## Exciting students for deep learning

Leon Liebenberg Mechanical Science and Engineering 5 Nov. 2020



#### 'I did not realize that I took my routine and university day for granted until now.'

'Difficult to work in the same environment all day.'

#### 'Online labs do not have the same impact as physical hands-on counterparts.'

'Seeing friends was a key part of coming to class. I miss that.'

'Sharing design ideas virtually is difficult.'

'I am actually quite fond of it.'

Sophomore Matt Grendzinski working at home (April 2020), chatting with his ME 270 teammates. (Photo used with permission)



To succeed in online classes, students must take more responsibility for their learning.

Self-direction!

# What positive and negative teaching experiences have you had?



Virtual poster collaborative Forum excitement => talk office hours connecting ///





Core of success in teaching: Creation of enthusiasm about knowledge and learning

#### To get students excited to learn

### Reason does not get people to act. Emotion is what causes people to act!

It is neurobiologically impossible to build memories, engage complex thoughts, or make meaningful decisions without **emotion**. We only think deeply about things we **care** about. - Antonio Damasio

## I teach, by motivating Students get motivated, and excited They learn (by teaching themselves)

#### 1. Make it Collaborative

Learning awakens a variety of internal developmental processes that can operate only when the student is interacting with people in her environment and in cooperation with peers.

– Lev Vygotsky

Sharing knowledge and perspectives

Teaching and motivating each other

Social recognition

Relatedness

### 2. Mix them up

Diverse teams

Thinking preference questionnaire & answering an open-ended question

Team contract helps

	(Encir	cle only 3 attributes t	ce map
	(Elicit	describe you)	nut best
Concerned w	<b>LYTIC</b> ith data, facts, logical / rational		<b>INNOVATIVE</b> Concerned with the future, newness possibilities, strategy, "big picture", con
Making order Organizing and aligning	Thinking logically Rational and data-focused		Innovation Loving ideas New and Looking for new different theories and approaches concepts
Collecting Acquiring things or facts	Fixing it Seeing what's wrong, solving problems	Wanting to win Inspired by competition	Thinking ahead Always focused on the future Cut of the hear
Now Dealing with present, rather than future	Things Dealing with things, rather than people		Out-of-the-box thinker Adapting Finding Flexible, doesn't alternative scenarios and options
	Love of learning Always reading, researching, listening to presentations	Humor Always finding humor in situations	Synthesizing Experimenting Playing with ideas and ideas and possibilities come up with something new
Reliability esponsible and accountable	Having confidence Self-assured		Empathetic Intuitive Feeling for Trusting your others 'gut' instinct
<b>Fhinking back</b> Jsing the past as benchmark	Get to action Making something happen now	Thinking alone Needing time to contemplate	Peacemaking Storytelling Seeking Using stories to harmony inspire
Focusing ingle-minded oncentration	Equalizing Fairness for everyone	Goal-setting Constantly	Mentoring Fostering growth in others Networking Building Connections and 'bridges'
	Precision Vorking exactly and accurately	driven toʻ accomplish	Hands-on learning Including Touching, feeling 'All for one, and and using a tool or one for all' object
PROCED	OURAL		RELATIONAL

#### 3. Make it Performative

Get students to introduce themselves via a 1-minute video.

Let students document their work with ePortfolios (Wix, Digication ...)

- Communicate abstract concepts in simplified manner
- Brings students onto same page, organizes information, and presents it an efficient and accessible manner

https://psg203.wixsite.com/me270-petergutfeldt



Fabrizzio Vega (freshman) introducing himself to his ME 400 teammates. (Image used with permission)

#### 4. Break syllabus into bite-size chunks

Several mini assignments, "Mini-Projects"

Cumulative (formative) assessment

Self-directed and Scaffolded

Team-based assignments; last one is solo

Every mini-project:

