Using Reflection and Entrepreneurial Mindset to Promote Intentional Learning Paths for Students

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Why Care?

Lack of Student Engagement

How Do We Motivate Students to Learn More Intentionally?

Toward Intentional Learning Paths

- Reflection and Connections
  - to make meaning of and integrate learning

- Entrepreneurial Mindset Learning
  - to give purpose to learning

Entrepreneurial Mindset

To provide practice and purpose to learning

Design & Prototype a Water Tower Scaffold

Challenge Statement

Your engineering firm, **We Build Worcester**, started by a couple of WPI graduates, has a contract with the New England Water Works Association **(NEWWA)** to design and prototype a portable elevated platform to allow workers to construct a water tower under wind conditions using the following materials:

(1) one deck of cards and

(2) one roll of Scotch tape.

The tower construction will occur during the 2018 Summer Olympics in Hawaii, which means that we cannot have any accidents, and the structure should not takeaway from the Olympic atmosphere. This would be a disaster for the state of Hawaii who desperately needs a boost in their economy.

Design & Prototype a Water Tower Scaffold

REFLECTIONS

What made your project successful or not?

Engineering thought and action

Collaboration

Communication

Character

These are Skill Sets…but there is more

Design & Prototype a Water Tower Scaffold

REFLECTIONS

Disposition

Attitude

Motivation

MindSet

Design & Prototype a Water Tower Scaffold

REFLECTIONS

What fraction of success do you think it can be attributed to Mindset versus Skillset?

Most frequent answer 50-70%

Entrepreneurial Mindset Learning(EML)

THE 3 C's:

CURIOSITY

DEMONSTRATE constant curiosity about our changing world

EXPLORE a contrarian view of accepted solutions

"I have no special talents. I am only passionately curious." Albert Einstein

CONNECTIONS

INTEGRATE information from many resources to gain insight

MANAGE and ASSES risk

CREATING VALUE

IDENTIFY unexpected opportunities to create extraordinary value

PERSIST through and learn from failure

Entrepreneurial Mindset Learning

Course: Introduction to Physics-Mechanics(PH1111)

Department: Physics

Title: Improving Living Conditions in South Africa-Static Equilibrium and Elasticity

Term: 2016 A-Term

# of Students: 82

Improving Living Conditions in South Africa
Static Equilibrium and Elasticity

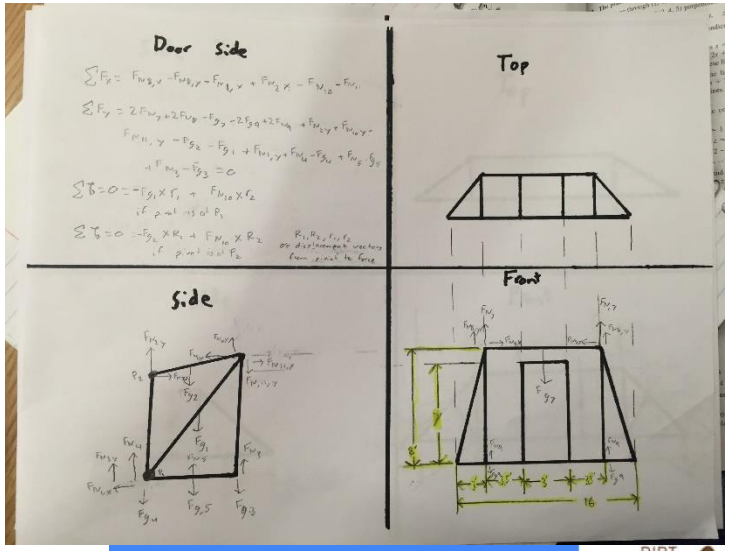
Challenge Statement

A WPI team working on their IQP has just arrived in South Africa. As they explore the surroundings in their free time, they are profoundly impressed by the need of better shacks in the area. The WPI IQP team knows that better housing can be built, but they need help. In order to designing a new shack, they reach for help to the on-campus student community.

The WPI IQP team has identified the following fundamental requirements for designing the new shack: (1) have a light structure, (2) be expandable, (3) to efficiently protect from elements, and (4) be cheap. The students in PH 1111 are ready to take on the challenge. Using your knowledge covered in mechanics (forces, torque, angular momentum, static equilibrium) and with help from your teammates you feel ready to design a new shack and contribute to people's life.

