

Design Document

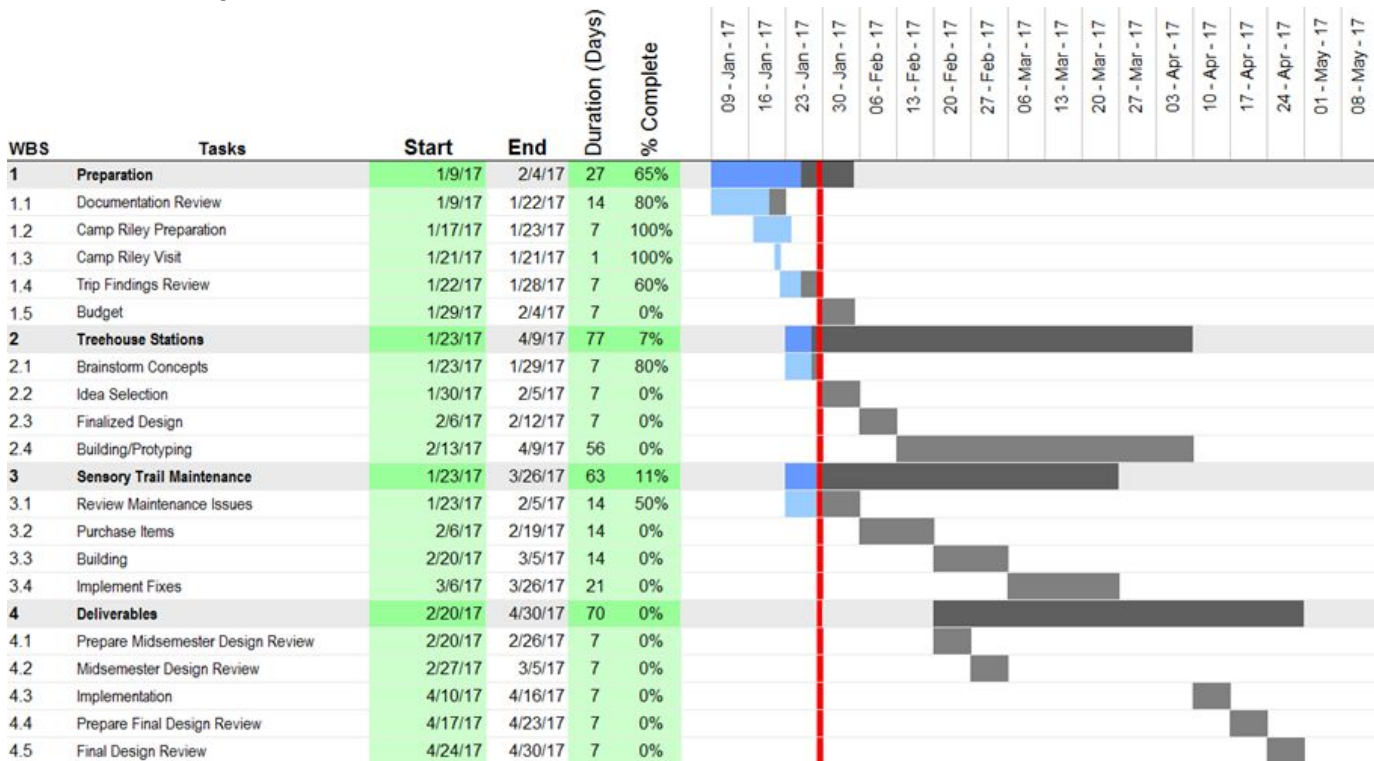
The Senstation Team

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Design Status

Phase	Sensory Trail Fixes	Treehouse Path
Phase 6: Service / Maintenance	Status: <i>To be done</i> Semester: <i>Spring 2017+</i>	Status: <i>To be done</i> Semester: <i>Spring 2017</i>
Phase 5: Delivery	Status: <i>In progress</i> Semester: <i>Spring 2017</i>	Status: <i>To be done</i> Semester: <i>Spring 2017</i>
Phase 4: Detailed Design	Status: <i>Completed</i> Semester: <i>Spring 2017</i>	Status: <i>In Progress</i> Semester: <i>Spring 2017</i>
Phase 3: Conceptual Design	Status: <i>Completed</i> Semester: <i>Spring 2017</i>	Status: <i>Completed</i> Semester: <i>Spring 2017</i>
Phase 2: Specification Development	Status: <i>Completed</i> Semester: <i>Spring 2017</i>	Status: <i>Completed</i> Semester: <i>Spring 2017</i>
Phase 1: Project Identification	Status: <i>Completed</i> Semester: <i>Spring 2017</i>	Status: <i>Completed</i> Semester: <i>Spring 2017</i>

Project Plan



Project Identification

- Create sensory stations ready to be implanted into the treehouse trail.
- Perform maintenance on sensory trail projects: Some of the features on the sensory trail require replacement and maintenance (pegs, ball and toss, paint xylophone/replace mallet)

Community Partner

Bradford Woods, Indiana University's Outdoor Center, has a rich and interesting history. It is thanks to the generosity of the Bradford family, who called this area home in the late 1800s and early 1900s, that we are Indiana's largest preserved natural area outside the state and national park systems, and a national and international leader in outdoor education and summer camp programming.

From <<https://www.bradwoods.org/about-us/history/>>

Camp Riley is an annual summer camp program that allows lets children with disabilities experience life without limits, and adventures that help them build confidence and friendships. Riley Children's Foundation's role is to fund Camp Riley. Every summer, Camp Riley welcomes approximately 200 children between the ages of 8 and 18 from throughout Indiana and several other states. Campers have opportunities to experience a wide range of outdoor adventures, often for the first time, such as horseback riding, swimming, water skiing, climbing towers, and archery. Each camp session takes place among the peaceful trees and cabins of Bradford Woods— Indiana University's 2,500-acre universally accessible outdoor recreational facility.

