STEM House

August 7th, 2013 EDSGN 100 Section 201

STRUCTURE TEAM

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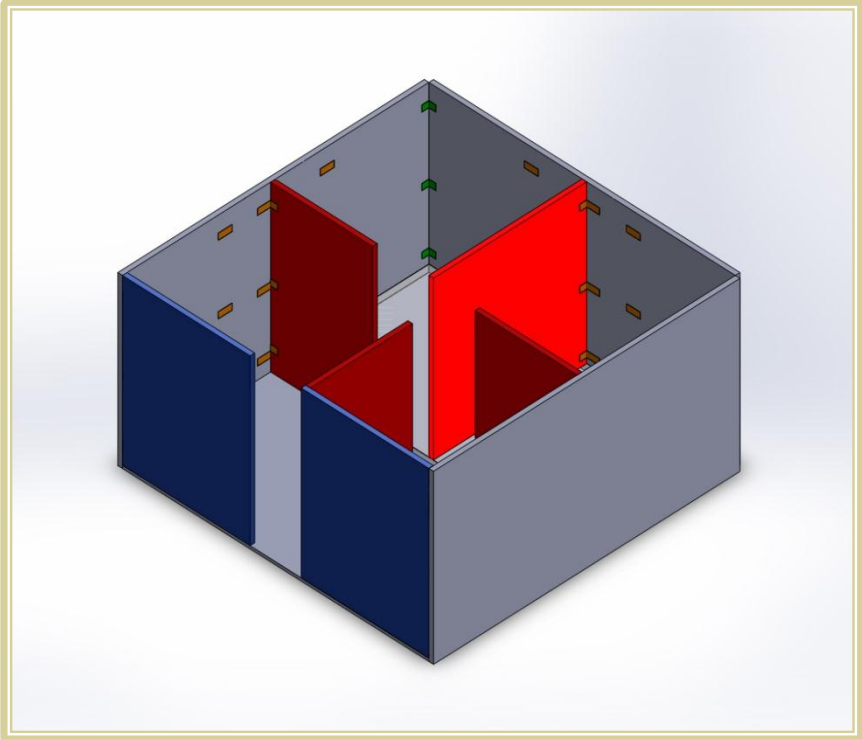

The Process

The Structure Team brainstormed dozens of ideas to meet the rather broad specifications we set for ourselves. The hollow plastic interlocking wall pieces were enough to support each other as well as meet the needs of what the other sub teams needed from the walls in their room. A raised plexiglass sub floor was constructed in order to provide a stronger learning experience for both water teams. Without a sub floor, floor, roof, or windows throughout the structure reduced complexity of the entire house, increased the structural integrity, made the overall cost cheaper and made the house more buildable by our intended age group. The house was made not only with our specifications in mind but also the needs of other sub teams and the consumer themselves.

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Introduction

We, as a structure group, have the opportunity to build a house structure for children. In the economy today, we are exhausting our resources and would like to teach young children about sustainability. They rely on resources that will only exist for eternity. We have developed a few specifications for the STEM House. These specifications include: an inexpensive structure, an effective structure, a structure that is simple and easy to handle, as well as portable structure. These specifications will be met if we keep the cost of the structure beneath $1000, teach children about our educational objectives, a lightweight structure that is put together in a simple manner, and also we must use pieces small enough that make transportation easy. Our specifications were based off of the audience that will be potentially buying a STEM House: teachers, schools, and museums. There is a schedule of our steps throughout the design process on page 10.

