“Active Learning and other High Impact Strategies for a Large Gateway Engineering Course”

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The phrase "The king is dead, long live the king!" was first declared upon the accession to the French throne of Charles VII of France.

The Lecture is Dead, Long Live the Lecture!

One solution?

Active Learning
Active Learning Incorporated to Statics

• Class Discussions/Socratic Lecturing
• Open ended questions/Brainstorming
• Class Activities (group quizzes)
• Humor-Video Games
• Class Demonstrations
• Project Based Homework (PBH)
• Experiential Learning (IDEAS)

How?

Which one of the following is a scalar

• 1) Force
• 2) Weight
• 3) Velocity
• 4) Position
• 5) IHNI

Turn to your side and debate with your partner about the possible answers and select 1 😳🤔
Interactive Animated Presentations

What do you remember about **MOMENT**?

- Force
- Torque
- Cross Product
- Force x Distance

**MOMENT OF A FORCE** - SCALAR FORMULATION

“Give me a lever long enough, and a place to stand, and I can move the earth.”

Archimedes, 287 to 212 BC.

Socratic Lecturing and Class Discussions (Clickers)

**Increased my interest, engagement, and class participation** (n=259)

- Strongly Agree: 48.3%
- Agree: 27.8%
- Neither: 9.3%
- Disagree: 1.3%
- Strongly Disagree: 6.9%

**Helped me to better understand the concepts presented in class** (n=259)

- Strongly Agree: 53.3%
- Agree: 25.9%
- Neither: 10.0%
- Disagree: 6.2%
- Strongly Disagree: 4.1%
**APPLICATION OF VECTOR ADDITION**

There are four concurrent cable forces acting on the bracket.

How do you determine the resultant force acting on the bracket?

In your opinion… Which one is the most important of all the components?
EGN-3310  Grading Policy

• Class Activities:
  • UNANNOUNCED
  • IN-CLASS
  • AT ANY TIME (Beginning/End)
  • 5 min-8 min

.....A tool used to measure attention and acquired knowledge...

What is a Class Activity?
Graded unannounced group class activities (group quizzes) converted in Hands-on HW
Hand-Clickers and In-Class Activities

• Class Attendance

• **Focus:** Students must keep focus during the lecture; otherwise they might not be successful in completing the activity.

• **Ask Questions:** Students must ask questions if they don’t understand the material to be sure they can do the class activity.

• **Group work and brainstorming:** Students must brainstorm, discuss, reach consensus, and solve the assigned activity.

Humor and Games

• Introduce Principles and Implement Professional Tools to solve Real-Life Scenarios
Find the Error(s)

Intentional mistakes mimicking most common students’ errors in exams

\[ \vec{Mo} = \vec{r}_{OA} \times \vec{F}_A \]

\[ \vec{F}_A = 7.77i - 5.83j - 17.5k \]

\[ \vec{r}_{OA} = 0i + 0j + 10.5k \]

\[
\begin{vmatrix}
i & j & k \\
7.77 & -5.83 & -17.5 \\
0 & 0 & 10.5 \\
\end{vmatrix}
\]

\[ \vec{Mo} = (-61.2i - 81.6j) \text{N.m} \]

\[ \vec{Mo} = i(-5.83*10.5) - j(7.77*10.5) \]
• Collaborative Project Based Homework (PBH)

"Tell me and I will forget,
teach me and I will remember,
involves me and I will learn"

Attributed to Benjamin Franklin and…
Aristotle; Confucius; Native American proverb; Chinese proverb; Voltaire; Association For Experiential Education
How is the typical the Teaching & Assessment for this class?

- Lectures
- Class Demonstrations
- Online Homework
- Tests (2 Mid-Terms)
- Final Exam

Teaching Delivering
Chegg, Solutions Manuals...
Assessment

Extra Credit Mini-Projects

- One Problem is Assigned as regular Homework to all the Students

- Same Problem is also offered as Additional Extra-Credit where the students Model it, compare results with hand-calculations and

- Make a Video of themselves explaining the problem and conclusions.
Modeling

EXTRA CREDIT[1] for HW2

You have the opportunity of one extra credit mini-project for the Homework grade. This is what is looked for your extra credits:

1. Create a physical model of the problem 3.14 of your HW 2 (Check Measuring Engineering).
2. Read the values from your physical measurements.
3. Solve (theoretically) with your experimental measurements.
4. Compare the results.
5. Make a small video clip of you explaining your model and submit it via webcourses or on before Thursday 23rd (10.59 pm).
6. Also submit the problem solved showing also the measurements from your model (a small report including pictures).

