

The Efficacy of Screencasts to Address the Diverse Academic Needs of Students in a Large Lecture Course

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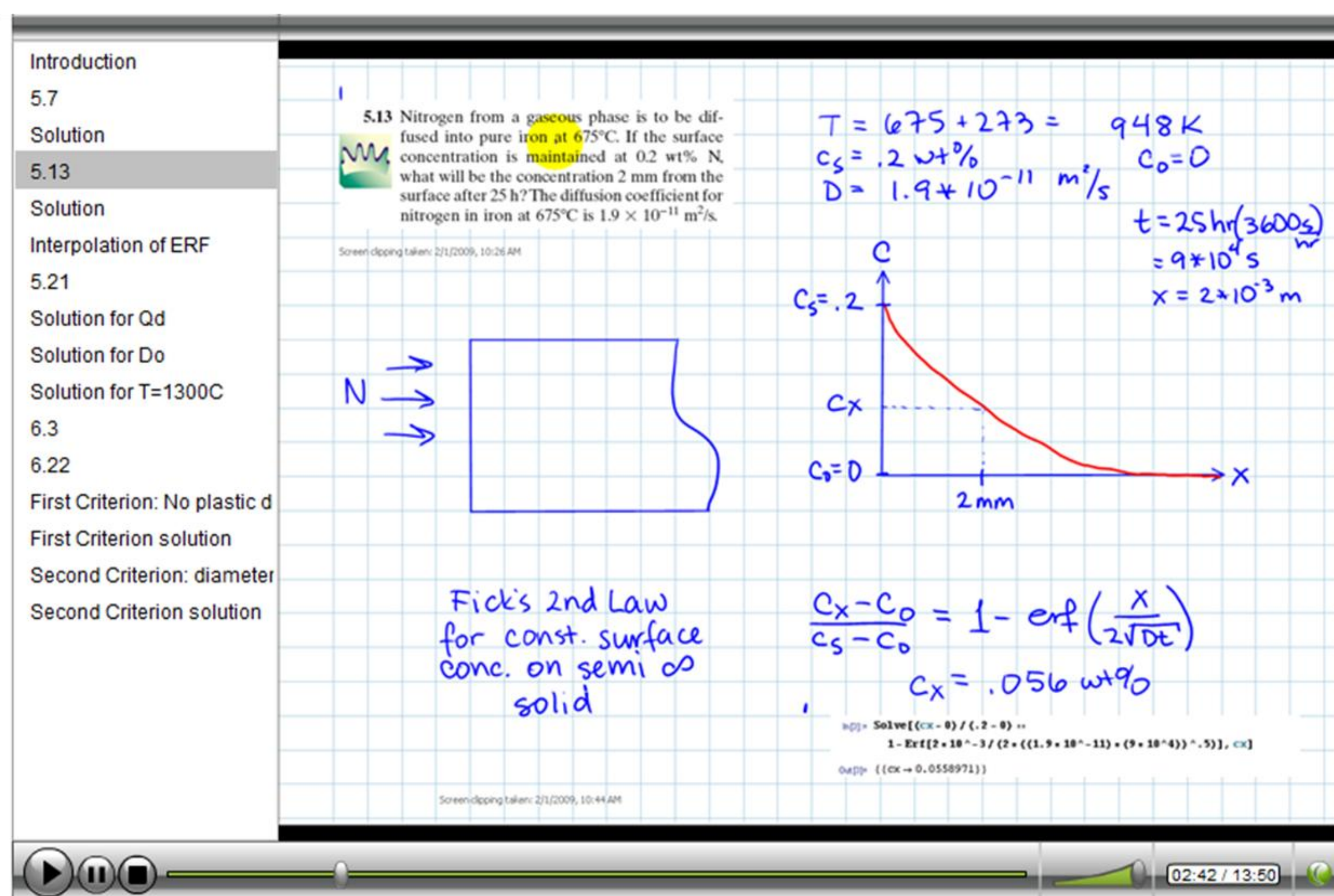
Abstract

Screencasts, recordings that capture audio narration along with computer screen images, can be used to supplement lectures with content that addresses diverse student needs. This study documents the strategic use of screencasts in a large introductory Materials Science & Engineering (MSE) course, examining their impact on course performance. While screencast use is perceived as helpful and is positively and significantly correlated with course performance, the most substantial gains were found for students with the least amount of prior exposure to concepts in the course material.