Improving Living Conditions in South Africa

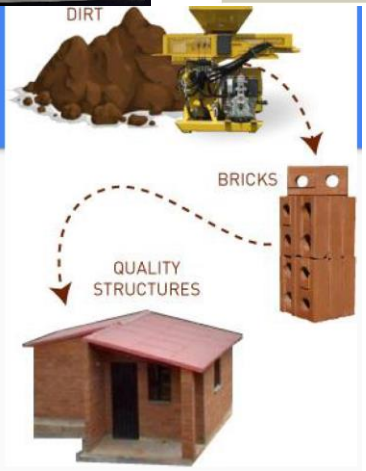
EXAMPLE STUDENT SOLUTION

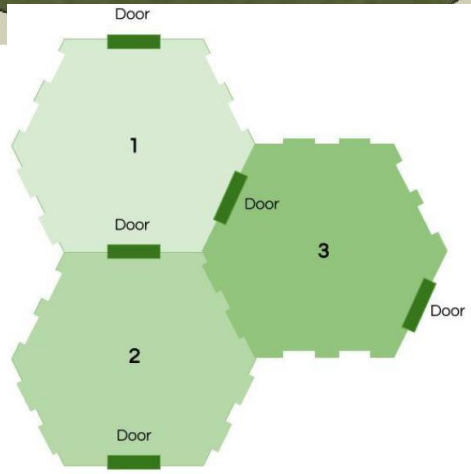


Materials/Cost:

Available Resources: DIRT!

- Vermeer's BP714 Earth Block Machine
  - 3 Gallons of Diesel
  - 2.6 cubic yards of dirt
  - 6-8% cement- weather resistance
  - 240 blocks/hour (1400-1900 per day)
  - 7" x 14" x 4"
  - Standard Price: $17,000





Entrepreneurial Mindset Learning

Course: Introduction to Physics-Electricity and Magnetism (PH1121)

Department: Physics

Title: Improving Living Conditions and Energy Poverty in South Africa

Term: 2016 B-Term

# of Students: 125

Improving Living Conditions and Energy Poverty in South Africa

Challenge Statement

"My old shack was made from wood, and it was also very cold and flooded often. My children were constantly sick, but life is very different now. We have lights, and it is no longer cold at night. The children are feeling better, which makes me happy," Plaatjie told IRIN.

"The iShack was developed in a master's degree program at the Sustainability Institute of Stellenbosch University; an initial instalment of $250,000 was received from the Bill and Melinda Gates Foundation to scale-up the project.

The three iShacks in Enkanini cost $870 each, and are equipped with a solar panel, distribution box and battery - which can power three lights, a cell phone charger and an outdoor motion detector spotlight, a consequence of technological advances in lower wattage lighting systems. Each also has a rainwater harvesting system. "

Can you students in PH 1121 at WPI do better? With your knowledge gained in the Electricity and Magnetism class, your drive to make the world a better place, and your outstanding creativity, can you power the shacks that you mindfully designed in the PH 1111?

If you will (1) provide more power to the shack, (2) provide a solution for cheaper or no cost electricity (3) wire the shack for the appropriate everyday needs, you will make a tremendous difference in people's life.

Modules Summary

Objectives

- collect and critically evaluate relevant information on existing shacks and living conditions in South Africa
- identify and define parameters (technical, regulatory, economic) needed to consider when designing the shack
- apply the static and equilibrium and elasticity concepts to build a structure specific to certain conditions
- apply electricity concepts to wire a house specific to certain conditions.

Deployment and staging schedule

- two weeks; Introduce in class; Research outside the class
- Jigsaw; in class expert groups; out of class home groups

Deliverables and student assessment

- in class 15 minutes presentation for reporting (group)
- student assessment includes student evaluation forms.

Improving Living Conditions and Energy Poverty in South Africa
EXAMPLE STUDENT SOLUTION

iShack- Lighting up Africa

Jack Marabello, Catherine Matyas, Jessie Gaulin, Brian King

Goals

This project had three goals:

- Provide more power to the iShack
- Provide cheaper of no cost electricity
- Wire the iShack for everyday needs of a family

We have met these goals though the application of efficient solar power, as well as wiring the iShack to provide more than before when it comes to the basics of everyday needs.

Basic Family Needs

The most important goal of the iShack is to make sure that the basic needs of a family are met. Thus, we found the wattage of important necessities, as well as the price, and made sure that our iShack could support them.

