

"WE NEVER LEARNED THAT...."



ABSTRACT

We are investigating knowledge retention between lower level introductory courses in the Materials Science and Engineering (MSE) department and upper level junior and senior classes. It is an ongoing problem that students do not recollect material between MSE 170 (Introduction to Materials Science) and MSE 362 (Mechanical Behavior of Materials). Our goal is to identify any factors that contribute to this and to adjust the teaching methods and/or curricula for these classes.

Our main tool for identifying trends is the Materials Concept Inventory (MCI), a thirty question test of basic concepts, developed at Arizona State University by Steven Krause. Students take the MCI at the start and end of each quarter.

In the 2004-2005 academic year, all four MSE 170 instructors administered the MCI and a large amount of raw data has been gathered. The MCI was also given to the Spring 2005 MSE 362 class. We are awash with data, and our main challenge at this point is to organize and analyze the data into useful packets.

Knowledge Retention Between Sequential Classes

A Study on Students Recollection

Brian D. Flinn

Russell J. Caspe

University of Washington

Materials Science and Engineering

Contributing Factors

A Starting Point: MSE 170 varies in teaching style and class emphasis:

- Professor A specializes advanced structural materials.
- Professor B specializes in materials and processing.
- Professor C specializes in biomaterials.
- Professor D specializes in thin film electronic materials.

One End Point: MSE 362 is taught by Professor A

"... I TAUGHT THAT LAST QUARTER!"

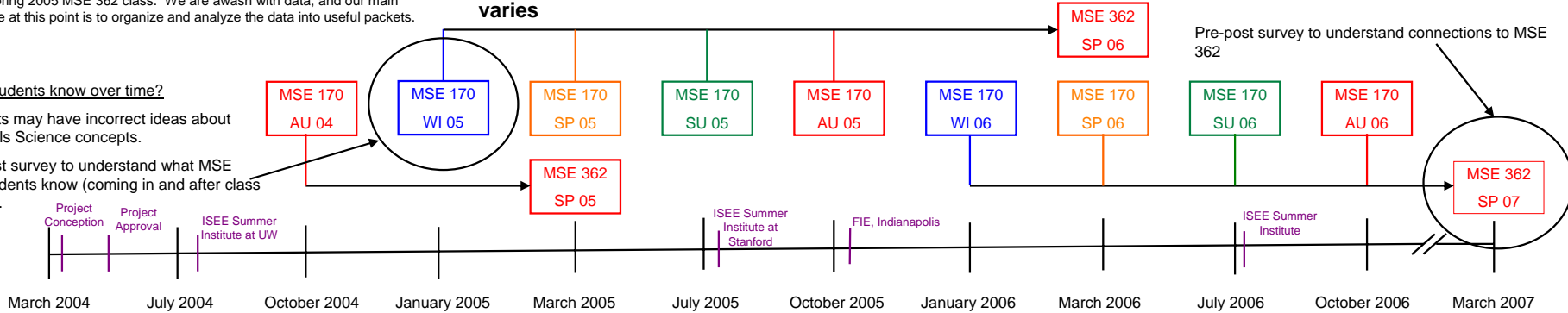


Our ISEE Story

In early April, 2004, Robin Adams of the UW Center for Engineering Learning (CELT) and Teaching contacted us about joining the Institute for Scholarship on Engineering Educations (ISEE). After some face-to-face meetings to brainstorm problems that we've encountered in our classes, we proposed the idea of a study into knowledge retention. In June we were officially accepted as Institute Scholars. We applied the tools of our study to our MSE 170 class in Autumn 2004, and in the the Spring 2005 MSE 362 class.

We've faced a number of challenges along the way. For instance, we were able to include all the MSE 170 instructors in the study and they gave the MCI to their respective classes. However, as a result, we have a large amount of qualitative data and we are unsure of how to analyze it. Throughout the process the ISEE group at UW has provided critical support and feedback through our weekly meetings.

An Issue: The time between MSE 170 and MSE 362 varies



What do students know over time?

- Students may have incorrect ideas about Materials Science concepts.
- Pre-post survey to understand what MSE 170 students know (coming in and after class is over).

The Materials Concept Inventory

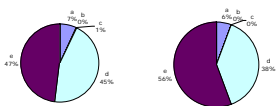
The MCI is a thirty question test that probes for misconceptions students might have entering the class. We modified the multiple choice test to ask for the students' level of confidence. *Krause, S., Decker, J.C. And Griffin, R. (2003). "Using a Materials Concept Inventory to Assess Conceptual Gain in Introductory Materials Engineering Courses" Proc. Of 33rd ASEE/IEEE Front. in Ed. Conf. T3D7-11.*

Each question is then sorted into four categories:

- 1) Level of Difficulty: Easy, Moderate and Difficult
- 2) Type of Knowledge: Intuitive, Common, Specific
- 3) Time to Answer: Declarative (snap), Think, Ponder
- 4) Time in 170: Not Covered, Covered, Emphasized

Sample Questions

This question is: Easy, Common, Declarative and Not covered in 170



Taken from 191 responses before MSE 170

Taken from 104 responses after MSE 170

The answer is e; Ni can exist as a solid, liquid or gas.

This question is: Moderate, Specific, Think and Covered in 170.

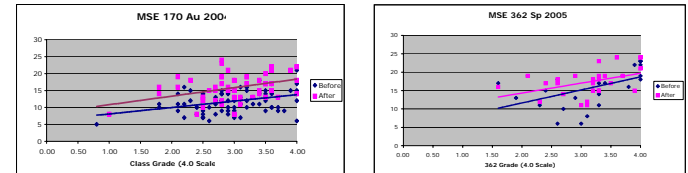


Taken from 189 responses before MSE 170

Taken from 103 responses after MSE 170

The answer is d. Copper's atomic level defects move more easily

Some Early Results



These Charts Show:

1. In both classes, the average score was higher after than before.
2. In general better (higher class grade) students scored higher on the MCI.
3. On a whole the MCI scores were better in 362 than in 170.

Acknowledgements: This material is based on work supported by the National Science Foundation under Grant No. ESI-0227558, which funds the Center for the Advancement of Engineering Education (CAEE). CAEE is a collaboration of five partner universities: Colorado School of Mines, Howard University, Stanford University, University of Minnesota, and University of Washington.