Background

What are screencasts?

- Videos that capture the activity on a computer screen with real time audio commentary.
- Types: Lecture Capture; Homework, Quiz & Exam Solutions; Muddiest Point



Extant Research

- Several studies show that screencasting is perceived by students as beneficial and is used primarily to review material or make-up absences.
- Research on screencast use as a *replacement* for lecture:
 - Screencast use benefits students with lower class attendance.
 - Students viewing screencasts remembered key concepts better than those attending live presentation of material.
- Research on screencast use as a *supplement* to lecture:
 - Using screencasts for note-taking is positively correlated with exam performance.
- More research is needed to determine the impact of supplemental screencast use on student learning and performance, both collectively and according to characteristics i.e. gender, race, citizenship status, academic level, and major.

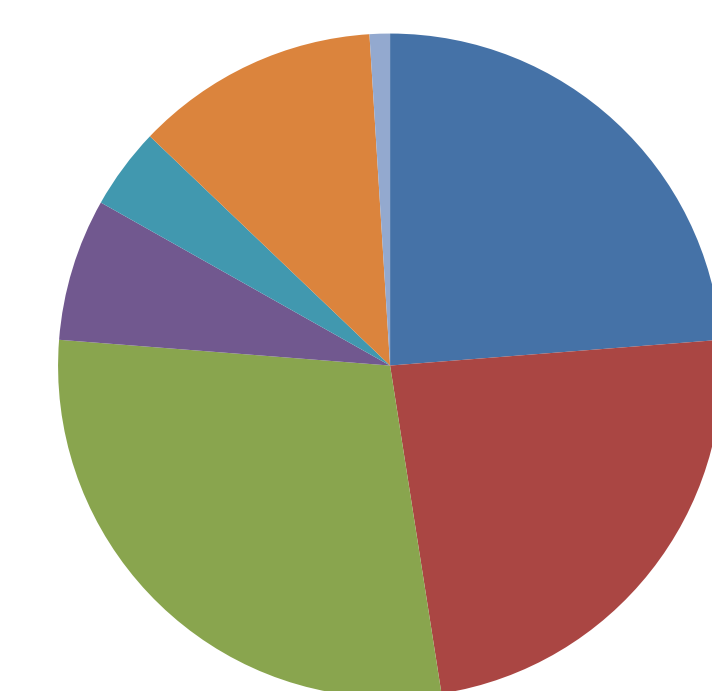
Our research focuses on whether student use of supplemental screencasts affects learning in terms of self-report and/or exam performance, and whether screencasts benefit all groups of students equally.

Experimental Design

- Methodology
 - Collected data on screencast use, course performance, and demographics, as well as student perceptions of screencasts (online survey with 65% response rate).
- Sample: 397 students in MSE 220 Introduction to Materials & Manufacturing (Fall 2008 & Winter 2009)

Student Academic Background

- Over 70% of students come from three departments: Aerospace Engineering (AERO), Chemical Engineering (ChE), and Industrial and Operations Engineering (IOE).



Academic Background (Major)

- AERO (24%)
- ChE (24%)
- IOE (29%)
- NERS (7%)
- MSE (4%)
- Other Engineering Majors (12%)

Prior Exposure to MSE 220 Concepts

- While IOEs have academic indicators (e.g., GPA & SAT) comparable to their peers, they start MSE 220 at a disadvantage due to less prior experience with material.

