

Workshop: Problem Definition and Concept Ideation, An active-learning approach in a multi-disciplinary setting

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Abstract:

This workshop integrates an Active Collaborative Learning (ACL) approach to class management with ideation techniques. Participants will have a hands-on experience, acting as students in a “train the trainer” format. Three topics will be introduced: 1) The Gallery Walk method, 2) Problem Decomposition, and 3) The Brainsketching ideation technique. A brief preview of next steps will be presented as well.

Workshop Overview

The five step process covered in the workshop will allow participants to experience and ACL approach successfully used with freshman engineering students. Participants will be divided into teams of four or five to engage in the workshop activities. In Step 1, each team will be given “bugs” or “pain points,” which are instances of frustration, annoyance, dissatisfaction or sub-optimal solution people experience on a frequent basis. These “bugs” were previously generated by students enrolled in the workshop facilitators’ courses. In Step 2, teams will fashion these bugs into Point of View statements for simulating design discussion. Step 3 involves an interactive Gallery Walk, while Steps 4 and 5 address issues related to problem decomposition and design solution ideation.

In addition to the ACL and ideation techniques presented in the workshop, a formal out-of-class meeting approach will be presented that includes agenda and record keeping methods. This approach is used to facilitate student team self-management.

A Gallery of BUGS and Ideas

Step 1: Students Identify BUGS

The starting point for the ideation process is to identify consumer pain points, or BUGs. These are instances of frustration, annoyance or dissatisfaction that people experience on a frequent basis. We have students’ research newspapers, online news websites, online social networks/bulletin boards, examine societal trends, and talk with family members and friends to identify situations where frustrations have been experienced that are important enough to grab headlines, generate discussion, or be vividly recalled. BUGs must reflect a *significantly important* pain point to warrant the time and effort to develop a solution.

Step 2: Develop a Formal Problem Statement – POV

After identifying one or two "bugs" for further investigation, the second stage of this activity involves the development of a formal problem definition statement. The Stanford d.school calls this a Point of View (POV) Statement [1]. Investigation during the first stage of this exercise begins to set the design challenge for the student. The POV statement reframes the "bug" into an actionable problem statement that can help guide the ideation process. Students use a basic template such as the one presented in the figure below.

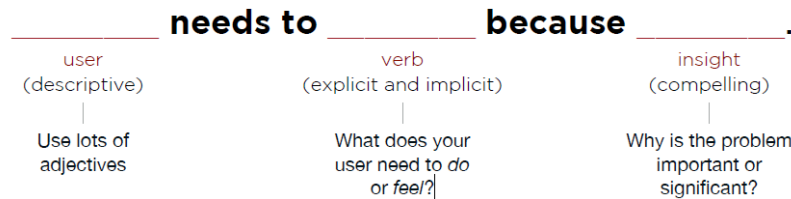


Figure 1: How to start simple and build the statement out to better guide ideation. [2]

An example of adequate and good POV Statements is provided by the Stanford d.school [1]:

Adequate: "A teenage girl needs more nutritious food because vitamins are vital to good health"

Good: "A teenage girl with a bleak outlook needs to feel more socially accepted when eating healthy food, because in her hood a social risk is more dangerous than a health risk."

The important issue with the development of POV statements is to start simple and build the statement out to better guide ideation (**Error! Reference source not found.**).

Step 3: Gallery Walk

The Gallery Walk is an active learning technique that generates feedback by all students in the class for student projects. This activity is used multiple times throughout a semester-long project to stimulate student discussion. Students work in their design teams to discuss each other team's POV statements. The feedback that is generated allows for teams to further refine their problem definition statements *before* moving on to ideation. Working in the design space, a well-defined problem can help to avoid design problems later in the project.

Using flipchart paper, whiteboards or some other medium to display each team's POV statement, stations are set up around the room. Each team has their own station at which the other teams will conduct their review (Figure 2).



Figure 2: Gallery Walk Organization. [3]

Teams begin the gallery walk by moving to the next station to their right of their home station. Using different color post-it notes, teams discuss the POV statements and provide at least two to three thoughts (Figure 3). This process continues until teams return to their home station. In a class with six to eight teams, each team will receive 18 to 24 unique comments to be used in the problem decomposition stage discussed below.



Figure 3: Students participating in a gallery walk session.

Step 4: Problem Decomposition

Following the gallery walk teams reconvene and assess feedback provided by other groups. At this stage the facilitator of the exercise provides a quick overview of the problem decomposition method. Decomposition can focus on functional aspects, processes or sequences of user actions, consumer needs, or other area important to better understanding the design challenge [4].

This workshop revolves around students developing a “smart product,” which involves the application of technology to the problem solution design. An example of a way to decompose the problem is presented (Figure 4). In this case the problem is decomposed into the user interface, physical attributes and electronics. After presenting the concept of problem decomposition, teams are given time to work together to decompose their problem as appropriate.