From <<http://www.rileykids.org/about/camp-riley/>>

Stakeholders

#	Stakeholder
1	User (Child)
2	Camp Riley Faculty
3	Future EPICS team
4	Parents

Social Context

Sensory Trail:

The sensory trail is a pathway which surrounds a horse pen and along the way, it contains various sensory stations such as peg boards, sound tubes and drums.

The updates of the sensory trail projects will impact campers and the counselors. Currently, some of the stations have bug infestations, dirt, and cobwebs. These have the potential to be dangerous (e.g., spiders) and are overall unpleasant to see. For example, the peg boards have loose pegs

because the mounts are broken. This needs to be fixed as it could leave behind sharp wooden splinters. Next, the ball and toss station needs cleaning and mesh on most of these stations has been ripped. They need to be replaced in order to be accessible. Furthermore, the xylophone will need to be painted and it has a broken mallet. Finally, the maintenance guide will help the upkeep of these projects.

This is important to keep Camp Riley not only looking good, but to keep it in good working order. The kids deserve the best and we want to provide them with clean, functional stations and we also want to ease any burdens on the camp counselors.

Treehouse:

Several stations will be placed on the path leading towards the treehouse and depending on the size of the treehouse, certain stations might be placed inside. Along the path, there will be activities placed on walls in order for campers to utilize them. The stations to be implemented are the binoculars, gears and crank, calming bottles, and matching games. However, this is not the final decision as we are awaiting approval from Tim and Jennifer. This project is important because it will help a plethora of campers to easily access the zip lines. Additionally, the Camp Riley will have expanded its cause to help the kids.

By the end of the semester, we would like to ensure that all the stations at the trail are functioning adequately and are well maintained. For the treehouse, we hope to design and develop at least 4-5 stations.