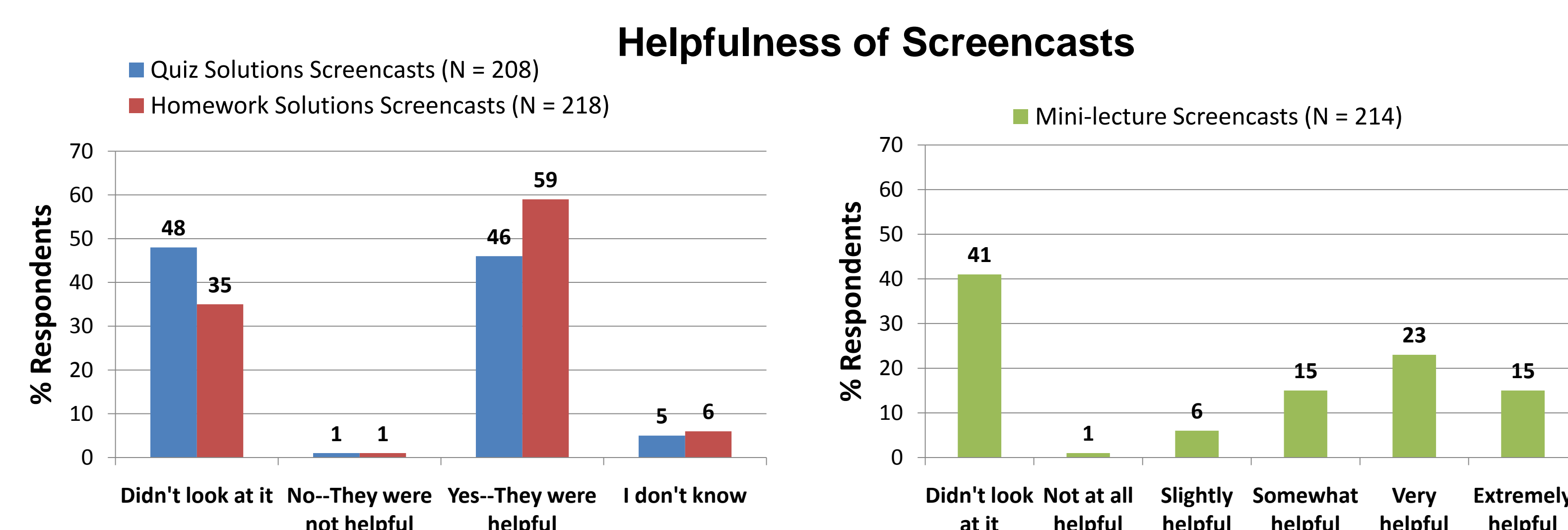
Materials Science & Engineering	Chemical Engineering	Aerospace Engineering	Industrial & Operations Engineering
<ul style="list-style-type: none"> • Principles of Engineering Materials • Physics of Materials • Thermodynamics of Materials • Kinetics & Transport • Structure of Materials • Mechanical Behavior 	<ul style="list-style-type: none"> • Materials and Energy Balances • Chemical Thermodynamics • Fluid Dynamics • Heat and Mass Transfer • Separation Processes • Reaction Engineering and Design 	<ul style="list-style-type: none"> • Intro to Aerospace Engineering • Intro to Solid Mechanics and Aerospace Structures • Intro to Gas Dynamics • Aircraft and Spacecraft Structures • Aerodynamics • Aircraft and spacecraft Propulsion • Space Flight Mechanics • Aircraft Dynamics 	<ul style="list-style-type: none"> • Economic Decision Making • Operations Modeling • Probability and Statistics • Intro to Optimization • Intro to Markov Processes • Ergonomics • Linear Statistical Models • Data Processing

• Bolded course title indicates direct connection to MSE concepts.