- $\checkmark$  Covers a core aspect of syllabus
- ✓ Analysis + Synthesis
- ✓ What is? What if? What wows?
- ✓ Disassemble discarded products
- ✓ Honor Code statement

lome	Mini Project 1 ~	Mini Project 2 ~	Min	ii Project 5 ∽ Mini	i Project 10 v
		Analysis	>	Ice Shaver	
	<u>ii.) Can "18/8</u> <u>think it can p</u>	Design Challenge	>	Keychain	well as cast iron? Do you
	The melting p	Reflections		General Analysis	en 1400-1455°C. The melting
	point of cast in and easy to c	ABET Learning Go	bals		of iron and carbon that is a useful ing point. Since the melting point
	of AISI type 3 18/8 stainless	Sources		0	it, it would be more difficult to cast cous than cast iron which requires
					han cast iron making it more e most common type of stainless
					s 18% chromium and 8% nickel. 304 stainless steel, it is still
					used because of its good tainless steel is usually casted
		U U		n shape casting like It to shape cast ste	e sand casting, which is used for el.

Extract from a team-based ePortfolio of a series of 10 "miniprojects" in ME 270. (John, Shanay, David, Matt, and Francesco)

#### 5. It takes a lot of preparation



#### **Typical sequence of mini-project activities**

### 6. (Guided) Self-directed learning

## Open-ended questions have tips

Required: Rigorous, independent research

Self-reflection on learning

'How to?' + "Why?" +
"Value judgment"

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	This site was designed with the WIX.com website builder. Create your website today.	Start Now	
ME 270 E-F			
I	Reflection Three		

I have found that ME 270 really challenged the breadth of my knowledge of the design process from start to finish. This class has not only challenged the way I approach a problem, but the way I iterate through it as well. I was particularly impressed by the brainstorming unit. As a senior engineering student this part of the process seemed to be second nature. However, it challenged me to approach a problem from directions that had not occurred to me before. This was beneficial not just for the lab but for the final project and my other courses as well. I also found the recycling unit to be quite helpful because recycling of materials is what the entirety of my senior design project centers around. I was introduced to equipment I had not considered and was also able to find a piece of technology that will now be part of the final solution for the project. Finally, the simple concept of "design for manufacturability" has given me insight not only on how to design a product but how to simplify one.

One challenge I've faced over the course of the semester is familiarity with the software used in the class. The technology such as CREO and aPriori feels outdated and is un-intuitive to interface with. I was able to complete labs and other projects using Autodesk software such as Fusion 360 in half the time I spent riding the learning curve to use unfamiliar software. I also struggled with the time commitment of this class. While the work is doable and enjoyable, the time frame in which assignments are expected to be completed is shorter than I would expect. Scheduling out time to meet with my group consistently and put in hours of my own proved difficult.

All in all, I expect what I have learned in this class to carry over to future projects I will work on. While of course the prototyping and manufacturing lessons will be of use on future design projects, the way this class

#### 7. Make it situated

Establish a context that gives value to the necessary skills.

Adoption of contexts helps students to appreciate the immediate situation and underlying content.

"Real-world" challenges!

Discover the larger, interrelated system. Immersion!

> Spring 2020 individual mini-projects. ME 270 Students challenged to repurpose existing non-medical products for application in Covid-19 emergency scenarios



https://maciekmbaran.wixsite.com/mbaran20/2-1-the-product



Learners not only need to learn but also need to know what they know Self-confidence **Motivation** 

#### 8. Virtual ideation

GroupMe, WeChat, Discord

Miro idea boards

Active participatory learning

Synchronous interaction

Captures essential elements of a face-to-face ideation environment



### 9. Make it Tangible

Students like stuff they can see and touch.

Ask students to disassemble products.

And to make low-fidelity prototypes.

Play with ideas!

Big payoff is not the stuff they build, but insights gained.



cardboard to fold and put

together.

MP #3 Team AB9\_1

Due to the relief notch, the sheet did not deform much, therefore there is less strain. This design was the easiest to form; as you can see in the picture, an extra hand was not needed.

### 10. Stay in touch

Talk to students in real time.

#### Empathize!

Adjust your expectations.

