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High Return on Faculty Investment: Addressing Diverse Student Needs in Large Lectures Through Screencasting

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U-M College of Engineering

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Impact of Screencast Technology: Connecting the Perception of Value and the Reality of Performance

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The efficacy of screencasts

- A screencast is...
  - A movie that captures voice, video, and presentation materials
    - Lecture capture
    - Supplemental lectures
    - Homework/exam solutions
Lecture capture

- Direct recording of what went on in class

  - resolved shear stress lecture
Supplementary Lecture

- Additional resource

  - Kahn academy
Homework/exam solution
Project Goals

This study documents the strategic use of screencasts in a large introductory Materials Science and Engineering (MSE) course, and examines their impact on student usage and course performance.
Research Questions

- Do students perceive screencasts to be valuable
- Does the use of screencasts promote student self-efficacy and increase performance
- What are the motivations for using or not using the screencasts
Theoretical Framework

- **Self Efficacy**, students’ beliefs about their academic capabilities, has been shown to be strongly linked to their motivation to achieve
  - Intrinsic Motivation- based on an inherent interest
  - Extrinsic Motivation- based on achieving a desired result

- **Expectancy-Value Theory** states that a person’s choice, persistence, and performance on a specific activity is strongly linked to her expectation that she will do well and how much she values the activity
  - Activities that are initially extrinsically motivated can be shifted towards the intrinsic given enough autonomy and success

Ryan and Deci, Contemp. Ed Psych **25** 54 (2000)
Methodology

- Student Perceptions
  - Midterm evaluations conducted by CRLT
  - End of term survey administered by CRLT

- What really happened
  - Analysis of usage was tested for significance to student data
    - Academic background (Major, Year, Cumulative GPA)
    - Demographics (Gender, Race)
    - Student performance (homework, exams, final grade)

- No analysis on usage was performed until after the final scores in the course we posted.
A majority of students who view the screencasts believe that they are helpful.

90% of students agree that mini-lecture screencasts in particular promote a deeper understanding of the course material.
What the students said

- … I felt they were extremely helpful, and much more extensive study tools … screencasts can be downloaded and played on iPods make them very convenient. … and I hope that more professors begin using this technology.

- Screencasts both showed solutions and problem strategies. The verbal explanation makes it more understandable than a simple [homework] solution handout.

- I really liked listening to the solution explanation to the homeworks even if I got the problem right. Just listening to the way the problem was reasoned out in words helped me to remember processes and procedures better.
Students tend to watch screencasts from start to finish

- The highest watchers were more likely to watch the entire homework solution screencasts
- Those who watched the entire hw screencast were more likely to have lower homework grades

<table>
<thead>
<tr>
<th>Strategies for Self-Assessment</th>
<th>Number</th>
<th>Percentage</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watched entire video from start to finish</td>
<td>68</td>
<td>33</td>
<td>129</td>
<td>66</td>
</tr>
<tr>
<td>Re-watched certain segments based on my homework responses</td>
<td>54</td>
<td>26</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Went to specific points to review</td>
<td>40</td>
<td>19</td>
<td>24</td>
<td>12</td>
</tr>
<tr>
<td>Watched large chunks looking for information</td>
<td>29</td>
<td>14</td>
<td>18</td>
<td>9</td>
</tr>
<tr>
<td>Browsed around</td>
<td>18</td>
<td>9</td>
<td>15</td>
<td>8</td>
</tr>
</tbody>
</table>

I got things wrong and wanted to fix them
Screencast usage was positively and significantly correlated to overall performance in the course.
Examined different groups of students to see if there were differences

- No significance across gender, citizenship, ethnicity, academic level
Performance

Significance across major

- ChE use screencasts at lowest levels, while receiving the highest grades
- IOE use the screencasts the most, and receive average grades. Prior to the introduction of screencasts; IOEs received the lowest grades.
The ChE Curriculum contains many MSE topics covered

