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DELVING INTO DESIGN: USING DESIGN THINKING IN STEM CURRICULUM ENVIRONMENTS
A case study from a design workshop at Rochester Institute of Technology

Professors are the facilitators

Group of 3–4 Students work collaboratively

Design Thinking Process
Background

This presentation features a case study of a workshop that includes Middle School aged students (grades 7–9) who came to a university setting for a week-long summer workshop.

The students were taught by university design professors to learn life-long problem-solving techniques and strategies through design thinking. The “Delve into Design” workshop was an interactive, experiential, immersive learning experience that provided exposure to design thinking and problem-solving.
Workshop structure

The workshop format was developed as a learner-centered environment for all types of learners by offering information both verbally and visually, so the students could learn the best way that suited him or her.

The professors provided real world examples so the information was connected to what students have experienced, and how the process and ideas were used and employed in real world examples—which helped to establish a bridge between theory, history and practical use.

As a means to identify student strengths and weaknesses, critiques and discussions were used throughout the workshop as a time of learning and check for understanding. Student participants also benefitted from one-on-one meeting time with the instructors so they could get personalized feedback.
The workshop was led by 2 design professors and college student mentors. Students participants were in grades 7–9. Students worked in a studio setting and in a computer lab to solve a design problem, while exploring how thoughtful design positively impacts our daily lives. Students thoughtfully presented their final work to a panel of judges on the last day.

- The workshop had a focus on design thinking rather than final finished designs. Process and a strong sense of communication along with collaboration is what mattered most.
Team task (as presented to workshop participants)

Your team will pick a theme or category.

You and your team will design the next big THING!

Your team will need to name IT.

Your team will need to research it, plan it, sketch it, describe in detail how it works, why it’s needed etc ... like you would for a shark tank.

Your team will make a presentation to sell IT (include name, price, sales pitch, audience, human factors, green aspect, etc).

On Friday your team will present your ideas to a group of judges.
Theme or category

Leisure / Recreation
Fashion / Lifestyle Accessories
Communication
Technology
Home Items
Personal Care, Wellness and Beauty
Transportation
MODELING EXAMPLES

(Also given to the participants was background information to further inform them about the examples presented)
Snapchat co-founders Evan Spiegel (left) and Bobby Murphy on The Colbert Report.
Fidget Spinner
Lego
Swell Water Bottle
Rainbow Loom
Problem to solve

• Your team will pick a theme or category out of hat
• You and your team will design the next big THING!
• Your team will need to name IT
• Your team will need to research it, plan it, sketch it, describe in detail how it works, why it’s a good idea etc ... like you would for a shark tank
• Your team will make a presentation to sell IT (include name, price, sales pitch, audience, human factors, green aspect, etc)

Analyze
Define objectives
Identify audience/users
Determine time table
Forecast
Prioritize
Define specifications & limitations
Students divide tasks
Objectives: IDEO on Design Thinking

*Design thinking is a human-centered approach to innovation that draws from the designer's toolkit to integrate the needs of people, the possibilities of technology, and the requirements for business success.*

Tim Brown, president and CEO

- Thinking like a designer can transform the way organizations develop products, services, processes, and strategy.

- Design Thinking brings together what is desirable from a human point of view with what is technologically feasible and economically viable.

- Allows people who aren’t trained as designers to use creative tools to address a vast range of challenges.
Objectives for the workshop

• To introduce techniques and strategies of design thinking and brainstorming to solve problems
• To practice both divergent and convergent thinking skills in solving problems
• To practice sketching and other means of visual communication to share concepts with others
• To work on meaningful design projects
• To encourage social skills and a sense of community by having students work collaboratively
• To develop self-reliance and confidence by having students work individually
• To provide students with access to various instructors as appropriate on a rotating basis, as well as to college student mentors
• To provide instruction in software to assist in the completion of the project for the workshop
• To have student groups each prepare a professional presentation in a shark tank like manner to an audience of guests and judges
The Design Thinking:  
A Systematic Approach

1. **Design Brief**  
   - Analyze  
   - Define objectives  
   - Identify audience / users  
   - Determine time table  
   - Forecast  
   - Prioritize  
   etc

2. **Investigation**  
   - Research and discovery  
   - Competitive analysis  
   - Brainstorm  
   etc

3. **Developing Alternative Solutions**  
   - Ideation  
   - Exploration  
   - Sketching – thumbnails  
   - Composition  
   etc

4. **Shape & Delivery**  
   - 1st Draft  
   - Evaluation  
   - Refinement  
   - Evaluation  
   - 2nd Draft

5. **Choosing a Solution**

6. **Models, Prototypes, Finished Comps**

7. **Testing & Evaluating**

8. **Final Completed Solution**  
   - Manufactured, posted, printed

**Objectives**

**Convergent Thinking**

- Information is at the center and possible solutions move outward from that point.

