Educational Hooks to Bring About Learning: Engaging Students through Communication They Can Understand

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With Dr. Bridget Trogden, Undergraduate Studies,
Dr. Taimi Olsen, OTEI (Office of Teaching Effectiveness and Innovation)
In this session, we seek to provide a good snapshot into the General Education courses in physics at Clemson University, just one lens through which student engagement is achieved. We will also discuss the programmatic efforts that are in place or in progress that assist instructors with communicating transparently with students, enhancing their critical thinking skills, and effectively evaluating their improved learning.
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Welcome to CLEMSON!
Time to learn physics!
\[ x = x_0 + v_0 t + \frac{1}{2} a t^2 \]
\[ v = \lambda f \]
\[ y(x, t) = A \cos \left( \frac{2\pi x}{\lambda} - \frac{2\pi t}{T} \right) \]
\[ \theta = \theta_0 + \omega_0 t + \frac{1}{2} a t^2 \]
\[ T = 2\pi \sqrt{\frac{L}{g}} \]
\[ I = \sum m_i r_i^2 \]
\[ P_1 + \frac{1}{2} \rho v_1^2 + \rho g y_1 = P_2 + \frac{1}{2} \rho v_2^2 + \rho g y_2 \]
\[ F_G = \frac{G m_1 m_2}{r^2} \]
\[ U_G = -\frac{G m_1 m_2}{r} \]
\[ \nu_e = \sqrt{\frac{2GM_E}{R_E}} \]
\[ T^2 = \frac{4\pi^2}{GM} R^3 \]
\[ P_{gauge} = P - P_{atm} \]
\[ v = -A\omega \sin(\omega t) \]
• Education has to move beyond textbook exercises and rote memorization, toward critical thinking and analysis.

• Today’s students - while not always digital natives - are frequently quite adept at finding resource or solution on the internet.

• As instructors, our challenge is to provide an educational environment that seeks for students not to just find the answer, but rather, to analyze scenarios and reason through possibilities themselves.
Waves $\nu = \lambda f$

- A wave is a disturbance that propagates from one place to another.
- Waves must propagate through a medium, but do not transmit matter.
• Amy—how education has moved, critical thinking, new types of students, engaging them
• Your syllabus
• Engage/make it clear what it is
• Physics content with thinking
Gen Ed Revision

Gen Ed hasn't changed in 20 years

Rubrics

Global Challenges

Transparency and Assignment Design

Engaging Courses
• Transparency
• Right now, fighting this battle, helping students understand what is going on in an online situation
Exams: 
There will be four exams during the semester and one final exam. Each exam is worth 15% of your final course grade with the lowest of the 5 exam grades being dropped which makes the four regular exam and the final exam worth a total of 60% of your total grade. For the first exam that you are unable to complete, you will have to use the missed exam as your dropped exam grade. In the extremely unlikely case that more than one exam is missed, you must obtain an excuse which may be verified by University sources before a makeup exam will be granted. All exams will be taken using the Respondus Lockdown browser. This browser must be downloaded through the Clemson University download page. It is the student’s responsibility to ensure that the browser is working prior to taking each exam. Students who turn in a paper copy of the exam will have 5 points deducted from their exam grade.

Homework: 
The 56 homework assignments are worth 20% of your course grade. Each homework is weighted the same. Homework is due at 11:59 pm on the day indicated in the schedule. Late homework can be submitted for up to 50% credit until 04/24/2019 at 11:59 pm. No homework grades are excused. All due dates are recorded on the calendar at the end of the syllabus.

To register for Expert TA, the cost is $32.50 per semester per student. Expert TA offers students the option of a 14-day free trial. Any work done during the trial, including grades received, is saved and available after the license is purchased.

Engagement: 
Engagement grades are worth a total of 10% of your final class grade. Each engagement grade is worth the same amount of credits (regardless of the number of raw points). Your answers will be graded 40% by correctness plus 60% for participation. Thus, an incorrect answer gets you a score of 60% while a correct answer gets you a score of 100%. No answer (an absence) gives no credit. Each day of participation is worth the same number of points regardless of how many questions are posed. Because of the pace at which material is covered and because of the cumulative nature of the principles involved it is recommended that students not miss a class unless there is a compelling reason. Students are requested to wait 10 minutes in the unlikely event that your instructor is late for class.

