

Situated Design in the Wilderness

A preliminary exploration of the role of the environment in the design-learning process

Chris Saulnier (saulnier@mit.edu), Dr. Aikaterini Bagiati, Dr. J.G. Brisson

Introduction

Participants in a 10-week long Global Leadership Program (GLP) were asked to complete two design activities as a component of a design-based wilderness education class. GLP is a component of an ongoing collaboration between the Massachusetts Institute of Technology (MIT) and the Singapore University of Technology and Design (SUTD). GLP brings approximately 30 students from SUTD and 5 students from MIT together to interact with the MIT community and experience MIT's academic environment by participating in a curriculum designed to assist with the development of leadership and engineering skills.

The design activities were situated in two different physical locations. The first design task took place in a traditional classroom environment; the product built by the students (a single-burner alcohol fuel stove) was subsequently used to cook food on a three-day wilderness expedition. The second design task took place completely in a wilderness environment; students designed and built objects to desalinate water using solar and thermal methods. These two contrasting projects allow us to compare the potential role of the classroom and wilderness environment as a motivator, a source of information, and a source of feedback for students when engaged in a design-based learning activity.

Theoretical Frameworks

Situated learning theory suggests that learning is not simply a transfer of knowledge from teacher to student, but instead occurs in the context of the learning community, available tools, and physical environment (Johri and Olds 2011); this perspective provides a valuable lens through which to examine engineering education.

Wilderness education is an attractive pedagogy for engineering education as it is traditionally associated with the development of competency in leadership, teamwork, self-confidence, and communication (Sibthorp, Furman, Paisley, & Gookin, 2008).

Methods

Within a week of completing the wilderness trip, 27 students participated in exit interviews. Of the interviewed students 25 were from SUTD and 14 were female. The interview questions were open-ended; students were asked to reflect upon their learning experience and to compare the class to previous design experiences. Each interview lasted approximately 20 minutes. The interviews were analyzed using a constructivist grounded theory approach (Charmaz 2014) and triangulated with the instructor's field notes.

Conclusions

The desalination project situated in the wilderness environment may have encouraged creativity due to restricting outside resources. However, students seemingly did not perceive value in being able to take environmental considerations immediately into account, and when asked would have preferred starting in a classroom environment.

Conversely, after building a stove on campus then experiencing unexpected challenges while using it in a wilderness environment, students emphasized the importance of high-fidelity testing and understanding the context in which products would be used before designing a solution.

This points towards a trade-off that may exist between having student designs benefit from understanding the context of a problem, and understanding the importance of understanding the context of a problem. Deliberately placing students in an environment where they experience unexpected challenges only after designing a solution may better meet the learning objective of understanding the importance of understating the context in which an artifact will be used.

Single-Burner Alcohol Stoves



Students designed, built, and tested single-burner alcohol stoves while on campus. They then relied on the stoves to cook while travelling in a wilderness environment.

- Students relied on an artifact that they made themselves to be able to eat over multiple days.

"I learned that engineering isn't just all being in classroom. So, it's not boring. I always thought engineering was useless in a sense 'cause I felt like it wasn't really applicable to our life. I thought like, 'Oh, if you're engineering it's like good for your company and like for the product,' but I felt like we could live without any of the engineering. But then I realized that's not really true, I was just... my understanding of engineering was just focused on this one aspect but I think I made the mistake of thinking engineering was just that instead of thinking in broader terms. So it helped me not be too pessimistic about engineering."

- Students did not believe that they would actually have to use their stoves.

"I didn't believe it. I thought maybe we will use some working prototypes that you have made or like some other instruments instead of our own designs"

- After experiencing unexpected problems while in the wilderness environment, students came to value high-fidelity testing.

"This experience has helped me understand that like it's important to understand your environment before you go about solving a problem."

- Students used materials they found in the environment to develop solutions to design flaws.



Thermal and Solar Desalination



Students were provided with a kit of materials while camping on an island surrounded by salt water and challenged to produce fresh water via thermal or solar desalination.

- Outside of the classroom students prioritized building over planning:

"Okay, we have a problem, let's build it. In the classroom if we had more time I'd do more research and see what we have, plan it out perhaps, then build it"

- This was accompanied by a feeling of more freedom to be creative and think of their own solutions to problems instead of researching other established solutions.

"Oh! What I learned is in the wilderness I'm more creative... let's say someone gives me a task... instead of me trying stuff – the internet has so many like resources so why waste time if I can just Google it and do it? Whereas in the wilderness I tried to think on my own and try it."

- Students did not perceive value in being able to take environmental considerations immediately into account, and when asked would have preferred starting in a classroom environment.

- Students were not motivated by being in the environment as they knew they had access to other sources of fresh water.

"I only got a few drops, so I know we proved the concept that it worked but it was not really applicable to us, like even if we were stranded we wouldn't be able to use that method."

References

- Charmaz, Kathy. 2014. *Constructing Grounding Theory*. 2nd ed. Thousand Oaks, California: SAGE Publications.
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