User Needs

Need #	User Need	Stakeholder
Project:	Sensory Trail Maintenance	
Need #:	User need	Stakeholder
1	Clean and safe	Children, faculty, parents
2	Xylophone Mallet replaced	Children
3	Gold Drums replaced	Children
Project:	Treehouse Stations	
Need #:	User need	Stakeholder
1	Clean and Safe	Children, faculty, parents
2	Ready to be mounted	Faculty, EPICS team
3	Weather-resistant	Children, faculty

Project Objectives

In general, the project's objectives are to improve the sensory trail and design play stations for the tree house that is going to be built. The sensory trail is in need of improvement because numerous stations are in need of cleaning and preventative maintenance. The peg boards, ball throw stations, and mailboxes have become homes for a variety of creatures. There is also some future concerns with the xylophone sagging. By ensuring that these sensory stations are safe and clean, allows the users to encompass the educational and soothing experience by its entirety. The play stations for the tree house will be another form of entertainment for the campers ensuring that they get the best experience that they can while they are at Camp Riley

Sensory Trail Maintenance

- New objects for ball and toss stations
- Redesign peg board sliding pieces
- Replace one mallet on xylophone
- Paint xylophone
- Replace painted gold buckets with gold plastic buckets

Treehouse Path

- Create 3-6 mountable stations for treehouse path

Project Deliverables

Our team believes that by the end of the semester we will have achieved deliverables in both of our projects. The first of these is the sensory trail, by the end of the semester we will have completed the following objectives: done basic maintenance on the trail such as cleaning out insects and cobwebs. Then will also fix the current pegboards, ball and toss, install a new mallet on the xylophone, and replace the bucket for the drums. The second project is the treehouse. The deliverables are currently to design and implement 4-5 sensory stations along the path to the treehouse as well as inside the treehouse.

In efforts to keep the trail in pristine condition, the team will also provide a maintenance schedule for the sensory trail stations. The schedule will state the maintenance activities and their frequencies. Additionally, a maintenance schedule will install a maintenance schedule for the stations at the treehouse.

Brainstorm

Our brainstorming phase included researching ideas for treehouse stations that would involve campers' senses. The campers themselves helped in this brainstorming phase by providing ideas of their own that they would like to see in the tree house.

Brainstorming (20+ Ideas)

- Xylophone
- Rain sticks
- Wind chimes
- Drums
- Piano
- Windpipe with PVC
- Kaleidoscope
- Telescope/binoculars
- Basket Toss
- Corn holes
- Slingshots
- Enlarged fidget cube
- Puzzles
- Calming bottles
- Obstacle course
- Spider web walk
- Activity wall (gears, water, marble and pipes)
- Wheels
- Spinning match game
- Kinetic sand station

This list was given to the stakeholders, so they could identify which stations Camp Riley would be the most interested in having.

Idea Reduction (Stakeholder's Preference)

- **Xylophone**
- **Rain sticks**
- **Wind chimes**
- Drums
- **Piano**
- **Windpipe with PVC**
- Kaleidoscope
- **Telescope/binoculars**
- Basket Toss
- Corn holes
- Slingshots
- **Enlarged fidget cube**
- Puzzles
- Calming bottles
- Obstacle course
- Spider web walk
- **Activity wall (gears, water, marble and pipes)**
- Wheels
- **Spinning match game**
- Kinetic sand station

Each idea was then looked at from a feasibility standpoint. The ideas that were not feasible, due to factors such as safety or weather, were eliminated.

Idea Reduction (Feasibility)

- **Xylophone**
- **Rain sticks**
- **Wind chimes**
- Drums
- **Piano: need electronics**
- **Windpipe with PVC: universal use problems**
- Kaleidoscope
- **Telescope/binoculars**
- Basket Toss
- Corn holes
- Slingshots: *dangerous*
- **Enlarged fidget cube**
- **Puzzles: Difficult to implement**
- Calming bottles
- Obstacle course: *universal use problems*
- Spider web walk: *universal use problems*
- **Activity wall (gears, water, marble and pipes): water and marbles hard to manage**
- Wheels
- **Spinning match game**
- **Kinetic sand station: Not outdoor friendly**

Six ideas were then chosen based upon the team's preference. The team was split into pairs, and each pair was assigned three stations to pursue.