Results

Self-reported Impact on Student Learning

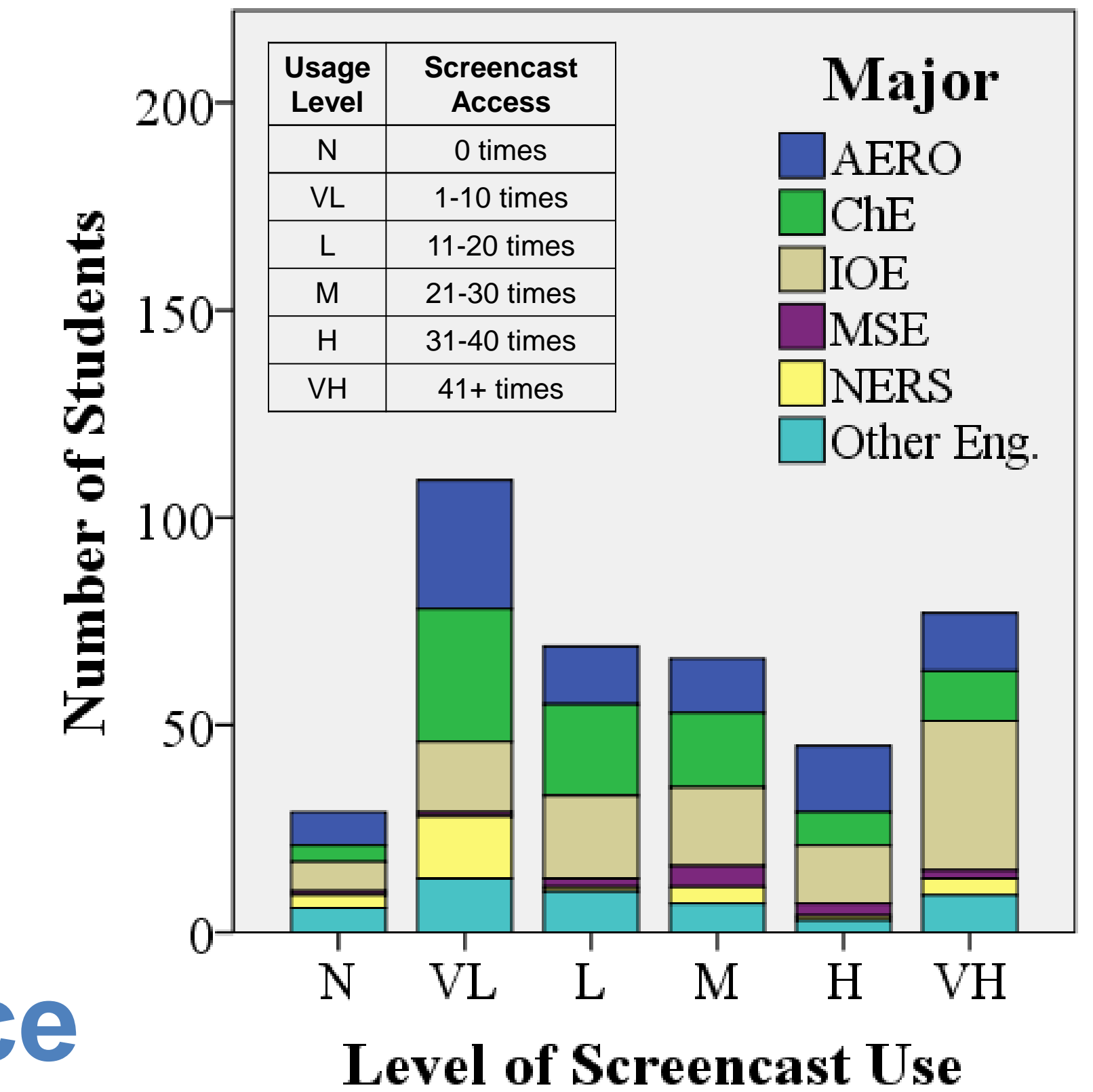
- Students typically used screencasts as study supplements and found them to be helpful.
 - Over 86% of students who responded to the survey and viewed the screencasts in question felt the homework/quiz solutions and muddiest point screencasts were helpful.



“...screencasts allowed me to clarify concepts I didn’t fully understand before the quiz, and helped me master them before the exam.” ~ Fall 2008 Student

Screencast Use

- Significant difference in screencast use by major: for three largest major groups, lowest use among ChE, highest use among IOE.



Impact on Course Performance

Overall, those students who used screencasts more earned a significantly higher grade in the course.

- Students benefit from screencast use equally, regardless of whether they are male or female, U.S. citizen or not.
- Differences in course performance were found across race and academic level, but they could not be attributed to screencast usage.
- The most important differences in course performance and usage were across **Academic Majors**.
 - ChEs perform the best of all the majors regardless of screencast usage.
 - IOEs are the only major group for which high usage is significantly related to higher course performance.
 - This group had the lowest course performance prior to the introduction of screencasts, but raised its collective performance upon their introduction.
 - These students have the most to gain by using screencasts because they enter MSE 220 with the least academic preparation.

Supplemental screencasts most helpful to students whose academic backgrounds are dissimilar to Materials Science.

Implications & Future Work

- Regardless of course format, screencasts have the potential to:
 - Allow students the flexibility to work at own pace and level of detail.
 - Synthesize resources into multimedia presentation of concepts that can reach a wider range of learners.
 - “Level the playing field” among students with comparable academic ability, but varying levels of academic preparation.
- Further exploration is needed to:
 - Understand the reasons for lower or higher screencast use among particular groups of students.
 - Test our conclusions across additional semesters and other courses that enroll students with diverse academic preparation.
 - Determine whether screencasting is similarly beneficial across other course formats (i.e., labs, computer design courses, etc.).
- This work is being published in *Advances in Engineering Education* (in press) 2011.

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