Team #505:
Pop-Up Classroom

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Team Introductions

Kyle Jackey
UX Engineer

Jean Roquebert
Software Engineer

Michael Johnson
Prototype Engineer

Valeria Bernal
Communications & Testing Engineer

Yahdid James
Vehicle Engineer

Daziyah Sullivan
Project Manager & Design Engineer

Sponsor and Advisor

Concept Mentor
Pete Butler
Campus Reimagined

Concept Mentor
Rashad Aziz
Campus Reimagined

Academic Advisor
Dr. Shayne McConomy
Mechanical Engineering

Objective

Campus Reimagined (CRI) seeks to create a new campus experience through the pop-up classroom. This device will provide a comfortable space for meetings, lectures, and similar events that is nomadic and can be ordered online.

Project Background

Jean Roquebert

Project Scope

Providing an opportunity for learning in any environment.

Potential uses: University, Military, and Disaster Relief

Customer Needs

Mobility, accessibility, and access to common media devices were found to be most important to the customer.

Functional Decomposition

Main functional systems defined to be mobility (items involving motion) and connectivity (human interaction and technological connections).

Jean Roquebert

Targets and Metrics

Determined based upon:

- Functional Decomposition
- Benchmarking with Similar Products
- Researching Industry Standards

Jean Roquebert

Metric Verification

Testing methods:

- Simulations in CREO Parametric
- Measuring dimensions
- Survey of user experience

Note: a significant amount of our metrics are based upon whether the target is present (a yes/no system).

Jean Roquebert

Function	Target	Metric
1. Allows Movement of Device	There is a braking mechanism	Yes
	Wheels present and functioning	Yes
4. Reduces Complexity	Moveable components stay in place unless moved on command	Yes
	The design is intuitive	Yes, confirmed by a survey
6. Allows for Tracking	There is an admin portion to the online platform	Yes
8. Facilitates Collaboration	Provide enough room for 10-15 people to sit comfortably	The total seat widths exceed 25' (20" seat width x 15 people)
External to Defined Functions	Adequate battery life	> 5.1 kWh
	Device base can handle the weight of the components and passengers	Carries at least 5000 lb

Jean Roquebert

Concept Generation

Valeria Bernal

Concept Generation Methods

We generated 100+ concepts during the concept generation process

Methods used to assist in creativity:

- Morphological chart
- Biomimicry
- Word association

Valeria Bernal

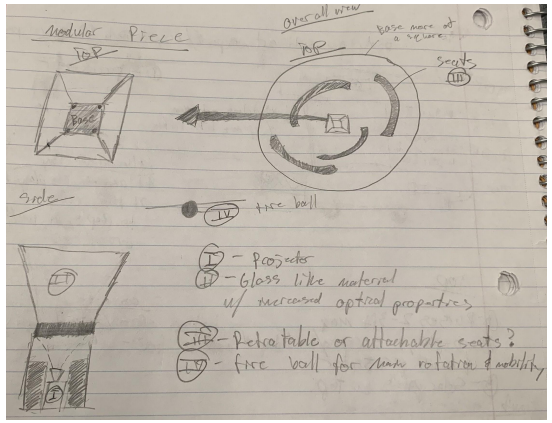
Determining Fidelity

Based upon:

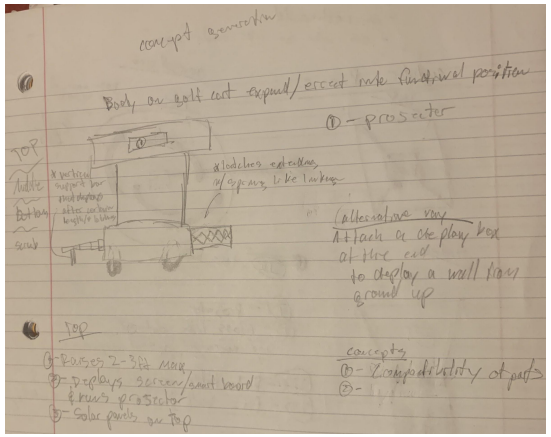
- Adherence to the targets
- Manufacturability
- Potential cost
- Ease of user understanding