Concept Development

In the beginning, we brainstormed every idea that came to mind in order to create a structure for the STEM House. The most important focus was education. We decided that we would teach structural stress through demonstrations and experiments. Also, we would like to teach kids how to assemble a structure based off of plans developed and design and construct a cost effective house. Next, we needed a strong material. Our ideas for the structure were: particleboard, plastic interlocking walls, and building walls out of Lego's. Following material research, we narrowed down our decision to use plastic interlocking walls. Using particleboard would not be suitable because it weighs too much, and children would not be able to pit up the pieces. The decision came down to Lego's and the interlocking plastic pieces. As we collaborated with other groups, we realized each group needed to hang objects on the walls of the house. We thought having children build the house out of Lego's was not the best idea because it has the potential to lack stability and safety if they build it the wrong way. Also, the blocks were not in our price range. The final decision was to use plastic interlocking walls (Figure 1). This is the same plastic used in Little Tikes play homes. It is said to hold up to 100 pounds per wall, but it is also light enough for children to put them together on their own. To hold the walls in place, we came up with a few ideas. We could use magnets or braces. This decision was quickly made after we decided to build the structure out of interlocking walls; the structure would not need anything more to make it sturdier. Thirdly, we brainstormed a roof. A few of our ideas were: full roof with a slight slant, half roof where there would be a device to change the slant, and also a flat roof. Our main obstacle here concerned the children. It would be dangerous for kids to build a roof that is bigger and, in most cases, heavier than them. After discussion with other groups, we made a joint decision to trash the roof idea. Since the roof idea was gone, we took our attention to an idea about windows. The teams said they did not particularly need windows and could do without them. Therefore, we didn't need to brainstorm for this element of the house. Our next aspect of the house to think about was the floor. Some of the teams wanted to put something interactive in the floor. As the structure team, we had to figure this out.

Concept Development

We received information that only two teams would like a so-called sub floor. Researching the sub floor was quick and easy. We decided to make the floor out of Plexiglass, so the children could see through it. Additionally, the children could open the floor up to build things on their own. A team member made a floor structure that would hold the Plexiglass, but the support was also light and easy enough for the children to put together (Figure 2). With all the material decisions finalized, we needed to figure out how we were going to shape the home. We could have one big room with a few smaller rooms inside, or each team can have their own room built as an individual structure. Our collaboration as a group led us to a quick decision. The agriculture team wanted to use something from the wastewater and the energy team wanted to use something from water team. We decided on one big twelve foot by twelve-foot square that will have four individual rooms (Figure 3). We derived those dimensions by considering the average size of a classroom. The house could not take up the entire room, and this house was large enough for every team. With these dimensions, the teams could have a six-foot by six-foot room where the children would fit comfortably, and the teams had enough room for their systems as well. Lastly, our biggest obstacle to overcome was the actual process of the children building the structure. Our thoughts were to have instructions, different blue prints, and pre- made variations of the home. Quickly, we dismissed the variations of the home. This was due to the topic earlier about size and placement. Children would not have placed each system in a correct fashion, so we decided to go with one standard blue print that they would follow (Figure 4). After the long process of brainstorming, analysis, elimination, and research, we finally had made all of the decisions for our structure.

Concept Development Figures

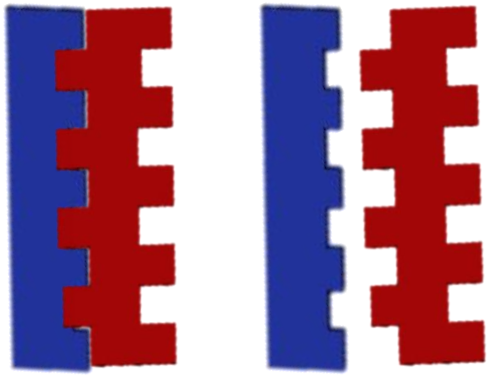

Figure 1: Plastic Interlocking Walls

This image helps to demonstrate the simplicity of the walls when it comes to connection. The walls will be easy for kids to assemble while being light enough in order to maneuver with ease.

