Development and Assessment of an Innovation and Entrepreneurship Boot Camp for Sophomore Engineering Students

Cheryl A. Bodnar, Renee M. Clark and Mary Besterfield-Sacre
University of Pittsburgh

Rationale

- To remain competitive in today's marketplace, students need to develop innovation and entrepreneurship skills

- These skills include:
  - Dealing with ambiguity
  - Customer empathy
  - Persistence through failure
  - Rapid prototyping
  - Delivering business pitches

Current Approaches to Innovation and Entrepreneurship Education

- Curricular Infusion:
  - Insertion of relevant material into existing courses
  - Generation of multi-disciplinary design courses
  - Guest speakers with entrepreneurship experience
  - Lean LaunchPad and Design Thinking classes

- Extracurricular Activities:
  - Business plan competitions
  - Product idea fairs
  - Entrepreneur In residence
  - Innovation challenges

Extracurricular Activities and their Impact on Innovation and Entrepreneurship Skills

- Shartrand *et. al* (2010)
  - Extracurricular activities are capable of building entrepreneurship skills in undergraduates
- Yasuhara *et al*. (2012)
  - Positive correlation between development of motivation, professional and problem solving skills with extracurricular activity participation
- Condoor and Keogh (2012)
  - Students felt participation in extracurricular innovation challenges was positively contributing to their entrepreneurship skill development

Swanson School of Engineering: Innovation and Entrepreneurship at the Undergrad Level

- Epicenter Pathways initiative
  - Curricular reform underway
    - Product realization & Humanitarian engineering certificates
    - Offer many entrepreneurship related electives
    - Core classes and Capstone
  - Spaces and IP
  - Mentor and Industry involvement
  - Focus is curricular in nature
- **Problem:** Students tend to be exposed too late within their degree path to these concepts; and need more co-curricular
- **Concept:** Develop a boot camp for sophomore students to expose them early to innovation and entrepreneurship skills

Boot Camp: Overview

- 3 day session
- Mixture of curricular sessions, hands-on activities and product design, iteration and prototype development
- Product design topics selected from the National Academy of Engineering's Grand Challenges
- Culminated in an elevator pitch of final prototype to a panel of professionals with entrepreneurship experience

Sample Boot Camp Schedule – Day 1

Boot Camp - Day 1		
Time	Topic	Additional Detail
9:00-9:30	Boot Camp Introduction	Objectives, overview of activities, pre-assessments
9:30-10:45	Creativity Innovation Challenge	
10:45-11:15	Grand Challenge videos	Six possible challenges
11:15-12:00	Brainstorming session on Grand Challenge topics	
12:00-1:00	Lunch and Pitches of Grand Challenge ideas	One grand challenge topic is selected for product/service development
1:00-1:30	Team formation for product/service development	
1:30-2:30	"Team Building" games	Support students in working well together
2:30-3:30	"How to Develop a Product or Service with a Customer Focus"	Concepts addressed include 1) Who are potential customers? , 2) Determining what is important to customers, and 3) Customer value propositions.
3:30-3:45	Assignment of homework	Customer Values in a World Without Oil game

Boot Camp: Participant Demographics

Number of participants	10
Gender	8 Male, 2 Female
Ethnicity	6 White, 3 Black/African American, 1 Asian
Academic level in engineering studies	10 Sophomore
Engineering major	3 Bioengineering, 2 Industrial, 2 Mechanical, 1 Chemical, 1 Bio/Electrical dual, 1 Computer

Boot Camp: Assessment

- Student self-assessment of innovation and entrepreneurship skills through a pre-/post-survey

- Comparison of student product design process maps generated at the start and end of the boot camp

Pre-/Post-Survey Analysis

- Survey constructed using questions from the Entrepreneurship Knowledge Inventory (EKI)
- Results Pre-Survey:
  - 1 student felt that they could start a business prior to participating in the boot camp
  - 8 of 10 students expressed interest in starting a business within 5-10 years
  - Majority of students felt they had high familiarity with concepts of consumer needs and creativity
  - None of the students felt highly familiar with technology transfer

Pre-Survey Results: Most Important Innovation and Entrepreneurship Skills

Most Important Innovation/E-Ship Skills	Occurrences
Creativity/thinking outside the box	6
Communications	4
Networking/relationships/likability	3
Flexibility	2
Open mindedness/accepting of other ideas	2
Sales ability/business savvy	2
Knowledge	1
Recognition of opportunities	1
Learning from mistakes	1
Leadership	1
Patience	1