Valeria Bernal

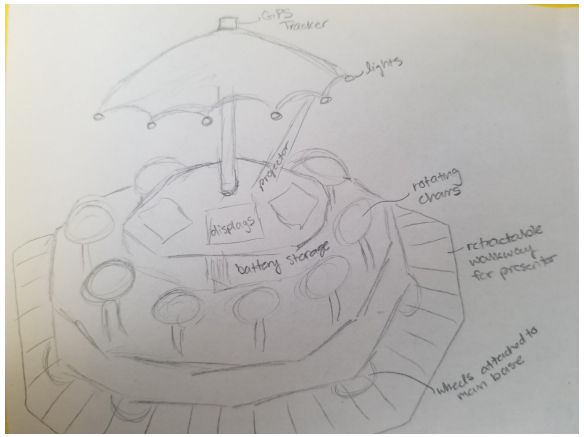
Medium Fidelity Concepts



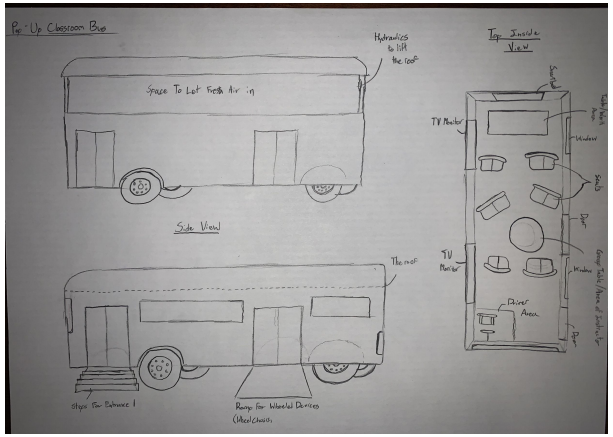
Design 1



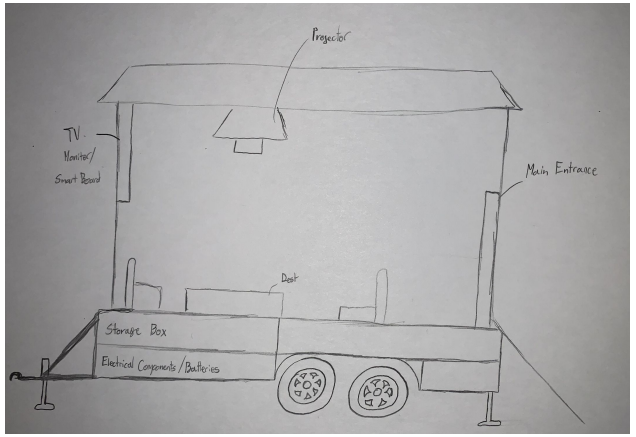
Design 2



Design 3



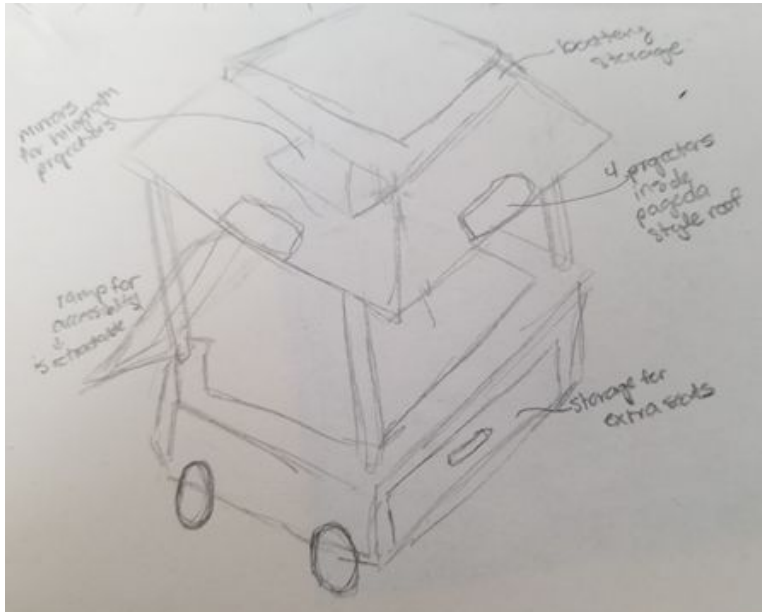
Design 4

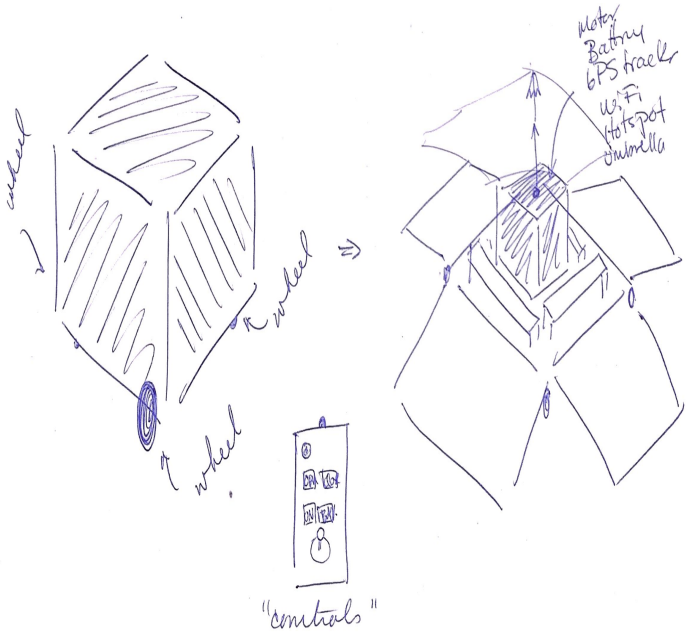


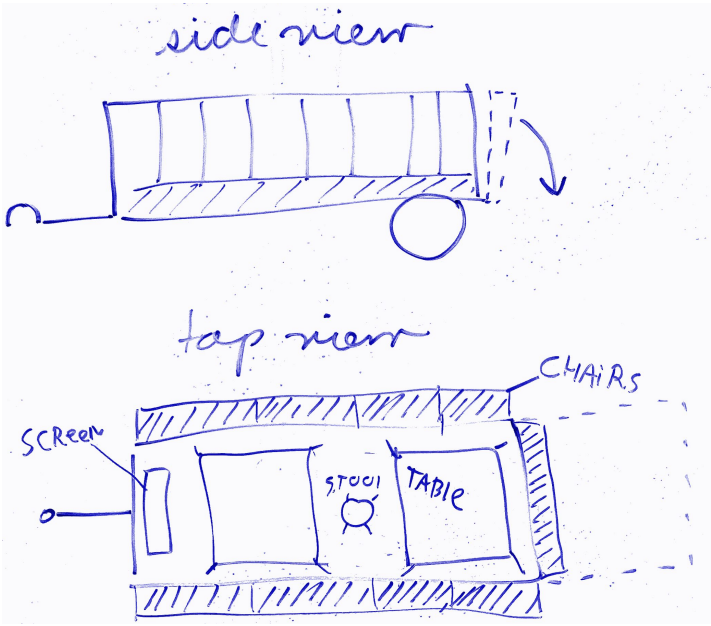
Design 5

Valeria Bernal

High Fidelity Concepts







Design 6

Design 7

Design 8

Valeria Bernal

Concept Selection

Michael Johnson

Concept Selection

Throughout this process, the team worked to keep customer needs at the forefront.

Engineering characteristics for evaluation were initially ranked based upon their contribution to customer needs.

Michael Johnson

Selection Process

Binary Comparison	House of Quality	Pugh Charts	Analytical Hierarchy Process
Compared customer needs that define the project the most, and ranked their importance.	Determined preliminary critical targets based upon the customer needs.	Compared concepts to a datum in order to refine the amount of concepts being used in the final decision matrix.	Utilized pairwise comparison and statistics to determine the best concept.
Mobility. Power Consumption. Weight. User Interface.	Components stay in place. Design is intuitive. Enough space for 10-15 people.	Reviewed Later.	Reviewed Later.

