



Reconsidering Tools and Contexts of Student Learning

National Academy & NSF DTS/ CAREER Workshop: Reconsidering the Textbook

Noah Finkelstein

noah.finkelstein@colorado.edu

University of Colorado at Boulder



CAREER: Research Questions

- How might we substantively include context in our models of student learning, course practice, and institutional reform in physics?
- How do tools, practices, and norms shape student learning and how are they shaped by learning?
- What are productive models and practices for sustainable and scalable educational reform?

Theme	i. Tools	ii. Practices	iii. Norms
a. Individ'l	Representational competence	Learning by teaching	Student attitudes and beliefs (ABs)
b. Course	Studies of sims	Course Practices	Secondary adaptation of reforms
c. Depart'l	Faculty use of PER-based materials	Programs in grad, p.d., and fac prep	Influence of dept'l norms

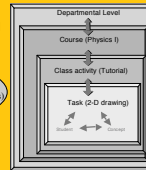
Socio-Cultural Framing

Foregrounding Context: people's knowing / cognition is situated within social, cultural and historical contexts



Adapted from Cole, M. (1996), *Cultural Psychology*

Frames of Context



Finkelstein, N. (2005), *Int. J. Science Education*

The Perceived Value of College Physics Textbooks

Noah Podolefsky and Noah Finkelstein

University of Colorado at Boulder

to appear in *The Physics Teacher* (2006)

Students in four introductory college physics courses were surveyed to find out: how much they read their physics textbook; when they read; what effect (if any) this had on their performance; if different textbooks/instructors made a difference.

Summary

- We found that while 97% of students buy the textbook:
 - Less than 41% regularly read.
 - 2.60% read after lecture.
 - There is little (or no) correlation between reading habits and course grade.
 - These results were strikingly similar across conceptual-, algebra-, and calculus-based courses with different instructors and textbooks.
- We build on previous studies^{1,2} that found similar results.

The Courses

Course	Textbook	N
Calculus-based (Fall 04)	<i>Fundamentals of Physics</i> , Halliday, Resnick, and Walker ^a	479 (402)
Calculus-based (Spring 05)	<i>Physics</i> , Knight ^a	334 (215)
Algebra-based (Spring 05)	<i>Physics</i> , Giancoli ^b	423 (183)
Conceptual-based (Spr 05)	<i>How Things Work</i> ; Bloomfield ^c	49 (29)

- Four courses were involved in the study. All were the second semester of a two-semester sequence.
- Numbers in parentheses in right-hand column indicate the numbers of students responding to the survey.
- The grade distributions for students taking the survey had a high correlation ($r > 0.9$) with the grade distribution for the class as a whole.

Student Interviews

We interviewed several students, who told us about many ways they use their textbooks.

- "I read word-for-word with understanding", and "pause after a concept and then think about it." ← A
- "I think that the majority of the material can be learned from attending class, actively participating, going to recitation and asking question, and doing the [homework]." "I don't ever read the text" except for "looking up constants." ← A
- "I read all the material in the book, so I guess I did it about right." ← D
- "[The textbook] was really useful for [homework]" but "the material on the exams is similar to the format of the lecture but not so much similar to the book." ← D

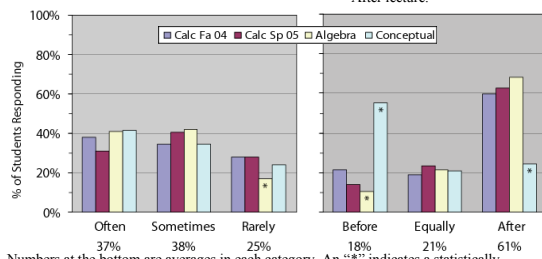
Survey Results

I read the textbook assignments...

- Often (more than 80%)
- Sometimes (20%-80%)
- Rarely (less than 20%)

When I read the textbook assignments, I read them...

- Before lecture.
- Equally before and after lecture.
- After lecture.



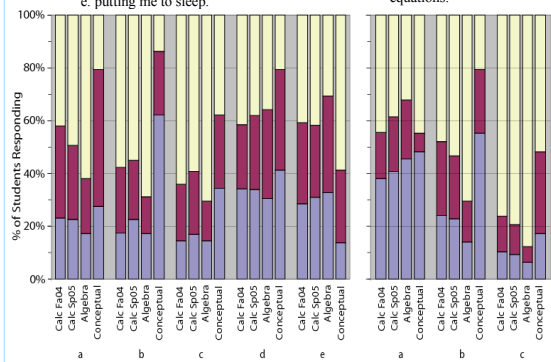
Numbers at the bottom are averages in each category. An "*" indicates a statistically significant (2-tailed z-test, $p < 0.05$) difference from each average. Only *conceptual* had reading quizzes.

I feel that the textbook is useful for...

- understanding the material covered in lecture.
- studying for exams.
- solving homework problems.
- learning physics just out of personal interest.
- putting me to sleep.

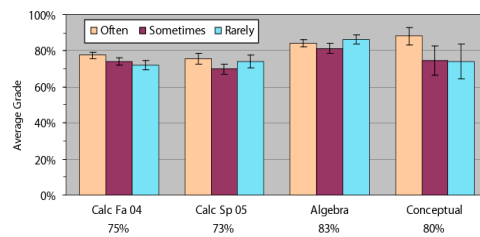
When I use the textbook...

- I read the entire chapter word-for-word.
- I study the sample problems.
- I look up constants and equations.



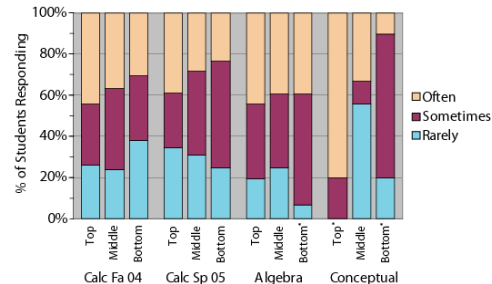
Effect on Performance

- For algebra- and calculus-based courses, we found no significant correlation between course grade and how much students read (average correlation coefficient $r = 0.07$)
- For the conceptual-based course, there is a moderate correlation ($r = 0.47$) that is weakly significant due to the small number of students responding.



Average grade vs. reading habits for each course. Error bars represent 95% confidence intervals. Numbers below the x-axis are the average grade in each course.

- For each course, we divided the students equally into the top, middle, and bottom 1/3 (by course grade) and compared the reading habits at each level.



Reading habits for the top 1/3, middle 1/3, and bottom 1/3 of students in each course. An "*" on a category label indicates a proportion that is significantly different ($\chi^2, p < 0.05$) from the average in each course.

Acknowledgements

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Conclusion

- While physics instructors tend advise their students to read the textbook before coming to class, we find that most students do not.
- These students are not necessarily hurt (performance-wise) compared to students who read as instructed. We do not know if students self-select appropriate reading habits, or if it does not matter how students use the textbook.
- Our findings should prompt educators to examine just what role textbooks play in their courses, particularly from the point of view of the students.