Class Preparation: 
These assignments are indicated on the syllabus in purple and labeled as Pox or MCS. These assignments are located through Canvas as quizzes and as Expert TA assignment. These assignments are intended to be completed after you have watched the pre-lecture video. The lowest 2 grades will be dropped.

Determination of Final Grade: 
Letter grades are awarded as shown below. Extra Credit adds for a total of 100% above your final course grade. No further changes to grades will be made after the last day of class. Grade conversion is as follows:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>A</td>
<td>90% or higher</td>
</tr>
<tr>
<td>B</td>
<td>80% to 89.99%</td>
</tr>
<tr>
<td>C</td>
<td>70% to 79.99%</td>
</tr>
<tr>
<td>D</td>
<td>60% to 69.99%</td>
</tr>
<tr>
<td>F</td>
<td>0.59.99%</td>
</tr>
</tbody>
</table>

The following scale will be used:

- engagement: 10.0%
- class preparation: 10.0%
- homework: 20.0%
- test: 60.0%

Transparency in Course Expectations
• No surprises or last-minute assignments.

• Pacing guides with best practices included.

### Course Schedule:

Due dates are fixed as per the schedule. On rare instances, I will grant more time on an assignment if we have not yet covered the material but please consider this a fixed document of due dates.

<table>
<thead>
<tr>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>January 6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>No class</td>
<td></td>
<td>Ch 16</td>
<td></td>
<td>Ch 16</td>
</tr>
<tr>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Ch 16</td>
<td>P17A</td>
<td>Ch 17</td>
<td>HW 16 due</td>
</tr>
<tr>
<td>20 MLK Jr.</td>
<td>21</td>
<td>22</td>
<td>23</td>
<td>24</td>
</tr>
<tr>
<td>P17B</td>
<td>CH 17</td>
<td>MCS due</td>
<td>Ch 18</td>
<td>HW 17 due</td>
</tr>
<tr>
<td>27</td>
<td>28</td>
<td>29</td>
<td>30</td>
<td>31</td>
</tr>
<tr>
<td>Ptest1</td>
<td>Review</td>
<td>Thermometer</td>
<td>Test 1</td>
<td>HW 18 due</td>
</tr>
<tr>
<td></td>
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</tr>
<tr>
<td>February 3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>P19A</td>
<td>Ch 19</td>
<td>P19B</td>
<td>Ch 19</td>
<td>HW 19 due</td>
</tr>
<tr>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
</tr>
<tr>
<td>P20A</td>
<td>Ch 20</td>
<td>P20B</td>
<td>Ch20</td>
<td>HW 20 due</td>
</tr>
<tr>
<td>17</td>
<td>18</td>
<td>19</td>
<td>20</td>
<td>21</td>
</tr>
<tr>
<td>P21A</td>
<td>Ch 21</td>
<td>Ptest2</td>
<td>Ch 22</td>
<td>HW 21 due</td>
</tr>
<tr>
<td>24</td>
<td>25</td>
<td>26</td>
<td>27</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>Review</td>
<td></td>
<td>Test 2</td>
<td></td>
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<tr>
<td>March 2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>P22A &amp; P22B</td>
<td>Ch 22</td>
<td>P23A</td>
<td>Ch 23</td>
<td>HW 22 due</td>
</tr>
<tr>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
</tr>
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</table>
Prepare to do your BEST

- Carefully watch the pre-lecture videos prior to class and complete the class preparation quiz.
- Preview lecture notes and skim through the text for the material we will cover. Education research shows that we have to be exposed to material three times before it begins to sink in.
- Lecture notes can be printed from Canvas prior to lecture. Or annotated on your tablet.
- Engage fully in class by listening or taking notes. While playing a game or surfing the web may be fun, it does not assist in your quest for physics knowledge.
- Come to class each day with your equation sheet and calculator ready to solve problems.
- Ensure to bring a laptop or tablet or smart phone with ExpertTA to participate in the class engagement activities.

- Explicit description of what a successful student will look like.
- Pacing guides with best practices included.

Assignments DUE this week:

<table>
<thead>
<tr>
<th>Date</th>
<th>Assignment</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>09/01/2020</td>
<td>R4 – Topic 15</td>
<td>Modules/Recitation</td>
</tr>
<tr>
<td>09/02/2020</td>
<td>Extra Credit Straw</td>
<td>Modules/Extra Credit/Long Straw (OPTIONAL)</td>
</tr>
<tr>
<td>09/03/2020</td>
<td>R5 – Topic 15</td>
<td>Modules/Recitation</td>
</tr>
<tr>
<td>09/04/2020</td>
<td>HW15 due</td>
<td>Modules/Recitation</td>
</tr>
</tbody>
</table>

Best Practices for this week: Suggested Pacing

Below is a suggested guide of how to use your time. The only items that are graded are shown above. Please note that you must complete both recitation assignments (R4 and R5).