Michael Johnson

Pugh Chart Outcomes

The initial Pugh Chart used the datum of “Work on Wheels,” pictured here.

After multiple iterations, the final concepts chosen for evaluation were concepts **5, 6,** and **7**.

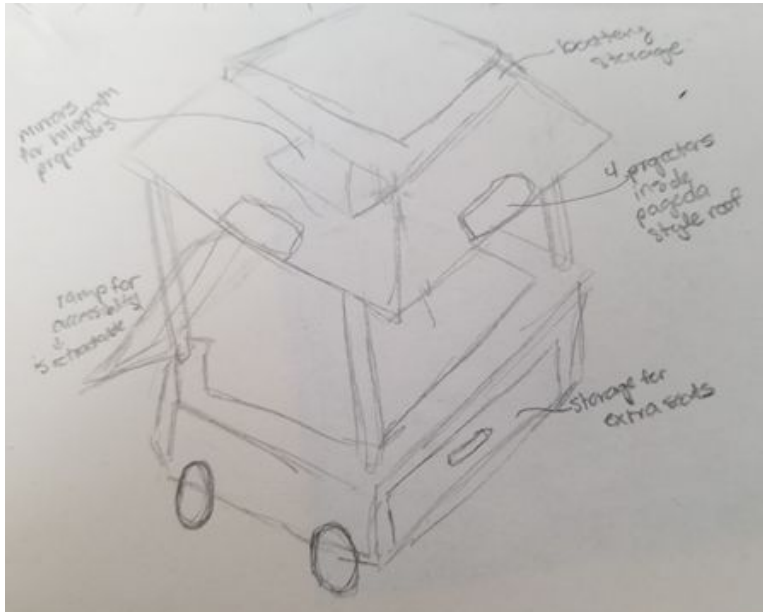
Michael Johnson

Analytical Hierarchy Chart

The three criteria that were determined to be critical targets were:

- Device Weight Tolerance
- Enough Space for 10-15 People
- Moveable Components Stay in Place

Concept 6 was chosen:



Michael Johnson

Bill of Materials

We have determined a BOM to work off of, and will be checking with our sponsor and advisor to confirm our decisions prior to ordering.

Current material choice is wood, with the use of weather-proof coating. Total costs is currently around $2000.

Michael Johnson

Five Takeaways

1. Critical targets determined to be mobility, battery capacity, user commodity, and wireless connections
2. Out of 100 concept generation only 8 design were chosen
3. Target progression will be measured through simulations, surveys, and manual measurements
4. Concept selections tools such as Pugh charts, HoQ charts, and binary comparison charts were used for our concept selection
5. Concept 6 was chosen to be the design for the prototyping phase

Michael Johnson

References

Phillips, G. (2019, March 13). The Most Common Wi-Fi Standards and Types Explained. Retrieved from https://www.makeuseof.com/tag/understanding-common-wifi-standards-technology-explained/.

Noe, R. (2015, November 25). Reference: Common Dimensions, Angles and Heights for Seating Designers. Retrieved from https://www.core77.com/posts/43422/Reference-Common-Dimensions-Angles-and-Heights-for-Seating-Designers.

E Source Companies LLC. (2008). Managing Energy Costs in Schools. Retrieved from https://dsoelectric.coopwebbuilder2.com/sites/dsoelectricdsoelectric/files/images/Business/schools.pdf.

King of Carts. (n.d.). King of Carts Q: Golf Cart Length Width Height – Lifted and Non Lifted: FAQ. Retrieved from https://kingofcarts.net/faq/q-golf-cart-length-width-height-lifted-and-non-lifted.html.

Prigg, M. (2014, November 26). The meeting room with a view (and wheels and an engine). Retrieved from https://www.dailymail.co.uk/sciencetech/article-2849606/The-meeting-room-view-wheels-engine-Transparent-concept-car-lets-set-office-anywhere.html

Schires, M. (2017, June 6). A Simple Guide to Using the ADA Standards for Accessible Design Guidelines. Retrieved from https://www.archdaily.com/872710/a-simple-guide-to-using-the-ada-standards-for-accessible-design-guidelines#targetText=Overview,law, compliance is not optional.