**Science and Technology**
- Left-brain dominant
- Logical, literal, analytical, and objective
- Approach problems in a sequential or linear direction as a series of parts
- Excel at challenges such as mathematical problems and are generally effective verbally
- Gather and study information from a variety of sources and reaching one absolute conclusion

**Divergent Thinking**

- Information is at the center and possible solutions move outward from that point.

**Arts and Humanities**
- Right-brain dominant
- Intuitive, imaginative and artistic
- Approach problems holistically, synthesizing information and interpreting seemingly random data in a systematic approach
- Excel at spatial problems and the use of metaphors
- Gather and study one stimulus and generating a range of possible solutions to the problem

*Hudson (1967)*
Objectives: What is collaboration?

To work jointly with others or together especially in an intellectual endeavor.

http://www.merriam-webster.com
Objectives: Why is collaboration?

Group projects can help students develop a host of skills that are increasingly important in the professional world (Caruso & Woolley, 2008; Mannix & Neale, 2005). Positive group experiences, moreover, have been shown to contribute to student learning, retention and overall college success (Astin, 1997; Tinto, 1998; National Survey of Student Engagement, 2006).

Properly structured, group projects can reinforce skills that are relevant to both group and individual work, including the ability to:

• Break complex tasks into parts and steps
• Plan and manage time
• Refine understanding through discussion and explanation
• Give and receive feedback on performance
• Challenge assumptions
• Develop stronger communication skills

https://www.cmu.edu/teaching/designteach/design/instructionalstrategies/groupprojects/benefits.html
Objectives: Why collaboration?

Group projects can also help students develop skills specific to collaborative efforts, allowing students to...

- Tackle more complex problems than they could on their own.
- Delegate roles and responsibilities.
- Share diverse perspectives.
- Pool knowledge and skills.
- Hold one another (and be held) accountable.
- Receive social support and encouragement to take risks.
- Develop new approaches to resolving differences.
- Establish a shared identity with other group members.
- Find effective peers to emulate.
- Develop their own voice and perspectives in relation to peers.

https://www.cmu.edu/teaching/designteach/design/instructionalstrategies/groupprojects/benefits.html
Objectives

Brainstorming

Group and individual brainstorming
Mind mapping
Word association
Word banks
Visual association
Ask questions
Forced limitations
Idea switch
Matrices
IDEO Brainstorming

- Defer judgment and no editing
- Encourage wild ideas
- Build on ideas of others
- Stay on topic
- One conversation at a time
- Be visual; use big paper
- Go for quantity of ideas
- No more than 30 minutes per session
- Consider people, business and technology
- Re-frame the question
Investigation

Research
Discovery
Competitive analysis
Interviews
Divergent thinking; Brainstorm
Developing Alternative Solutions

Synthesize
Interpret
Ideation and more brainstorming
Exploration
Sketching + thumbnails
Composition
Shape & Delivery

1st Draft
Evaluation
Refinement

Evaluation

2nd Draft
Choosing a Solution

Self editing is an important skill and a key part of the process. Based on facts the students uncovered, along with logic, each group should be able to determine, identify and select the strongest solution(s).
Finished Comps, Models, Prototypes,

Work the initial comps into finished comps that may include models and prototypes. Final presentations are put together.
Finished Comps, Models, Prototypes,

Rehearsing for presentation.
Final presentations
Final presentations
Final presentations to panel of judges
Final presentations
STUDENT GROUP SOLUTIONS
PAWllywood Hotels

Where your pet is the star!

PAWllywood treats your pet like a star!

Pet Spa
Your pets will get pampered in the spa where they will have a luxurious day being treated by our masseuse and highly skilled team. Your dog or cat will have the option to get groomed, trimmed, have play time with other animals, and go swimming.