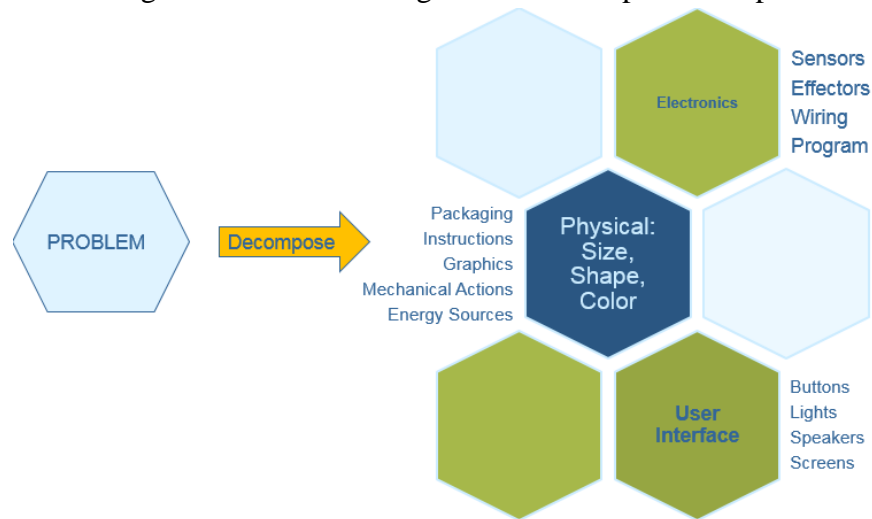


Figure 4: Problem decomposition guidance for smart product design.

Step 5: Practiced methods for Ideation

After problem decomposition teams are introduced to and guided through ideation techniques, two of which include brainsketching [5] and the WIBN/WIBT [6]. The purpose of presenting and practicing these methods in class is so that student teams can further apply them during out-of-class team meetings.

In the brainsketching module each participant is supplied with a blank sheet of paper and a distinctively colored pen. Participants are instructed to use the problem decomposition exercise to begin sketching one sub-problem of the decomposition. For example, one team member may focus on the product logo, while another focuses on the physical size, shape or materials of the product design. A third member may tackle the electronics or begin developing a program algorithm.

In the brainsketching exercise successive rounds of sketching take place where participants sketch out creative ideas (Figure 5). This is performed silently. After each 90 second round the sketches are passed clockwise such that each team member adds to each sketch. When each team member receives back their original sketch the teams may now speak. Teams are instructed to debrief each other on their contributions to each sketch. Typically each sketch is discussed in succession.

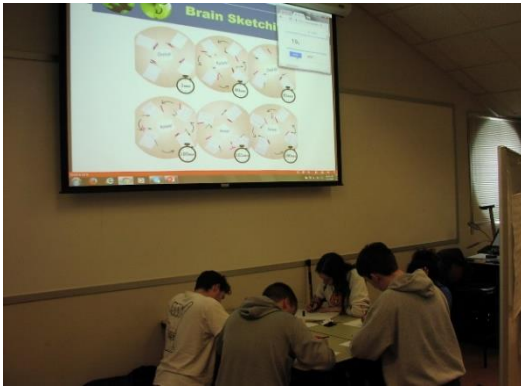


Figure 5: Students participating in a brainsketching activity.

Another useful ideation technique is WIBN/WIBT. These acronyms refer to the phrases “Wouldn’t It Be Nice and Wouldn’t It Be Terrible”. The focus of these questions is to stimulate teams to think about optimal and worst case scenarios related to the design and development of their solutions. Teams are asked to simply ask those questions about their developing concepts with the objective of pushing the boundaries of ideas.

At the end of the session teams are instructed on the development of product solution concepts, which is an out-of-class activity. At this point, product concepts should be complete, that is, not in the decomposed state but rather recombined into a full product concept (Figure 6).

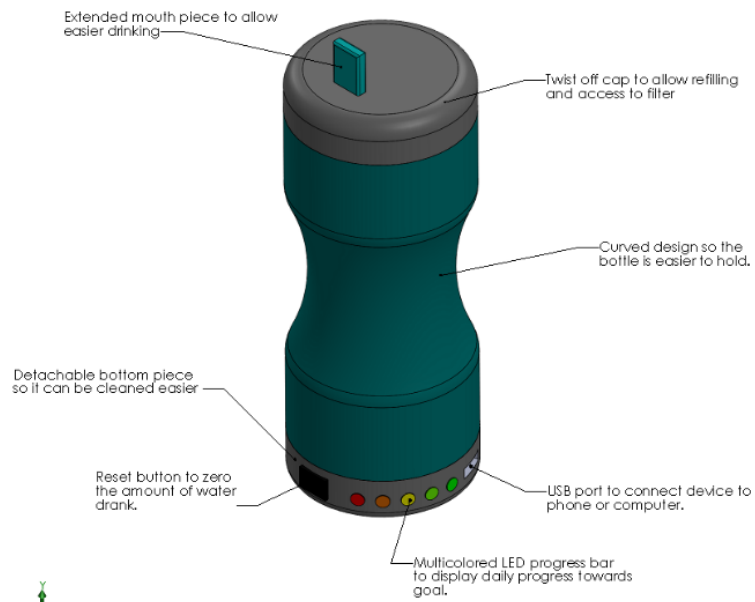


Figure 6: Example of a product concept.

