And it also reveals, maybe something that would be difficult to identify clearly, where students have misconceptions."

"It changed my teaching because I had to be more responsive to students being incredibly creative."

"I talked more about how to manage projects, not just numbers."

In two courses there were no changes in the course syllabi. The third course switched from two large projects to one large project and several smaller projects based on applications with more focus on the design process.

Testing Applications: Data Sources

Existing data

Student course evaluations
Student grades
Course syllabi

Additional data

Student surveys:

ratings of the course and each application in terms of difficulty, learning, class participation
activities that increased their ME interest
activities that increased their knowledge of specific ME topics .

Faculty interviews:

impact on of applications on students and on their teaching
unintended outcomes of using the applications
ratings of the applications/willingness to use them again.

Testing Applications: Data Issues

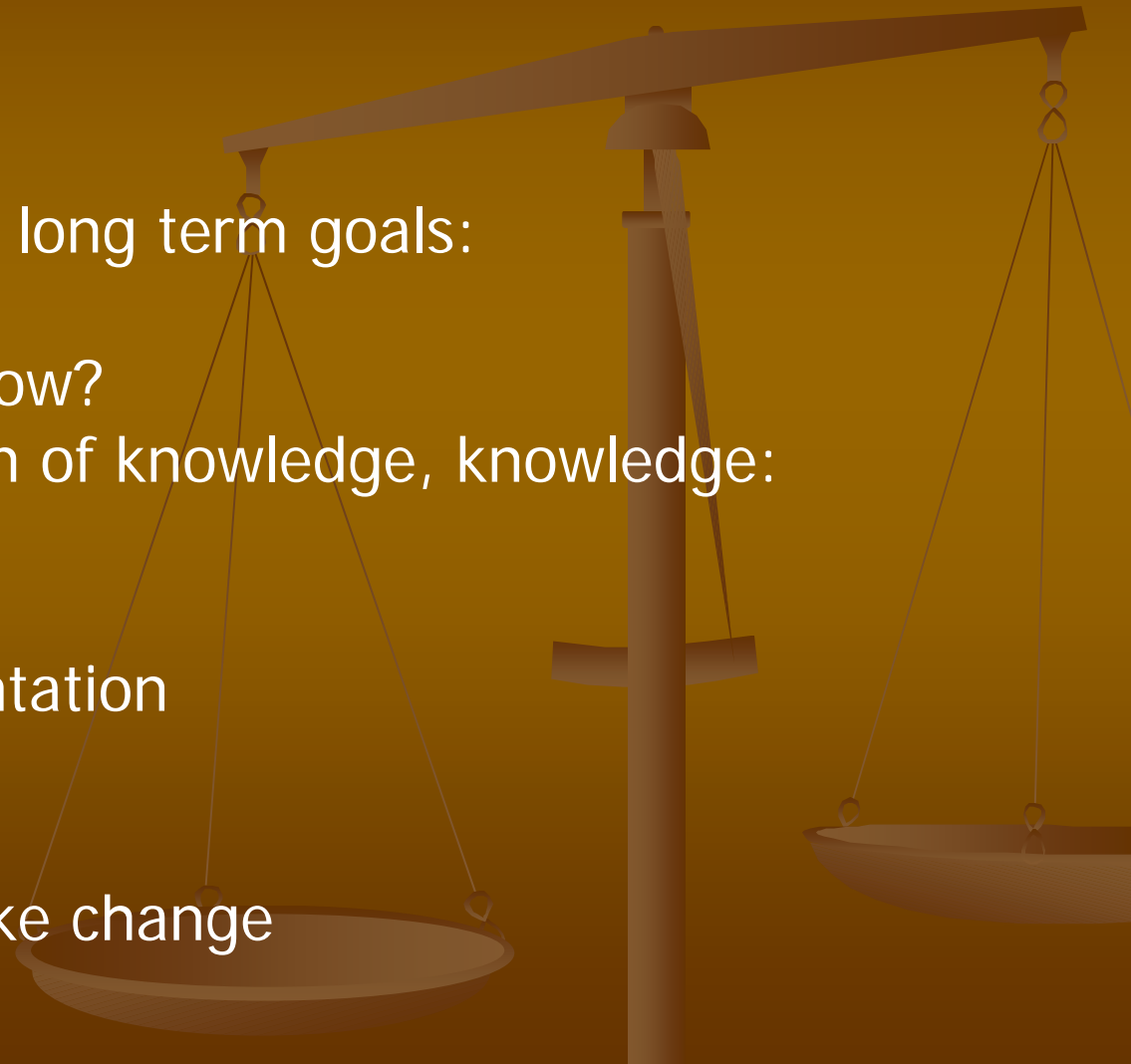
Compared to what?
Attribution of impact

What do we use?
Short term measures of long term goals:

What do we want to know?
Engagement, perception of knowledge, knowledge:

Is it being done well?
Quality of the implementation

Why are we doing this?
Using the results to make change



Testing Applications: Making It Easier

- Where possible use existing measures
 - Share measures with other projects. Common questions can be useful.
 - Look for benchmark measures that are predictors of longer term goals.
 - All self developed measures need some checking for validity and reliability.
 - A bad measure of the right thing is better than a good measure of the wrong thing.
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