Item	Power Consumption (W)	Price (R)
Indoor Light (3)	5	74.95
Outdoor Spotlight	150	1,488.38
Cellphone Charger	5	-
Fridge	33	1,999.00
Misc (Radio, TV, fan, etc.)	50	0-1000
Total Average	62	3,562.33 +-1000
Average kwh	45 kwh per month	540 kwh per year

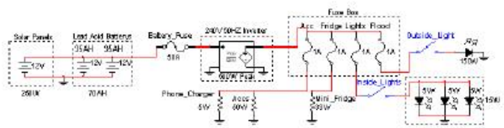
Basic Family Needs

These items were selected based upon importance and use in households in Africa. Indoor and outdoor lights are important for work and security. Cellphone chargers are important for maintaining communication. A fridge is essential to stop food from wasting and being unhealthy to eat. In addition to that, the radio or TV are very commonly found in households, and thus are important to include when calculating the power needed so that the family will not have to give anything up to have these. The numbers were found based upon reported wattage, as well as approximated usage. The prices are in South African currency, due to the fact that most of these item could be purchased after the iShack is built in Africa. Our total pricing for these electronics are below.

	Price in Rand	Price in USD
Items that need power	3,562-4,562	224.17-287.11
Power System	6,991.34-8,024.15	440-505
Total	10,553-12,586	664.17-792.10

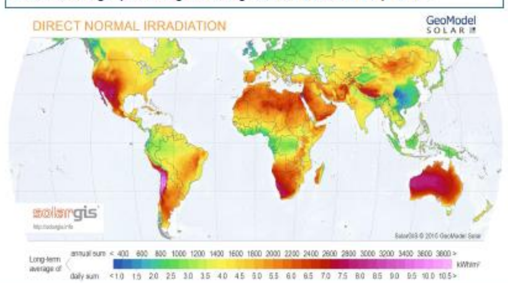
Wiring the House

The wiring was done with the needs of the family and the power system in mind. Overall, it is the simplest way to wire the iShack keeping in mind the regions plugs and power sources in mind.



Power Supply

We chose solar power due to the fact that wind speed and gas were less desirable options. Wind speed varies tremendously in Africa and day to day, making it an unreliable source of electricity. Gas generators are faulty due to the fact that the people using them do not have access to a constant supply of gasoline and won't be able to upkeep the generator. Also, there are no low wattage options designed for long-term use that are as cheap as solar.



Power Supply and Wiring Parts

The power supply was chosen with the household needs listed in mind. Solar was most efficient. Given that there are an average of 6.5 sunny hours in Africa a day, at 45 kwh, that gives 230 watts, so we needed a 250 watt solar system based upon inverter loss, which is about 80%. We used 240v 50hz inverter because that is the standard outlet type in South Africa.

