INTRODUCTION

Castle Storm is an activity box that engages the child in engineering thinking and problem solving. The activity challenges the child to devise both protection and attack schemes based around a castle gate and battering ram.

DEVELOPMENT

The idea initially started around a water dam protecting a town. The child was to build a dam out of building blocks using principals of structural integrity in order to protect a town. This idea failed upon construction of the prototype as we could not find pieces suitable to demonstrate the principals and significance of change in design versus failure. After failure, we brainstormed other possible ways to use the structural integrity idea, and came up with a momentum powered vehicle versus a static wall. This concept is exciting for children in that it usually means either the wall or battering ram will break, and heroic/adventure themes are emphasized with the façade of a castle gate and battering ram. In addition, the blocks used to build the wall and pieces to the battering ram are quite versatile and can be used in other building activities as well.

PROPOSAL

The purpose of this project is to teach children basic engineering principals. These consist of the ideas of momentum versus static force, properties of structural reinforcement, and the concept of "failing quickly" in order to learn and achieve your goal during the process in order to obtain a working product in the end. The activity box consists of the following:

- a lightweight poster board ramp to provide momentum to the car
- a car which has Lego platforms attached to its surface in order to provide building capabilities to the battering ram.
- a castle which is reinforced with 2"x4"s in order to enhance the static force of the gate
- a large set of building blocks which are made up of a specially designed rapid prototype piece as well as a composite of Lego and wooden block pieces for unique building capabilities.
- a flag module which provides a goal for both teams, the castle team must protect the flag, the battering ram team must knock it down.

The children will be divided into small groups of three kids. Each group will be assigned the task of either defending or attacking the castle. They will be told their objective (i.e. to knock down or protect the flag) and presented with a selection of the building blocks (chosen at the presenter's discretion) that they will use to achieve the objective. In order to stimulate an entire classroom of children, each group of three will be given their own set of blocks to build from in which they must design their ram or wall. At the end of class, the face-offs between battering rams and walls will occur, where the presenter may conduct single round or tournament style contests if desired.
In performing this activity, the goal is to have the children learn how different types of structures behave under impact. Ideally, the activity would be performed several times by each child so they can differentiate between types of designs.

The activity is designed for any child from second to eighth grade and is meant to appeal to a wide variety of children due to its universal content. As a generalization, most boys in this age range like to destroy things. This activity provides plenty of satisfaction along that line, as long as thinking skills are engaged. Girls like to make things and protect them, which this project satisfies as well. Most importantly, this provides an opportunity for both "smart" students and students who don't do as well in school for whatever reason to be brought to the same level and given equal opportunity to perform and emphasize practical skills not usually focused on in elementary and middle school classes.

This activity will easily fit in a compact car, as its max dimensions will be 1'x2'x2' and most likely smaller. The ramp, car, and building pieces should fit within the volume of the castle for easier storage.

**SCHEDULE**

- **April 7-8:** Build remaining parts of castle for April 9 beta test.
- **April 9:** Beta test kid to try out our activity.
- **April 10-17:** Modify according to feedback of beta test kid.
  - Manufacture parts using rapid prototyping.
- **April 17-23:** Refine and make design into final prototype.

Brent, Nate, and Vincent will work on various parts as needed according to the above schedule as time and other work from classes permits. Our goal is to due most of the work early so we can avoid the end of the semester crunch from all of our classes. We have achieved a substantial amount of progress already and will continue to manage time and work progress as scheduling conflicts arise.

**BUDGET**

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 tubs of Legos</td>
<td>$20.00</td>
</tr>
<tr>
<td>1 box of wooden blocks</td>
<td>$10.00</td>
</tr>
<tr>
<td>1 K-Mart car</td>
<td>$3.00</td>
</tr>
<tr>
<td>Poster board scavenged from the University Center</td>
<td>$0.00</td>
</tr>
<tr>
<td>2&quot;x4&quot;'s scavenged from Delta Upsilon Booth project</td>
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<tr>
<td>Special part to be built on Rapid Prototyping system</td>
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<tr>
<td>Jet glue to hold parts together</td>
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<tr>
<td>Spray paint</td>
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<tr>
<td><strong>Total</strong></td>
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PICTURES

Brent demonstrating the rough prototype the day after changing from a water dam concept to a battering ram concept. Initial battering ram was a rolling can of soup and our blocks were flimsy poster board cutouts.

Classmates critiquing and playing with our activity box after some building block and battering ram changes. Our battering ram was now a pulled apart K-Mart toy car and a wooden block-Lego block hybrid.