The IOE curriculum contains no MSE topics covered

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Principles of Engineering</td>
<td>• Materials and Energy Balances</td>
<td>• Intro to Aerospace</td>
<td>• Economic Decision Making</td>
</tr>
<tr>
<td>• Mechanical Behavior</td>
<td></td>
<td>• Structures</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Aerodynamics</td>
<td>• Ergonomics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Aircraft and spacecraft Propulsion</td>
<td>• Linear Statistical Models</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Space Flight Mechanics</td>
<td>• Data Processing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Aircraft Dynamics</td>
<td></td>
</tr>
</tbody>
</table>

Screencasts have a positive impact as a supplementary resource to aid student learning, especially for students with less familiarity with course content, all other things being equal.
Performance

Case study: Examined the impact of screencast usage on ability to answer exam questions.

- If IOE students watched ANY screencasts, they performed better on a PARTICULAR question
- If IOE students watched a PARTICULAR screencast, the significance was even stronger for the performance on that PARTICULAR question
- Also somewhat true for AEROs

<table>
<thead>
<tr>
<th>Major</th>
<th>n</th>
<th>Correlation</th>
<th>Sig.</th>
<th>Correlation</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AERO</td>
<td>34</td>
<td>r = 0.350*</td>
<td>p = 0.042</td>
<td>r = 0.345*</td>
<td>p = 0.046</td>
</tr>
<tr>
<td>ChE</td>
<td>45</td>
<td>r = 0.123</td>
<td>p = 0.421</td>
<td>r = 0.177</td>
<td>p = 0.243</td>
</tr>
<tr>
<td>IOE</td>
<td>60</td>
<td>r = 0.425**</td>
<td>p = 0.001</td>
<td>r = 0.375**</td>
<td>p = 0.003</td>
</tr>
</tbody>
</table>

*p < 0.05; **p < 0.01.
Students are motivated to use the screencasts because they are perceived to be helpful and they are shown to improve course performance.

- Exam Study Tool: 89%
- Study Supplement: 76%
- Working on Assignments: 29%
- Fill in Gaps in Notes: 25%
- Study Group Resource: 7%
Motivation

Why do only 58% of the students use the screencasts?

<table>
<thead>
<tr>
<th>Percentage of Students</th>
<th>0</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>Mean Final Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did Not Need the Additional Assistance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>87.3%</strong></td>
</tr>
<tr>
<td>Forgot</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>28</td>
<td>*82.5%</td>
</tr>
<tr>
<td>Did Not Have Time</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>29</td>
<td>84.6%</td>
</tr>
<tr>
<td>Did Not Find the Screencast Helpful</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4</td>
<td></td>
<td>85.9%</td>
</tr>
<tr>
<td>Unable to Find the Screencast</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td>------</td>
</tr>
<tr>
<td>Had Technical Problems</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td>80.9%</td>
</tr>
<tr>
<td>Used Another Resource</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>15</td>
<td></td>
<td>87.9%</td>
</tr>
</tbody>
</table>
What we’ve learned

- Screencasts are useful for explaining concepts and procedures.
  - Shift first exposure of a concept
  - Level the playing field
  - Allow for more active learning during class

- They appear to enhance student self-efficacy

- How to publish in the Ed literature
Screencasting Best Practises
Technical Requirements

■ On your own computer
  ● Software
    ▪ Camtasia $$$
    ▪ Screenflow $`
    ▪ Jing free
  ● Microphone

■ Course management system
Challenges

- Not a substitute for good teaching
- Can be a time sink if you let it
- Uploading large files to CMS can be a pain
Best Practices

■ Content Preparation
■ Recording
■ Editing and Production
■ Publish
Content Preparation

- WHY are you doing it?
- Decide on your production quality
  - YouTube vs Hollywood
- Start Small
Recording

- Have your materials ready
- Speak normally
- “Take two”
- Use your cursor to point
- Record in short segments
Editing and Production

- Watch the tutorials if they exist
- Cutting
- Zoom and pan
- Chapters
- Make it web friendly
Publish

- Upload to Ctools
  - Native upload tool
  - Third party upload tool (cyberduck)
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