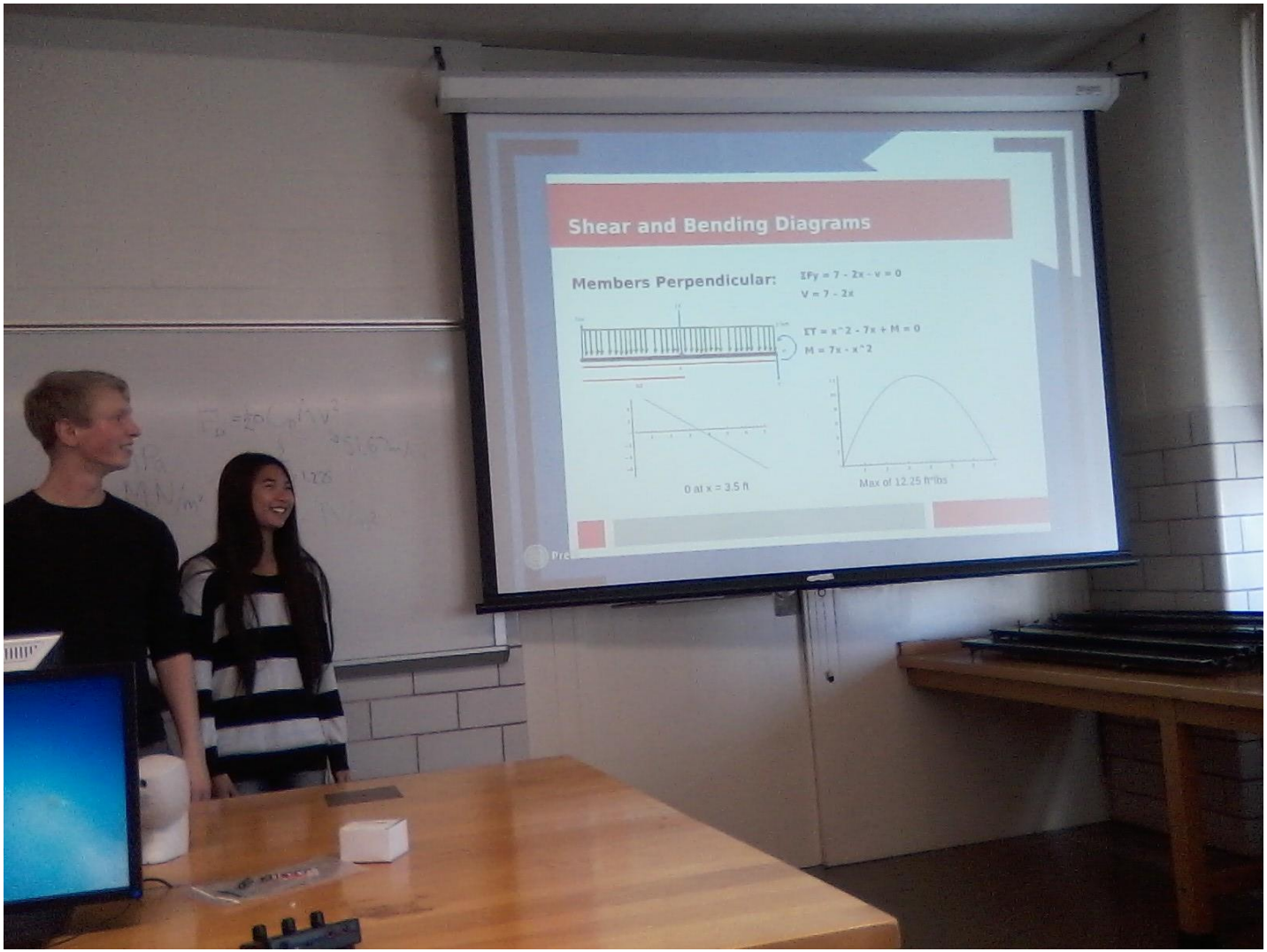
Item	Price (USD)
500W Inverter	55
250W Solar Panel	300 each
14AWG 15A Wire	.2 per foot
Fuse Box	15
12V 35AH Deep Cycle Battery	65
Fuses	.05 each
Universal M type outlet	6
Total (One vs Two Batteries)	440-505

Conclusion

Overall, the project is relatively inexpensive, suited for the region, and provides more than the iShack already does. By adding the power for a fridge, albeit a small one, there is the ability to keep food fresh, which will cut down on the need to get it, the money wasted by food going bad, and the potential health problems that come with eating food that has gone bad. In addition to that, factoring in the television or radio in the power consumption means that the family will not have to lose something if they wish to use those. The power source is suited for the region due to the amount of sunlight, as well as being more reliable and easier to maintain then wind or gas power. The wiring and pricing takes into account what is normal and available in the region, which is important because the family may wish to purchase their own electronics without ruining them with an ill suited power source.

References

QUESTIONS?


Shear and Bending Diagrams
Members Perpendicular:
ΣFy = 7 - 2x - v = 0
V = 7 - 2x
ΣT = x^2 - 7x + M = 0
M = 7x - x^2
0 at x = 3.5 ft
Max of 12.25 ft*lbs

Using Reflection

To Connect and Integrate Learning

Reflection Is Beneficial

For Students:

- **Connect, deepen, and make sense of their learning**
- **Achieve integrative learning across the curriculum**
- **Learn how to learn**
  - Reflect on strengths and challenges in the learning process
  - Reflect on how they are learning in the course
  - Connect to other courses they have taken or will take
  - Develop curiosity and awareness.

For Instructors:

- **Understand** student's experiences and challenges in the course
- **Compare** what they've learned to the learning goals.