Concept design sketches should include a title, be colored and labeled, and have a short descriptive paragraph. It is up to the team to decide how to recombine the ideas generated with the ideation techniques to develop the preliminary product concepts. It is expected that 3-5 product concepts be developed per team. These product concepts will be used in the next phase, concept selection. This is an important activity, but is not be addressed in this workshop.

Student Team Management: an out-of-class formal meeting approach

Due to limited time in the classroom each week, teams are required to meet outside of class to keep moving forward the ideation process. For instance, the level of detail shown in the product concept (Figure 6) could not be generated using class time alone. In order to keep teams focused and make efficient use of time, a formal meeting approach is used that include standard agenda and minutes forms (Figure 7). Teams are required to meet, and document, a minimum of 10 times out of a 15 weeks semester.

MEETING AGENDA

[Click to select date]
 [Time]
 [Location]

Meeting called by:		Type of meeting:	
Facilitator:		Note taker:	
Attendees:			
Please read:			
Please bring:			

AGENDA ITEMS

Topic	Presenter	Time allotted
✓		
✓		
✓		
✓		
✓		
✓		
✓		
✓		
✓		

OTHER INFORMATION

Meeting Minutes

Date
 Time
 Location

Meeting called by:	Enter meeting organizer here	Type of meeting:	Enter meeting type here
Note taker:	Enter note taker here		
Timekeeper:	Enter meeting timekeeper here		
Attendees:	Enter attendees here		
Please read:	Enter reading list here		
Please bring:	Enter items to bring here		

Minutes

Agenda item:	Enter agenda item here	Presenter:	Enter presenter here
Discussion:			
~Brief summary of agenda discussion~			
Conclusions:			
Enter conclusions here.			
Action items	Person responsible	Deadline	
✓ Enter action items here	Enter person responsible here	Enter deadline here	
✓ Enter action items here	Enter person responsible here	Enter deadline here	
✓ Enter action items here	Enter person responsible here	Enter deadline here	

Agenda item:	Enter agenda item here	Presenter:	Enter presenter here
Discussion:			
~Brief summary of agenda discussion~			
Conclusions:			
Enter conclusions here.			
Action items	Person responsible	Deadline	
✓ Enter action items here	Enter person responsible here	Enter deadline here	
✓ Enter action items here	Enter person responsible here	Enter deadline here	
✓ Enter action items here	Enter person responsible here	Enter deadline here	

Agenda item:	Enter agenda item here	Presenter:	Enter presenter here
Discussion:			

Figure 7: Example meeting agenda and minutes forms. These forms are distributed to teams so that they hold formal meetings throughout the semester.

For example, teams are instructed to meet twice out-of-class prior to the next deliverable due date following the ideation stage outlined in step 5. For the first meeting, teams are instructed to continue the concept ideation practiced during the class session in order to generate more potential solution ideas. In the second meeting teams are instructed to using a screening method to refine the total pool of concepts generated down to three to five for final solution design consideration.

The final deliverable for the ideation part of the project is a formal, business-style memo and report outlining three alternative problem concept solutions an example of which is shown

(Figure 6). For reference, participants will be given previously generated student work which they will adapt for their own submission.

References

- [1] T. Both and D. Baggerear, "Hasso Plattner Institute of Design at Stanford," [Online]. Available: <https://dschool.stanford.edu/resources/the-bootcamp-bootleg>.
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- [3] Science Education Resource Center @ Carlton College, "Starting Point Teaching Entry Level Geoscience - What is a Gallery Walk," 14 November 2016. [Online]. Available: <https://serc.carleton.edu/introgeo/gallerywalk/what.html>. [Accessed 15 April 2018].
- [4] K. T. Ulrich and S. D. Eppinger, "Concept Generation," in *Product Design and Development*, New York, NY, McGraw-Hill Higher Education, 2008, pp. 101-104.
- [5] R. van der Lugt, "Brainsketching and How it Differs from Brainstorming," *Creativity and Innovation Management*, vol. 11, no. 1, pp. 43-54, March 2002.
- [6] S. G. Isaksen, K. B. Dorval and D. J. Treffinger, "Generating When Constructing Opportunities," in *Creative Approaches to Problem Solving*, Thousand Oaks, CA, Sage Publications Inc., 2011, pp. 59-62.