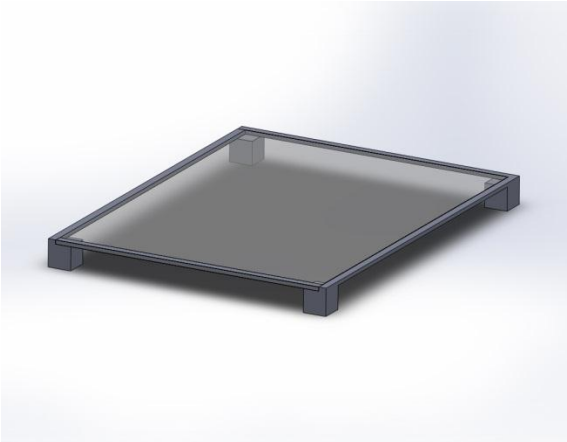

Figure 2: Subfloor

This is a piece of the subfloor. The subfloor will be made out of wood and plexiglass. The wood will provide a support for the plexiglass. The plexiglass will be used in order for the water teams to demonstrate the flow of water in pipes beneath the floor.

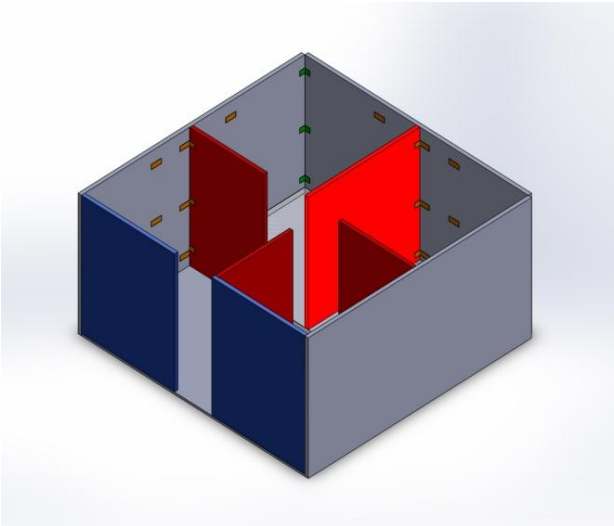

Figure 3: Isometric for Structure

This is the overall view of the structure that will contain other teams involved with the STEM House.

Concepet Development Figures

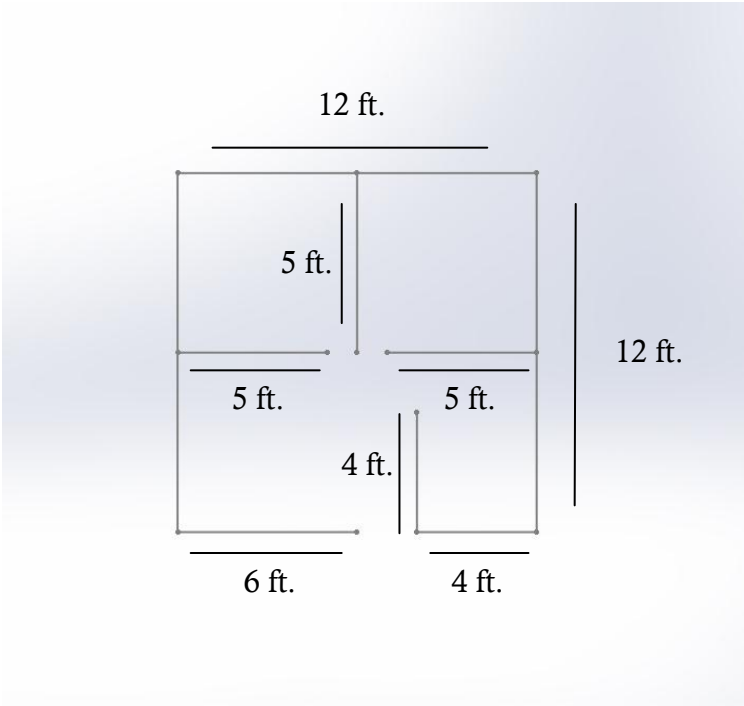

Figure 4: Floor Layout with Dimensions

Polyethylene plastic walls	LEXAN Plexiglas subfloor
Light weight	**Interactive**
Low cost	**Light weight**
Holds up to 100 pounds	**Low cost**
Easy assembly	**Easy assembly**
Attractive Design	

Figure 5: Positive Attributes of the Materials

Detailed Concept Development

As discussed before, we concluded to make the walls out of plastic interlocking walls (Figure1). We made the decision of using interlocking plastic for the walls based on the first Matrix found on page 10. We came to the conclusion that no extra support would be needed for the structure of the plastic wall. Also, there would be no roof or windows due to the children being unable to reach and no windows to decrease the cost. For the floor, we designed our own. A picture is shown in Figure 2 of this design and a list of positives about this floor is listed in Figure 5 of the appendix. With all the materials finalized on, we designed a floor plan exactly how the house would look so the children would be able to follow the instructions easily. The design of our house can be viewed in Figure 4.