Pet Kennel
A luxurious pet kennel is available if you need it. Pets will have potty breaks and play time with our friendly crew. There is no need to be stressed out, we will accommodate all of your needs and wants... and theirs too!

Your own Spa
For an even better experience, you are welcome to go to our spa for HUMANS ONLY! You will get a break from reality and have some personal time to relax. We want you to feel welcome which is why we have chosen a calming but sophisticated color scheme for every area of our hotel.
What is Chameleon?
Chameleon is a type of sneaker that has the option to change into all kinds of sports cleats.

How does it work?
The cleat attachment will come in 2 parts, one for the front and one for the back. To turn the sneaker into any kind of cleat, all you have to do is clip the attachment on.

Which sizes will these shoes come in?
These sneakers are for any person from girl's size three to women's size ten and boy's size four to men's size 12.

How much will they cost?
The shoes cost $75.00 and each attachment is $25.00.

Which kinds of cleats will it come in?
When the product is first launched, the attachments available will be basketball, track and field, football, soccer, baseball, lacrosse. The sneakers will also come in all different colors.

Where can I buy it?
The product will be available at our website.

Instead of buying multiple pairs of cleats for different sports, just buy Chameleon.
About the MPM!
The MPM is an easy, portable solution to your storage needs. With this product, it is very easy to send and retrieve movies, pictures, and music, resulting in endless memories.

MPM Energy Cords!
With our Energy Cords, transferring items is effortless when you simply plug in your cord to both your mobile device and the storage bank.

MPM Style!
64 gigabytes of amusement can be stored on MPM. Our bank comes in solid colors, patterns, and a customize option. Anybody with a mobile device and a love for entertainment would cherish the MPM.

The MPM App!
Transporting items just got easier with our new app! Now you can pick and choose how many and what you want to stay on your mobile device. Also this app is free to purchase.

Entertainment on the GO!

Our other products!
- An Apple Energy Cord
- A Samsung Energy Cord
- A custom Energy Cord

Cost and Storage!
Each Energy Cord is free with a purchase or $5.50!
64gb banks are $34.99
128gb banks are $59.99.

Design!
Our bank comes in over 10 colors. We also offer over 20 patterns including, poke dots, chevron, stripes, paint splatters, hearts, swirls, seasonal patterns, and so much more!

The MPM works on majority mobile devices! You can watch movies, look at pictures, listen to music, and store all of these items in the storage bank.
COOL IT keeps you cool!

COOL IT
wearable cooling technology

Why should you choose COOL IT?

Here at COOL IT, our products help you endure heat, so you are able to function normally and be cool even when it’s hot. This new and innovative technology comes in many different forms and colors. With the consumer in mind while creating our brand, we made sure that all ages would benefit from our products.

Great prices, colors and styles in a great product!

Our products

- The 3 pack of cooling patches... $7.99
- One round cooling patch... $4.99
- One rectangular cooling patch... $4.99
- One square cooling patch... $4.99
- The cooling headband... $9.99

Where can you get our products?

Online at our website

What are you getting in the 3 pack?
Within each pack of three cooling patches you will get three different sizes:
- A circle: 4.5” in diameter
- A square: 3.5” x 2”

How thick will the headbands be?
The headbands will be 1.5” thick, which is a typical headband width meaning it will rest on most people’s head normally comfortably.

Cooling Patches keep you cool!
The cool it patch is a pad that you can apply to any part of your body, arms, legs, back, neck, head, and neck...to keep you cool. These patches are made with a polymer and a cooling gel that will stay wet and release heat on your skin. By applying the patch, we keep your body at the desired temperature.

Our Cooling Headbands mix & match!
Our headbands use the same technology as our patches but are made with a cooler material. The moisture of the headband will be covered with a cooling fabric. This band will be able to stick to your head and keep you cool. The headbands will also be able to stick to the skin and keep your hair in place. Every time you put on a cooled headband, you will be able to feel the difference.

What’s in the future?
In the future of our company, we hope to create and introduce new products, such as cooling, visors, sports gear, and more. We will work hard and continue to develop and create our products.
Judges deliberate
And the winner is... COOL IT
All this was completed by the participants in a relatively short amount of time. The participants did not know each other before this project. Feedback was very positive and the participants enjoyed their experience. The Professors couldn’t have been more pleased with the results.
THANK YOU!

Associate Professor Carol Fillip
Professor Lorrie Frear