Questions?

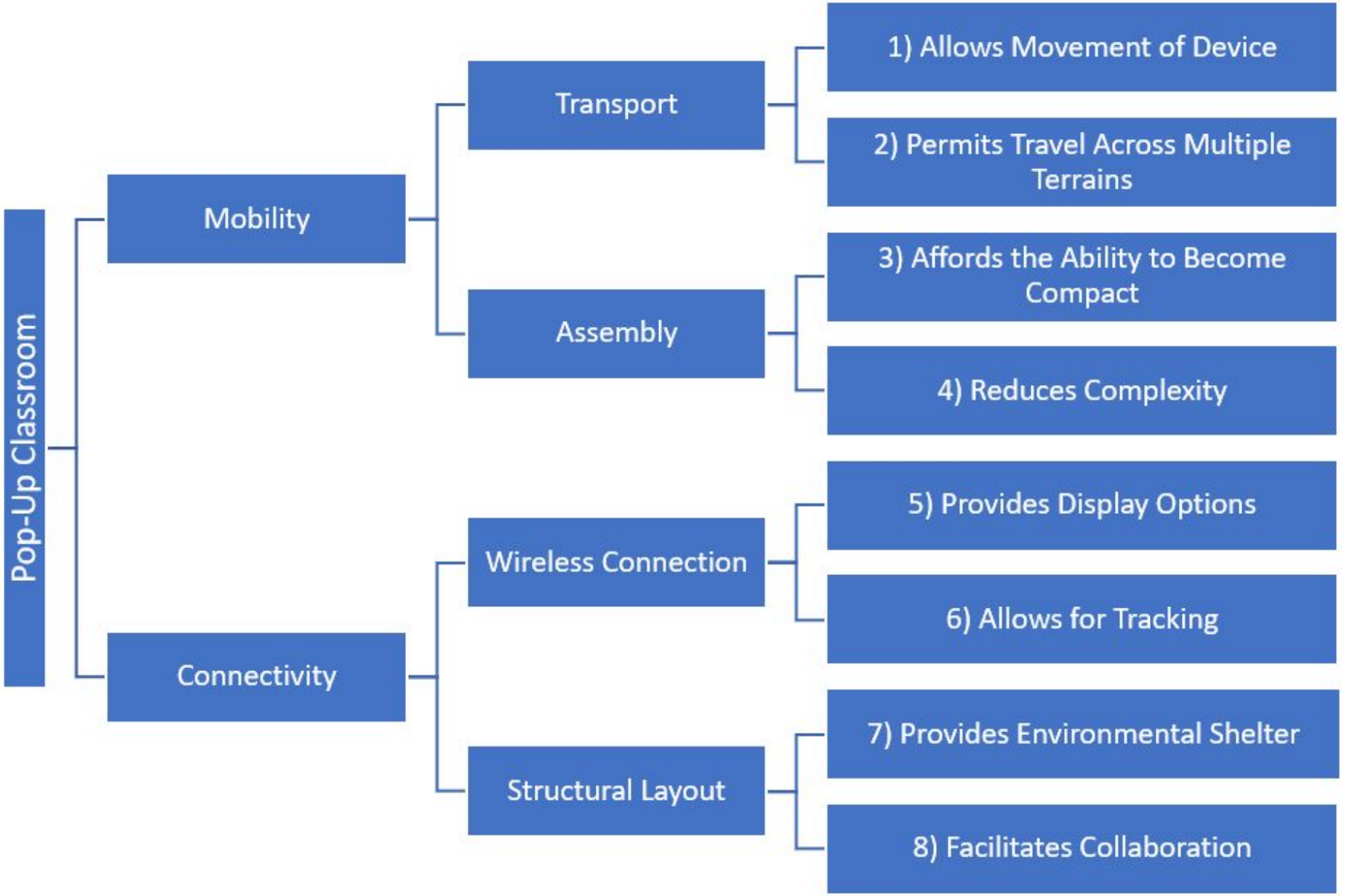
Backup Slides

Customer Needs Backup

Question/Prompt	Customer Statement	Interpreted Need
Questions to the Sponsor		
As Stated in Project Brief	The popup classroom should provide a collaborative environment that is nomadic and has the capability of being ordered online	1. The layout provides the ability for collaborative input
		2. The product is mobile
		3. The product is integrated with an online platform
What is the required terrain?	Surfaces around campus or in parks	4. The device can maneuver common university terrain
What was the need that prompted this project?	Enabling conversations and valid discussions whenever it is wanted	5. The device is easily accessible to the customers
What is your opinion of the standard classroom setting?	The standard classroom setting is not conducive for critical thinking and creative learning.	6. The device promotes creativity and interactive learning
How many people will be using the device at one time?	From the size of small project groups to the size of group studies or tutoring	7. The device accommodates 10 to 15 people comfortably
What level of mobility is being asked for?	It should be nomadic with off-road preferred, can be driven or pulled initially with autonomous capabilities not being present in the first iteration	8. The device's motion can be manual, with powered or autonomous motion being implemented in later versions
		9. The device can be packed to reduce the hassle of moving across campuses

Questions to General Customers		
What are the necessary components of a classroom?	Chairs, writing surfaces, some sort of projector that is connected to a computer, whiteboards, easily accessible electrical outlets, Wifi	10. The device includes media displays and seating/tabling options
