| 1 | Title Slide | Hi, I'm Kezia Alfred. I'm Matt Bandelt. And I'm Jose Gutierrez. We are teaching assistants in E-14 or Introduction to Solid Mechanics taught by Sheri Sheppard, Sarah Billington and Paul Mitiguy. Our talk this morning is about a new teaching approach called Scenario Based Learning. | 45 | Kezia |
| 2 | PechaKucha | We are using a presentation format called "Pecha-Kucha" - it's 20 slides for 20 seconds each. That's 6 minutes and 40 seconds, 965 words. Students in E-14 use this presentation format for their final project presentation, so it's only fair that we do it too. | 45 | Jose |
| 3 | Data | Research shows that 75% of engineering graduates go to work in private industry. 82% of engineering graduates think entrepreneurship education can help them find a job. Despite these numbers, only 20% of engineering programs have entrepreneurial curriculum, and only 16% of faculty engage students on business issues. | 47 | Matt |
| 4 | Suitcase | We think the answer is NOT to add classes to an already full college experience. The average ME student has only 5 open elective classes in their four year college career. This compares to a history major who has 21 open elective classes. There has to be another approach. | 49 | Kezia |
| 5 | OJ + Ca | Let's consider breakfast. Orange juice has Vitamin C - think of that as engineering learning. And milk has Calcium - think of that as business learning. Hardly anyone drinks two beverages at breakfast. Now consider orange juice plus calcium that has all the Vitamin C of orange juice plus the goodness of Calcium in one glass. | 56 | Matt |
| 6 | SBL Overview | We call this approach scenario based learning. The curriculum includes a case scenario or story that frames the concepts, a hands-on in-class lab experience that is completed as a group, a worksheet to record data and perform calculations and individual homework for reflection and decision making. | 46 | Jose |
| 7 | Content | Scenario based learning starts with the core engineering concepts taught in E-14 and places them in an entrepreneurial scenario or story. The scenario by just telling a story, introduces students to important entrepreneurial concepts. The engineering and entrepreneurial concepts are from two popular textbooks written by Stanford Professors Sheri Sheppard and Tom Byers. | 53 | Jose |
| 8 | Learning Theory | This approach is based on the research of Dr. David Kolb at Carnegie-Mellon called "learning styles." His theory suggests that students learn in many ways - by watching and doing, by thinking and feeling. Scenario based learning curriculum purposely contains elements of each of these styles. | 46 | Kezia |
| 9 | Case Scenario | The student experience begins by reading a scenario that describes the business situation and engineering challenge. In Madison Longboard, two entrepreneurs start a company to build longboards and involves two labs - one about forces on the trucks and one about forces on the deck. In Trek Bicycles students design the drive train for an urban shared bicycle. | 58 | Jose |
| 10 | Hands-On Labs | In class, students in teams of four work through a hands-on lab to solve the engineering problems. They measure forces on Longboard trucks, deflection of longboard deck materials and calculate forces translated through the gear system of an urban shared bicycle. They do this in conversation with other students helping to build their team based communication skills. | 57 | Matt |
| 11 | Worksheet | Through this collaborative, teamwork based process, the in-class worksheet guides student teams through both experimental discovery and equation-based analysis. Students draw free body diagrams, record data, apply equations, calculate answers and discuss conclusions. This also encourages peer based instruction. The worksheets are later graded as homework. | 46 | Kezia |
| 12 | Homework | The final phase of the learning process is completed individually, as out-of-class homework. The student concludes the scenario by making a business decision based on what they have learned. This encourages engagement with the concepts by providing the opportunity for both reflection and synthesis. | 44 | Kezia |
So what have we learned? Through three years of testing, we are confident that introducing entrepreneurial content does not reduce the learning of engineering content. Research has shown a significant 28% increase in both engineering and entrepreneurial learning across a range of student types. They are getting both Vitamin C and Calcium in one experience.

Second, exposure to the business concepts builds student self-efficacy on business skills like financing a venture or choosing the right marketing approach. Self-efficacy is a psychological construct that reflects self confidence in the ability to accomplish specific behaviors ... and has been shown to be an important first steps towards making a career choice.

Last, we saw that students appreciate this approach to learning. The scenarios, labs and exercises have high levels of student satisfaction. And they appeal to students who have career aspirations ranging from working for a small business, a global multinational company and even working for a non-profit organization.