- 8/23/2020
  - Watch Lectures: Concept 15 through Worksheet 15: Section A Answers (3 videos total)
  - Note: worksheets are not for a grade, just for your practice
  - ~ 1 hour to complete...be sure to take notes
  - location: Modules/Module 1/Module 1 Worksheets&Lectures: Concept 15

- 09/01/2020
  - Recording of Zoom meeting can be accessed after 2 pm. This recording is of one recitation session that was run earlier this morning...the content is unique from Thursday's recitation.
  - R4 – Topic 15 due
  - location: Modules/Recitation

- 09/02/2020
  - Watch Lectures: Concept 15 Fluids: Bed of Nails to the last video (6 videos total)
  - Note: worksheets are not for a grade, just for your practice
  - ~ 40 min to complete...be sure to take notes
  - location: Modules/Module 1/Module 1 Worksheets&Lectures: Concept 15

- 09/03/2020
  - Zoom meeting at 11 am – we will cover topics addressed in Concept 15 lectures
  - Join URL: https://clemson.zoom.us/j/97972759330
  - R5 – Topic 15
  - location: Modules/Recitation

- 09/04/2020
  - HW15
  - location: Modules/Module 1/Concept 15 Homework
Critical Thinking

- Transparency
- Right now, fighting this battle, helping students understand what is going on in an online situation
We will use Scooby and the gang to quickly assess our thinking.

Scooby and Shaggy look at an unusual situation and yell “It’s a ghost!”
This is our physical interpretation of the world and the physics student must go deeper than this.

Fred, Velma and Daphne use critical thinking to evaluate the problem. They arrive at a conclusion about the ghost based on reasoning and deduction. We will work through problems in this class evaluating our interpretation of our world on first blush and then through critical reasoning.
Joe is standing on the sidewalk as you pass by in your truck, traveling to the left at 100 km/h. You shoot a ball from the back of your truck, giving it an initial velocity of 100 km/h to the right. Describe the motion of the ball, as Joe sees it.

A) The ball travels as a projectile with an initial horizontal velocity of 200 km/h to the left.
B) The ball travels as a projectile with an initial horizontal velocity of 200 km/h to the right.
C) The ball travels as a projectile with an initial horizontal velocity of 100 km/h to the left.
D) The ball travels as a projectile with an initial horizontal velocity of 100 km/h to the right.
E) The ball free falls vertically to the ground.

The ball is shot at 100 km/h!

\[ v_{ball} + v_{truck} = 0 \]
Let's look at the video for proof!
• Transparency
• Right now, fighting this battle, helping students understand what is going on in an online situation
Physics of Sport
Making meaning from data
$$x = x_0 + v_0 t + \frac{1}{2} a_xt^2$$

Linear Fit for: VideoAnalysis | X

$$X = mt + b$$

m (Slope): 1.297 m/s

b (Y-Intercept): -1.422 m

Correlation: 0.9985

RMSE: 0.01953 m
Conservation of Energy

Work and Power

Pressure
A rigid foot-form (shoe last) was mounted to the material testing machine actuator and snugly fit into a fully-constructed shoe. The actuated foot-form compressed the midsole in the vertical direction to match the displayed general time history of the vertical ground reaction force, producing insole pressure patterns similar to those recorded during running at 18 km/h.

What is the Impulse on the shoe in kgm/s? Assume the force given is the average force. Be sure to evaluate the diagram for information.

\[ I = F\Delta t = 2000 \text{N}(0.185 \text{s}) = 370 \text{Ns} \]
Can football be safe? (Links to an external site.)

Chronic traumatic encephalopathy was once known as "punch-drunk syndrome" because it was thought to be a problem mostly exclusive to boxers. It's not. In 2002, an autopsy of former Pittsburgh Steelers football player Mike Webster, who died at 50, revealed the distinctive mark of CTE: a buildup of a protein called tau. Abnormalities in tau are also present in patients with Alzheimer's disease, and the symptoms of people with CTE are dementia-like. They include impulsivity, loss of memory, confusion, tremor and movement problems as well as depression and anxiety.