Pre-Survey Results: Muddiest Points

Muddiest Points	Occurrences
Financing/capital requirements/funding	4
Transitioning ideas to market/reality	4
Legal acumen and issues	2
Marketing	2
Regulatory requirements	1
Business acumen	1
Profitability	1
Patents	1
Business plan/model	1
Product development	1
Organizational structure	1

Post-Survey Results

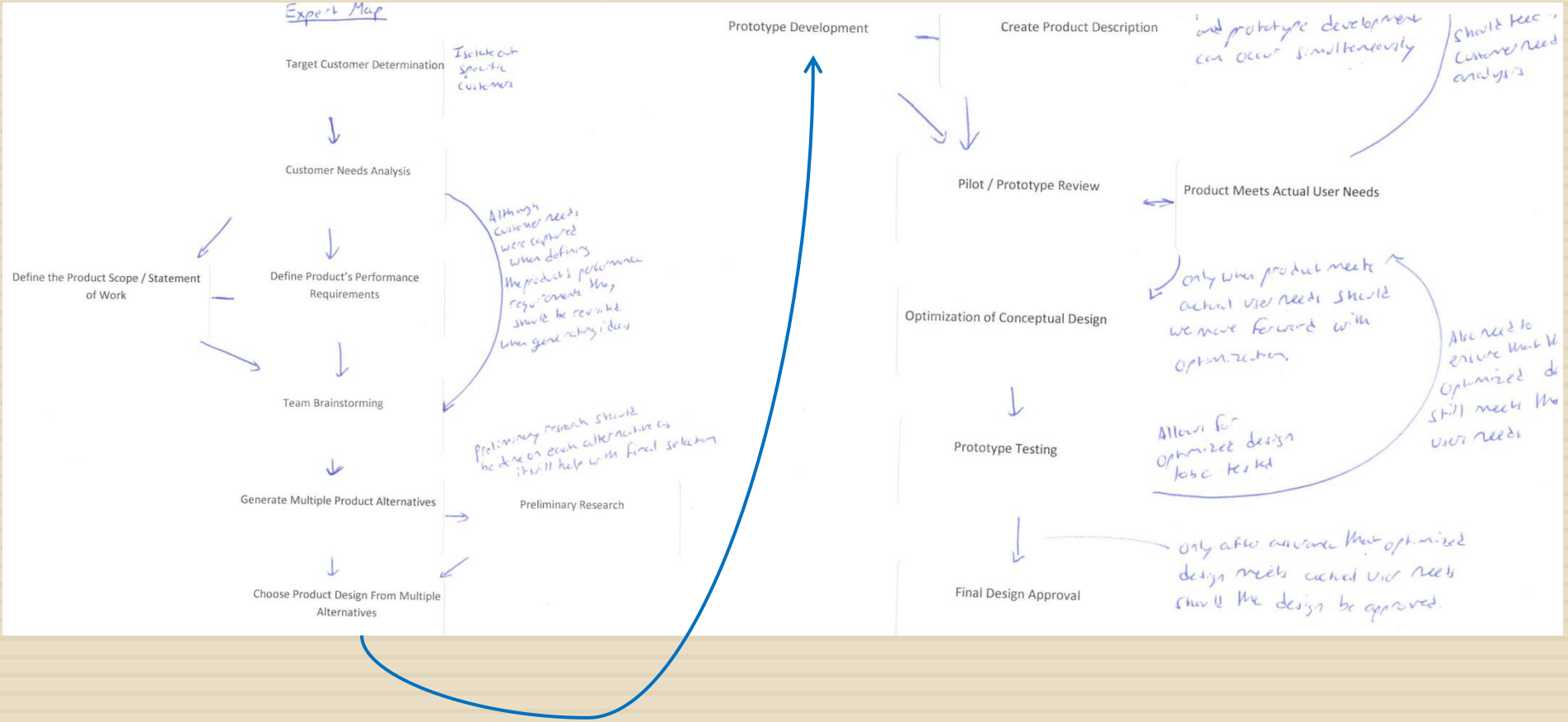
- 7 of 10 students felt that their list of important skills had changed through participation in the boot camp
  - Specifically, 3 of 10 students felt that understanding the importance of the customer had changed
- 9 out of 10 students felt that their muddiest points were made clearer or resolved
- All 10 students planned on remaining a part of the innovation and entrepreneurship community moving forward

Process Mapping Assessment

- A process map captures the activities that make up the flow from input to output within a particular process
- List of activities that could be included were:

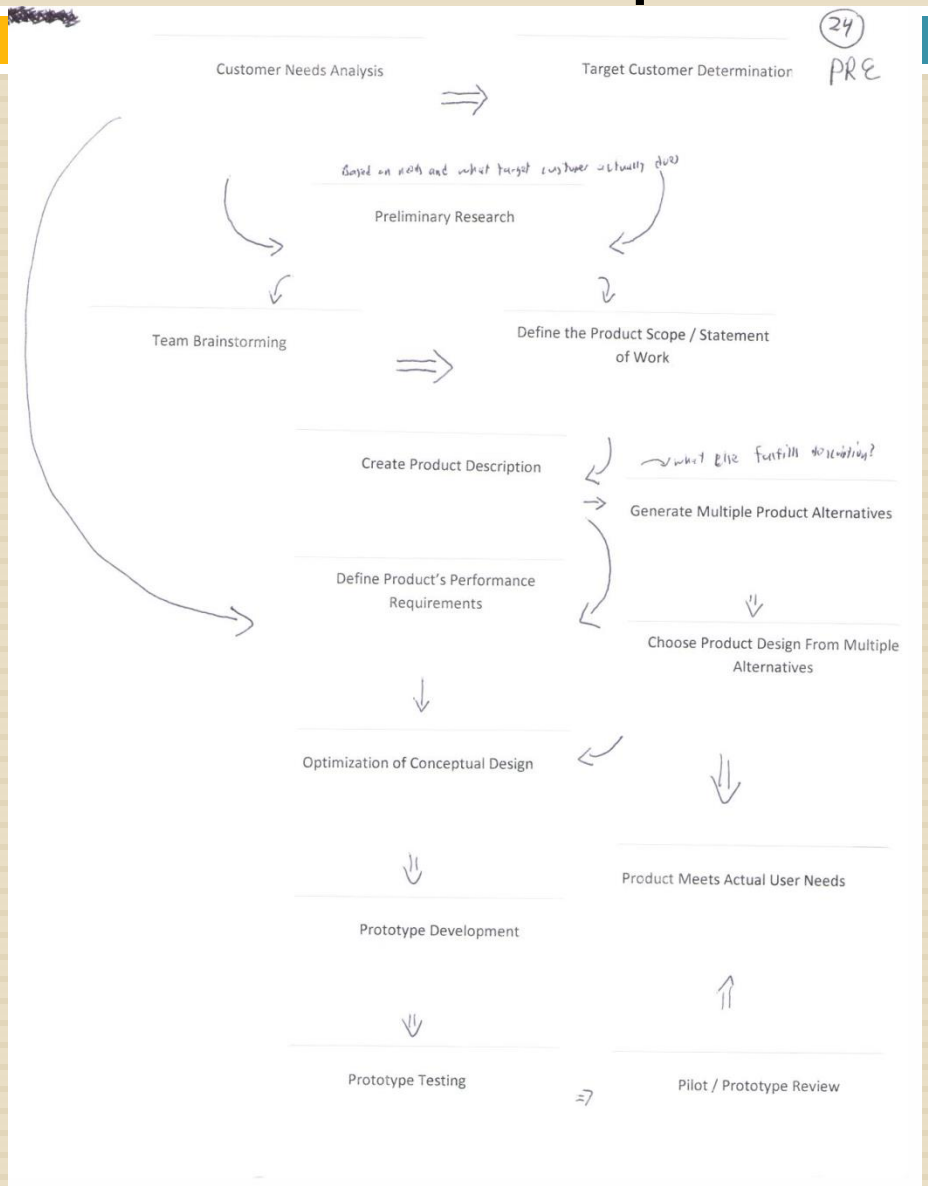
Customer Needs Analysis		Product Meets Actual User Needs
Define Product's Performance Requirements		Prototype Development
Define the Product Scope / Statement of Work		Prototype Testing
Final Design Approval		Target Customer Determination
Generate Multiple Product Alternatives		Team Brainstorming
Optimization of Conceptual Design		Pilot / Prototype Review
Choose Product Design From Alternatives		Preliminary Research
Create Product Description		