Use Targeted Reflection

- **Rationale:** *"According to conventional wisdom, thinking interferes with doing". Donald A. Schon.*
- **3 Key Reflective Moments**

Start of Term
- Learning process
- Homework strategies
- Time management

Mid-Term
- Exam preparation
- Test taking strategies
- Plan of actions
- Team dynamics

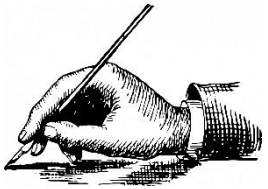
End-of-Term
- Integration of learning
- Making connection over time and across courses

Micro-Reflections in Lectures

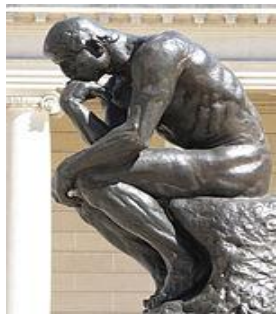
Could include formative assessment:
- What did we learn from last class?
- Minute CAT
- One Sentence Summary
- Muddiest Point

Assessing Reflection (Ash & Clayton, 2010)

- Assessing critical reflection may be challenging.
- **Example of Early Self-Assessment**
- Some key questions to keep in mind:
  - Did you ***identify*** a *personal characteristic, a winning learning strategy, or a challenge* ?
  - Did you ***explain*** *it* (so that a stranger can understand it)?
  - Did you consider ***how*** you found out about it? (e.g., When did you see it or note its absence?)
  - Did you ***analyze*** *the sources or causes* ?
  - Did you ***develop*** *or summarize your plan of action* for a *more effective learning experience* in this course and beyond?



Sample Reflective Assignments



A Few Examples

Examples of Reflective Assignment

- Student Background Information
- Early Student Self-Assessment on Learning
- Team Critical Reflection
- Post Exam Self-Assessment
- Integrative Reflection on Learning
- Micro-reflections

Integrative Reflection on Learning

Student Perceptions

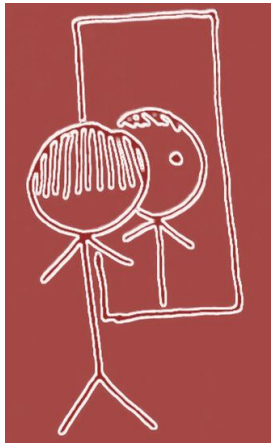
- *The **early self-assessment***
  - *"made me look at my habits in the classroom up to that point and see whether or not they were making me successful".*
  - *"… asked about completing assignments on time, and I realized that I wasn't allocating enough time for the reading checks".*
- *The **Post-Exam Self-Assessment**:*
  - *"helped me review topics that were still relevant but I was still getting wrong"*
  - *"made me look into my study habits and make adjustments"*
- ***The end-of-term reflection "***
  - *"gave me a chance to look back on what I had learned during the course, and note how that might be useful to me in the future."*

Sample Responses from Economics

- ***End-of-term Integrative Reflection on Learning***
  - "The laws of ***supply and demand*** show up from time to time in ***Chemistry*** when we talk about ***reactions***, though of course, they have different names."
  - "Various ***calculus formulas*** make appearances in economics as well (even though we didn't talk about them), so that foundational knowledge is there."
  - "This course will generally change how I look at the world going forward. … It is interesting to ***analyze various political ideas using economics principles***, and think about whether or not they would be beneficial."
  - "I have been able to relate it to my past ***psychology*** course. When thinking about the diffusion of responsibility, I am able to relate ***public goods and common resources*** to that. When I think of the ***Tragedy of the Commons*** example in the textbook, I am reminded of ***Kitty Genovese***."
  - "I learned how to ***organize my time more effectively*** and reduce my tendency to procrastinate. Not only did this apply to microeconomics homework, but it carried over to my other two classes."

It's Your Turn– Design Your Reflective Activities

Identify types and levels of reflection suitable for the course/lab/project



- Name the activity
- What will reflection help achieve?
- Develop at least one prompt
- How would you assess their learning?
- How would you motivate students to complete it?

Take 5 minutes to prepare

2 min to share

Tools for Reflection

- Refection Prompts for written essay
- Workshop with team reflection and class discussion
- Peer-review of reflective assignments
- One-to-one meeting with instructor to discuss responses
- Alternative forms of reflection – Formative assessments
- Motivate students (grading rubric, grading system, effects)

Conclusion

- Promoting Intentional Learning is Important
- Reflection and Entrepreneurial Mindset can help to promote more intentional paths of learning
- Questions and challenges may arise

Going Forward

Feedback

- Help us make the workshop better
- Please fill out the evaluation sheet

Actions Moving Forward

- Write down 2 compelling actions/next steps for improving your course using some ideas from this workshop

Take 2 minutes to prepare

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