		11. The device includes connectivity options such as internet access
What would you bring with you to an outdoors, educational experience?	Notebook and writing utensils, iPad, class materials, umbrella for shading or rain	12. The device allows users to set up their personal desk space similar to within a typical classroom setting
		13. The device provides shelter from the elements
Describe your ideal study or meeting space	In an area the size of a typical office space; a larger area that allows for personal space; a large table area to spread out	14. The device at normal capacity provides the ability to stretch out
What is your preferred shape for the educational experience?	U-shape, circling the speaker, modified U-shape, attendees in a circle with the speaker outside of it	15. The device's seating arrangement provides the participants the ability to view each other and requires the speaker to rotate to address them all
What does collaboration mean to you?	Cooperation of individuals that reach a common goal or mutual benefit	16. The device is structured to make it easy to interact with the other members
What tools do you find yourself using the most?	iPad, tablets, computers, smartboard, dry erase board	17. The device provides power for technological devices
		18. The device incorporates typical visual display options

Functional Decomp Backup

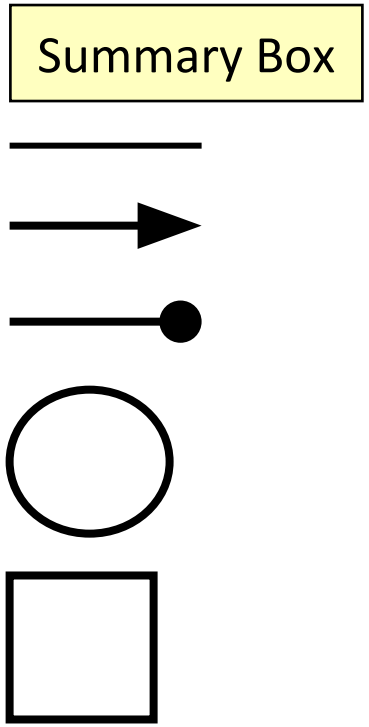

Pop-Up Classroom
Mobility
Transport
1) Allows Movement of Device
2) Permits Travel Across Multiple Terrains
Assembly
3) Affords the Ability to Become Compact
4) Reduces Complexity
Connectivity
Wireless Connection
5) Provides Display Options
6) Allows for Tracking
Structural Layout
7) Provides Environmental Shelter
8) Facilitates Collaboration