Process Mapping Assessment – Expert Map

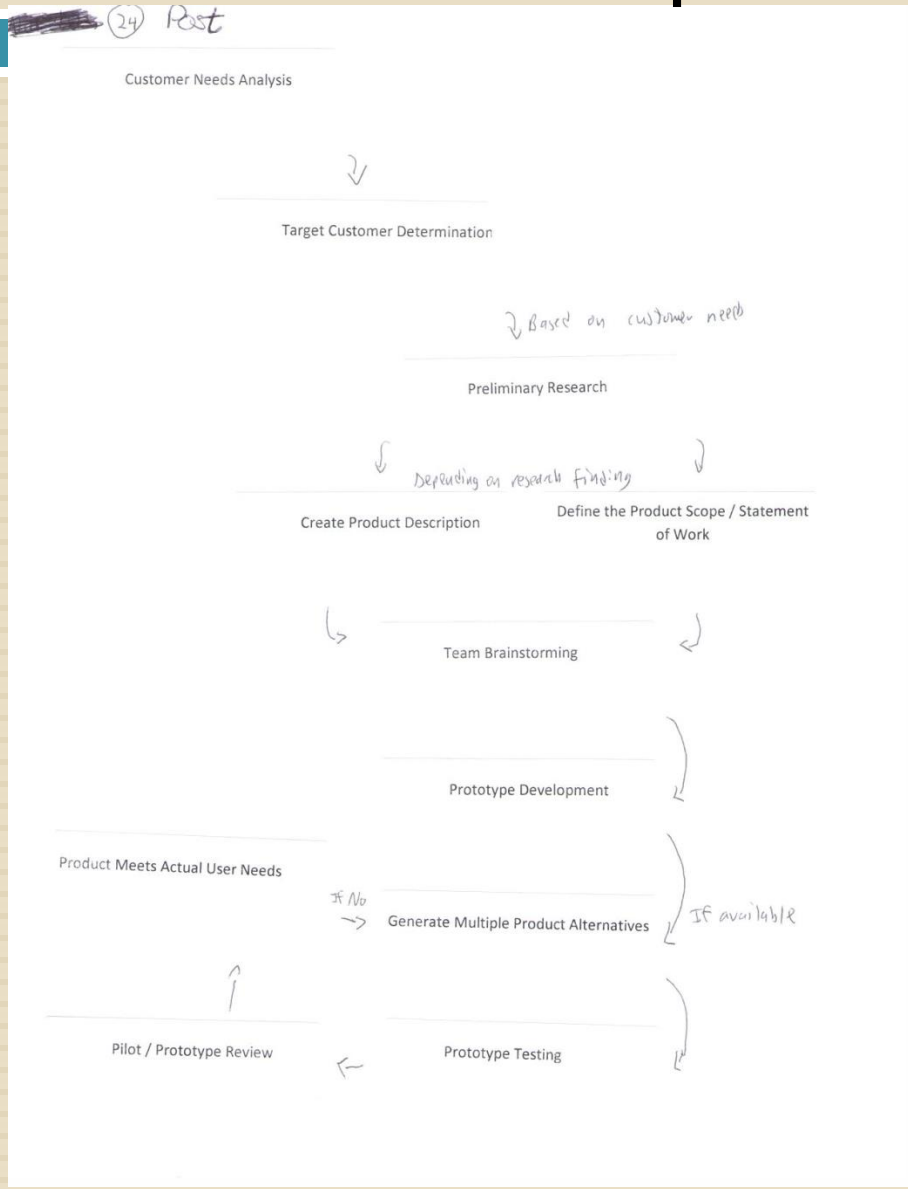


Process Mapping Assessment – Student Map

Pre-Boot Camp



Post-Boot Camp



Process Mapping Assessment – Results

- Focused on placement of activities and what was the starting node(s) for the process map

- Starting (root node) activities:
  - 10 pre-camp maps
    - Customer Needs Analysis — 5 maps
    - Target Customer Determination — 1 map
  - 9 post-camp maps
    - Customer Needs Analysis — 2 maps
    - Target Customer Determination — 0 maps

Conclusions

- First iteration of the sophomore student boot camp was successful
- Pre-/post-survey analysis demonstrated an increase in the understanding of the customer's role in product design
- Process map assessment showed mixed results
  - May be due to timing of post camp activity immediately after the "shark tank" pitch
  - Could also be due to mis-alignment between wording of process map activities and topics in curriculum

Future Directions

- Will continue to offer boot camp on a yearly basis
- Improve process map assessment technique
  - Determine if it can be used as a quantitative assessment tool for measuring student understanding of product design
  - Potentially too short of time span to see improvements
- Monitor boot camp participants participation in other innovation and entrepreneurship activities within the school

Acknowledgements

- NCIIA Course and Program Planning Grant

NCIIA
National Collegiate Inventors & Innovators Alliance