In conclusion, we are learning that engineering students can learn business concepts without diminishing engineering learning in the normal context of engineering curriculum. We are also learning that the scenario approach, in combination with hands-on, in-class learning experiences generate high student satisfaction.

This teaching approach is not without its challenges. It takes classroom and student time to discuss, internalize and reflect on the new business concepts. This can be offset by carefully evaluating every mechanics concept in the syllabus and looking for ways to reduce time spent on everything else.

Second, this curriculum is not easy to develop. It requires knowledge of two domains - engineering and business - that are not typically combined in engineering faculty experience. It is best to develop the curriculum in partnership with an expert in business and entrepreneurial activity.

And finally, this curriculum adds complexity and a touch a chaos to the classroom. But with that also comes a certain energy and enthusiasm that creates a dynamic learning environment. Of course, it’s all made easier by hiring the world’s best teaching assistants!

What’s next? There are two more scenarios in development and teaching instructions. This year the curriculum has been used at the University of Wisconsin Madison and UC-Merced with over 1,000 ME students. Other schools, through Stanford’s Epiceter have also expressed interest. Thank you for your time. Are there any questions?

<table>
<thead>
<tr>
<th>RL #1</th>
<th>RL #2</th>
<th>RL #3</th>
<th>RL #4</th>
<th>RL #5</th>
<th>RL #6</th>
<th>RL #7</th>
<th>RL #8</th>
<th>RL #9</th>
<th>RL #10</th>
<th>RL #11</th>
<th>RL #12</th>
<th>RL #13</th>
<th>RL #14</th>
<th>RL #15</th>
<th>RL #16</th>
<th>RL #17</th>
<th>RL #18</th>
<th>RL #19</th>
<th>RL #20</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td>17</td>
<td>18</td>
<td>19</td>
<td>20</td>
<td>21</td>
<td>22</td>
<td>23</td>
<td>24</td>
<td>25</td>
<td>26</td>
<td>27</td>
<td>28</td>
<td>29</td>
<td>30</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td>RL #1</td>
<td>RL #2</td>
<td>RL #3</td>
<td>Conclusions</td>
<td>Teaching Challenges</td>
<td>Teaching Challenges</td>
<td>Teaching Challenges</td>
<td>Next Steps</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>So what have we learned? Through three years of testing, we are confident that introducing entrepreneurial content does not reduce the learning of engineering content. Research has shown a significant 28% increase in both engineering and entrepreneurial learning across a range of student types. They are getting both Vitamin C and Calcium in one experience.</td>
<td>Second, exposure to the business concepts builds student self-efficacy on business skills like financing a venture or choosing the right marketing approach. Self-efficacy is a psychological construct that reflects self confidence in the ability to accomplish specific behaviors ... and has been shown to be an important first steps towards making a career choice.</td>
<td>Last, we saw that students appreciate this approach to learning. The scenarios, labs and exercises have high levels of student satisfaction. And they appeal to students who have career aspirations ranging from working for a small business, a global multinational company and even working for a non-profit organization.</td>
<td>In conclusion, we are learning that engineering students can learn business concepts without diminishing engineering learning in the normal context of engineering curriculum. We are also learning that the scenario approach, in combination with hands-on, in-class learning experiences generate high student satisfaction.</td>
<td>This teaching approach is not without its challenges. It takes classroom and student time to discuss, internalize and reflect on the new business concepts. This can be offset by carefully evaluating every mechanics concept in the syllabus and looking for ways to reduce time spent on everything else.</td>
<td>Second, this curriculum is not easy to develop. It requires knowledge of two domains - engineering and business - that are not typically combined in engineering faculty experience. It is best to develop the curriculum in partnership with an expert in business and entrepreneurial activity.</td>
<td>And finally, this curriculum adds complexity and a touch a chaos to the classroom. But with that also comes a certain energy and enthusiasm that creates a dynamic learning environment. Of course, it’s all made easier by hiring the world’s best teaching assistants!</td>
<td>What’s next? There are two more scenarios in development and teaching instructions. This year the curriculum has been used at the University of Wisconsin Madison and UC-Merced with over 1,000 ME students. Other schools, through Stanford’s Epiceter have also expressed interest. Thank you for your time. Are there any questions?</td>
<td>Total Words 977</td>
<td>Target Word Count 1000</td>
<td>Difference -23</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>