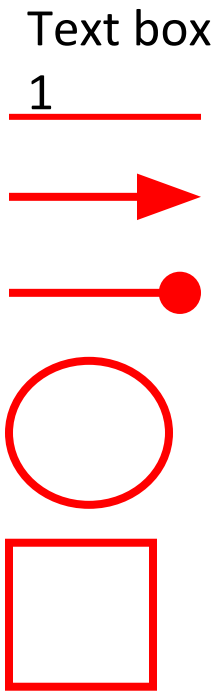
Concept Selection Backup

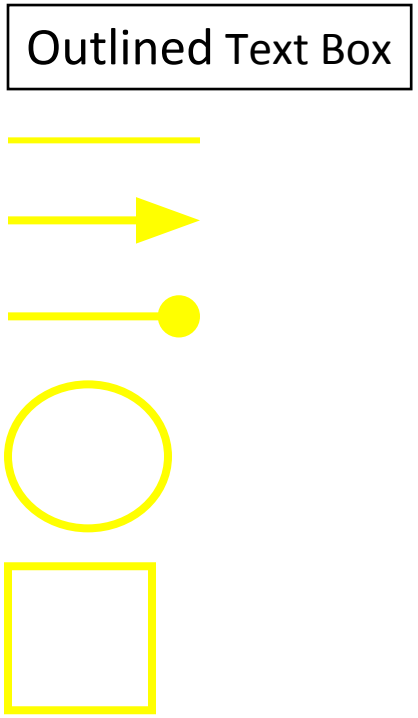
		Engineering Characteristics						
Improvement Direction			↑	↑			↑	↑
Units			lbs	#			m^3	kwH
Customer Requirements	**Importance Weight Factor**	**Wheels and brakes are present**	**Device weight tolerance**	**Movable components stay in place**	**The design is intuitive**	**There is an admin portion to online platform**	**Provide enough room for 10-15 people**	**Adequate battery performance**
Weight	**5**	1	3	3			3	3
Mobility	**7**	9	9	9	3	1	1	
Power Consumption	**7**				9	1	3	9
Area	**2**	3	3	9			9	3
Aesthetics	**1**	3	1	9	9	1	3	1
Weather Resistance	**3**		1	1	1			3
User Interface	**5**			9	9	9	1	
Raw Score (155)		16	17	40	31	12	20	19
Relative Weight %		10.3	11.0	25.8	20.0	7.70	12.9	12.3
Rank Order		6	5	1	2	7	3	4

Detailed Math Backup

Standard Shapes







Approved Logos

FAMU-FSU
College of
Engineering

FAMU-FSU
Engineering

FAMU-FSU
Engineering

FAMU-FSU
College of Engineering

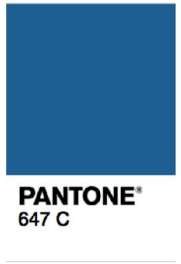
Color Palette

2299 C
Color values:
RGB 164 210 51
HEX/HTML #A4D233
CMYK 41 0 84 0

1788 C
Color values:
RGB 238 39 55
HEX/HTML #EE2737
CMYK 0 88 82 0

75% Black
Color values:
RGB 64 64 64
HEX/HTML
#404040
CYMK: 0 0 0 75

2239 C
Color values:
RGB 0 207 180
HEX/HTML #00CFB4
CMYK 59 0 39 0



647 C
Color values:
RGB 35 97 146
HEX/HTML #236192
CMYK 96 54 5 27

50% Black
Color values:
RGB 128 128 128
HEX/HTML
#808080
CYMK: 0 0 0 50

2199 C
Color values:
RGB 0 187 220
HEX/HTML #00BBDC
CMYK 77 0 16 0

7535 C
Color values:
RGB 183 176 156
HEX/HTML #B7B09C
CMYK 10 11 23 19

25% Black
Color values:
RGB 191 191 191
HEX/HTML #bfbfbf
CYMK: 0 0 0 25

APA Tables

Category 1	Category 2	Category 3	Category 4	Category 5
Item 1				
Item 2				
Item 3				
Item 4				

	Category 2			Category 3	
Category 1	subcategory 1	subcategory 2		subcategory 1	subcategory 2
Item 1					
Item 2					
Item 3					
Item 4					