Conclusion

With our current designs, we will have the ability to teach children about sustainability. Additionally, we have met all of our previous specifications including an inexpensive structure, an effective structure, a structure that is simple and easy to handle, as well as portable structure. We have met these specifications because our structure will cost less than $1000, teach kids about structures, and be assembled with ease due to the interlocking plastic walls. Also, our structure will be easy to handle due to the use of lightweight plastic walls; finally, our structure will be portable because all of the components are small in size and easy to put together due to the simplicity of the connections. With confidence, we know our design will appeal to our audience that includes teachers, schools, and museums.

Appendix

Materials	Particleboard	Interlocking Plastic	Legos
Cost	Good	Neutral	Neutral
Portability	Neutral	Good	Bad
Easy to put together	Bad	Good	Good
Weight	Neutral	Good	Good
Total	0	3	1

Matrix #3	%	1	3	1	1	2	2
Cost	25%	4	5	5	2	4	4
Effectiveness	20%	5	4	4	5	5	4
Simplicity	25%	4	5	3	4	5	3
Ease of Handling	15%	4	3	3	4	4	3
Portability	15%	5	4	5	4	5	5
Total	100%	4.35	4.35	4	4	4.6	3.75
Good?		Yes	No	No	Yes	Yes	Yes

Appendix

GANTT CHART - STEM House

Structure Team

No.	TASK		<Starting Date						Ending Date>
1	Recognized opportunity		7/17/13						
2	Discusssed potential location			7/19/13					
3	Finalized location			7/19/13					
4	Discussed potential space			7/19/13					
5	Colobrated with other teams			7/19/2013 - 7/26/2013					
6	Finalized space			7/19/13					
7	Add in educational aspects				7/24/13				
8	Brainstormed materials				7/24/13				
9	Brainstormed design layout				7/24/13				
10	Created design layout				7/24/13				
11	Brainstorm constructional integrity					7/26/13			
12	Finalized general structure					7/26/13			
13	Designed Solidworks model					7/26/13			
14	Bill of materials					7/26/13			
15	Designed charts						7/31/13		
16	Create presentations						7/31/13		
17	Communicate design solution							8/2/13	

Appendix

Matrix #1	Brainstorming Ideas								
Main Ideas:	Structural Stress Demonstrations/Experiments			Assemble Structures Based On Plans Developed			Design/Construct a Cost Effective House		
Sub-Ideas:	Vertical Stress	Horizontal Stress	Stress Lesson	Design a Floor Plan	Pre-Made Floor Plan	Floor Plan Lesson	Materials		
Strategy #1:	Partial Roof	Braces	Scaled Pieces	Draw Your Own	Sub-Floor	Scaled Pieces	Strong/Cheap		
Strategy #2:	Support Beams	Magnets			Instructions		List of Materials		
Strategy #3:		Bolts/Screws							

Matrix #2	1	2	1	2	3	1	1	1	2	1	1	2
Cost	X	0	0	X	0	X	0	X	0	X	0	0
Effectiveness	X	G	G	X	G	G	0	G	G	G	0	G
Simplicity	X	0	G	G	G	0	0	G	G	0	0	G
Ease of Handling	X	0	G	0	G	G	G	G	G	G	0	0
Portability	X	G	G	G	G	G	G	0	G	G	0	G
Total	-5	2	4	0	4	2	2	2	4	2	0	3
Good?	No	No	Yes	No	Yes	No	Yes	Yes	Yes	No	No	Yes