Our classroom "personality" affects the learning environment. From:

Sent: Monday, September 14, 2020 10:40 AM To: Liebenberg, Leon <leonl@illinois.edu> Subject: Thank you

Good morning Professor Liebenberg,

Thank you for your understanding, encouragement, and feedback; it means a great deal to me. I am indeed doing better this week!

Sincerely,

From: Liebenberg, Leon <<u>leonl@illinois.edu</u>> Sent: Sunday, September 13, 2020 3:51 PM To: Subject: How are you doing?

Dear

Thank you for your quiz. And for your superb work! No problems regarding the lateness, and no apologies necessary. Your problem-solving methodology is absolutely stunning, beyond being exemplary.

I am however concerned about the snow-ball effect due to your assignments being constantly late.

### **11. Activate peer learning**

- ✓ Get students to peer-grade each other's assignments (Google Forms)
- ✓ Detailed grading rubric and grading key

 ✓ Peer review promotes curiosity and critical evaluation of other approaches

✓Prompt response

ABG_2 AB1_1	The picture is not really clear because of the rack that is on top so it is hard to tell what the tray exactly looks like. 4 Also there are more pictures			The descriptions are clear and		The worst and best material was switched around and the discussion of strain to failure percent difference was missing.			The graph was correct as well as the discussion was 10 detailed.	
Everything was answered correctly.	Everything w 10 detailed.	vas answered and	The 5 corr	process and answer was ect.	t	he answer was v here were missin variables that wer	g and wrong	The steps that along with th 10 correct.	at were taken ne answer is	8
Dashed lines were not used to notate bend lines and there were no slots for the sides to insert into.	Clear	pictures along with ion met the criteria.		Some component missing and the fo was not compact 9 was a good projec	ormatting however, it	89				

### 12. Make it Fun

Discovery, re-inventing new perspectives, new solutions

Excite students with projects of their choice.

Use "playful" tools.

Stage a virtual class competition.

Student presentations (celebrations)



Team AB9\_1: Alexis Larson, Madison Yang, Maritza Renteria, Alex Stevens

**Team AB8\_4**: Adithya Ramakrishnan, Dean Wiersum, Frank Baez, Matthew Lotarski

Team ABG\_2: Kang Yoon Lee, Yantong Lin, Yun Hui Phoon



https://kierann2.wixsite.com/website https://averyrh2.wixsite.com/website https://roundme.com/tour/373767/view/1278498/ https://me200group11.wixsite.com/website Connections between the course material and students' lives outside of the course are one of the best available learning tools

#### Hailing the "whole"-student

#### COGNITION + EMOTION + ACTION (+ SPIRIT):

(Guided) Self-direction

Logic + Intuition / Imagination

Sense of control

Intrinsic motivation

Divergent (+ Convergent) thinking

Synthesis (+ Analysis)

Experiential (+ Abstract) learning

Immersion

Constant challenges

Reframe questions

New experiences from old circumstances

Clear + prompt feedback

Enjoyment

Excitement



## Does this integrative pedagogy work?

#### "Flow experience"

"Flow": Total involvement, focus

Challenge vs. Skill

A state of "flow" leads to greater interest and motivation to learn.

Does greater engagement due to "flow" (via mini-projects) lead to a more holistic learning experience? (ME 200,Thermodynamics, Fall 2019)



Pagano A, Goldstein M, Liebenberg L. Play-in-learning: studying the impact of emotion and cognition in undergraduate engineering learning. American Society of Engineering Education, ASEE 2019, Tampa.

## Cognitive and Emotional engagement

Measured students' cognitive and emotional engagement when subjected to mini-project & ePortfolio pedagogy (in ME 270)



Tucker A, Bo-Linn C, LaBore C, Wolf A, Baird R, Liebenberg L. "Transforming an Engineering Design Course into an Engaging Learning Experience using ePortfolios. *American Society of Engineering Education, ASEE 2020, online.* 

### **Continued Learning**

Independent study after completion of course



#### **Re-imagining the future**

Creative, committed online teaching can create deeper and richer learning experiences.

We should rethink and remake our educational practices.

Consider not only WHAT we have previously done but WHY we have done it and HOW it can be done better (for face-to-face *or* online learning)

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