This is a group activity (2 students per group or you can do it by yourself)

You will get up to 30 points added to your HW 2 (Depending on your work)

Dr. Zareian

https://umes.webex.com/meeting/join?h=03h445awv#3k

Mini Projects Equilibrium and Springs

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Mini Projects (2D-Supports Reactions) 
Crane Tilting
3D Particle Equilibrium

Trusses
Centroid

Experimental Calculations!
Scavenger Hunt

Trussemon

Look Around Campus and Catch All Trusses you Can... Snap a Picture, Put the Location on Campus Map, and Describe and Name the Type of Truss if Possible. Submit a PDF Document Showing the Truss, Description and Location on the Map. Also, Some students suggested adding a video [adding].

YOU CAN NOT DO IT FROM YOUR VEHICLE!!!!!!! STRICTLY PROHIBITED!!!!!!!

The first 10 Students with the biggest amount of trusses will earn 3 extra-credit points in the second mid-term...

Gotta catch ém all!

Supports Hunt

Look Around Engr1 and 2 Buildings and Hunt All Supports you Can... Snap a Picture, Make a list and indicate the type of reactions and How Many?

Submit a PDF Document Showing the list of supports with the pictures, where it is, and number/type of reactions.

The 10 students with the most amount of supports/Descriptions will get 3 points in their second mid-term exam.

Do not repeat the same exact one if there are several of the same (You can have several hinges, but only one door hinge)

• Semester Long Experiential Learning Project (IDEAS Showcase)

Preparing the Engineering Student for Success with IDEAS: A Second Year Experiential Learning Activity for Large-size Classes

Dr. Ricardo Zaurin P.E., University of Central Florida
IDEAS Tasks

1) Proposal
2) Literature Review
3) Abstract
4) Physical Model
5) Testing Design
6) Final Paper
7) Presentation to Judges
8) Awards Ceremony

IDEAS Showcase

1) Paper
2) Real-life model
3) Physical simplified model
4) Numerical calculations
5) Lab results
6) Comparison/conclusions
7) Poster
8) Presentation
IDEAS Showcase Fall 2015
Tenth IDEAS Winners (Fall 2018)
Several active learning strategies and their effect regarding students’ success, class engagement, and students’ perception of instruction (n=259)

- **Socratic Lectures and Class Discussions:**
  - 76.1% of the sample said these activities increased their interest, engagement, and class participation;
  - 79.6% expressed that this type of discussions helped them to better understand the concepts.

- **Open ended questions and Brainstorming:**
  - 85.3% of the same sample agreed in the benefits regarding engagement and class participation.
  - 84.6% expressed they were able to make better connections with previous courses’ knowledge and with real life engineering situations.

- **Graded unannounced group class activities (group quizzes):**
  - 74.9% of the students expressed that because the activities were “unannounced” they had to come to class and be prepared.
  - 78.8% said their engagement and participation increased.
  - 80.3% agreed on their understanding of the concepts was better because of it.

**Discussion of the results.**

- **Collaborative Project Based Homework (n=558, 129 participated)**
  - Results showed that PBH participants performed between 60% and 84% better than the non-participants.
  - In addition, 96.8% said this activity helped them to better understand the concepts and
  - 79.1% thought their class engagement increased.

- **Semester Long Experiential Learning Project (IDEAS Showcase)**
  - The percentage of success was between 44% and 81% higher for IDEAS students.
  - Retention within the college (~11 and 13 percent points higher)
  - Higher graduation rate (around 13 points higher for the participants).
Around 3,000 students have participated producing ~900+ papers/projects

Several Presentations (SSTL, NSSC, Stetson, Active Learning Expo, CDL, FCTL, ASEE)

8 ASEE Papers

4 QEP Awards-3 Course Redesign Award

2 Technology Fee Grants

Selected Peer Reviewed Publications


My Learning...

• Be early
• Before entering in the room take a deep breath and smile
• Start small talk with the students
• Hello Guys! How are you doing?
• I am also doing good... Thanks for asking?
• Start with a short story (Halloween) before class
• Move out of the Podium (presenters)
• Walk the classroom
• Talk with students in the back
• Cold Calls? They work for me
• Ask questions?
• Ask explanations of the answers
• DESIGN your activities
• Check the real results of your activities
• Collect Data
• Revise
• Ask students for suggestions on activities

• Try to be familiar with the trends (difficult)
• Relate your activities (if possible) with news
• Baby Steps
• Be prepared to discard the most amazing activity (in your opinion) if it doesn’t work
• Introduce new activities as extra-credit until you prove they work
• Do not do it ALL at once
• Have a transparent syllabus and rubrics
• Be prepared to accept criticism (even from your colleagues)
• Disseminate your results
• Attend to conferences (even if you don’t present)
• Stay after the lecture for few minutes with the students that wants to talk to you
• You don’t have to be their friend but definitely not their enemy

• It is a lot of work... but IT IS WORTH IT!

Questions? Comments? Collaborations?
Your Turn!!!

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