- Calming bottles (4+3+2=9)
- Gears and crank (2+4+2=8)
- Rainstick (3+2+3=8)
- Tossing game (4+3=7)
- Playground Wheel(2+4=6)
- Telescope/binoculars(4)
- Kaleidoscope (1+1+1=3)
- Drums (3)
- Matching game/tic tac toe spinning poles(1+1=2)
- Xylophone
- Windchimes

- Emerson & Pat
- Don & Pranai

Top 4 Ideas				
Kat	Emerson	Don	Pranai	Pat
1. Calming Bottles 2. Rainstick 3. Gears and crank 4. Kaleidoscope	1. Gears and crank 2. Calming bottles 3. Rainstick 4. Kaleidoscope	1. Tossing game 2. Drums 3. Calming bottles 4. Matching game	1. Binoculars 2. Tossing game 3. Wheel 4. Matching Game	1. Wheel 2. Rainstick 3. Gears and crank 4. Kaleidoscope

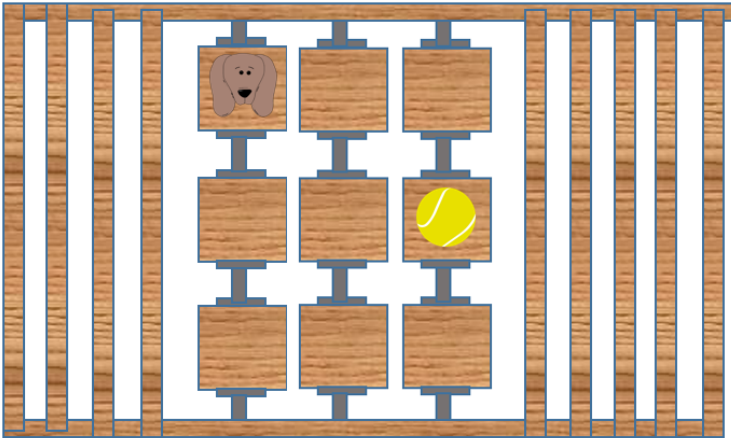
Idea Selection

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| <ul style="list-style-type: none"> • Xylophone • Rain sticks • Wind chimes • Drums • Piano: need electronics • Windpipe with PVC: universal use problems • Kaleidoscope • Telescope/binoculars • Basket Toss • Corn holes | <ul style="list-style-type: none"> • Slingshots: <i>dangerous</i> • Enlarged fidget cube • Puzzles: <i>Difficult to implement</i> • Calming bottles • Obstacle course: <i>universal use problems</i> • Spider web walk: <i>universal use problems</i> • Activity wall (gears, water, marble and pipes): <i>water and marbles hard to manage</i> • Wheels • Spinning match game • Kinetic sand station: <i>Not outdoor friendly</i> |
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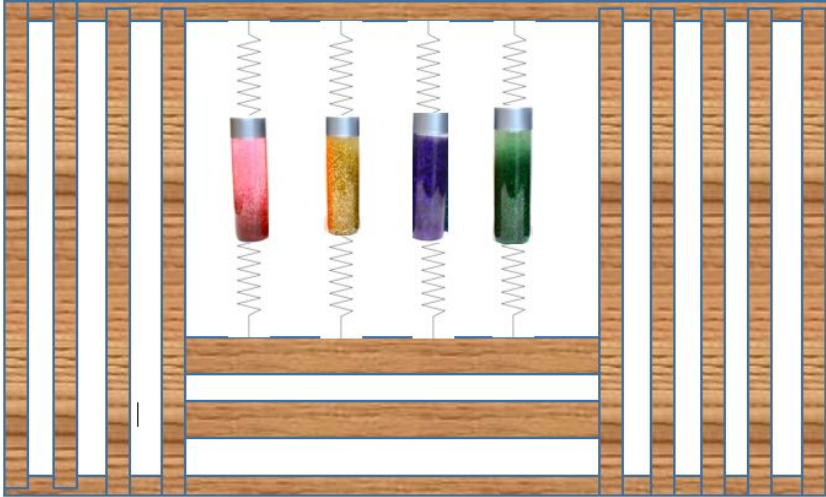
Low Resolution Prototyping



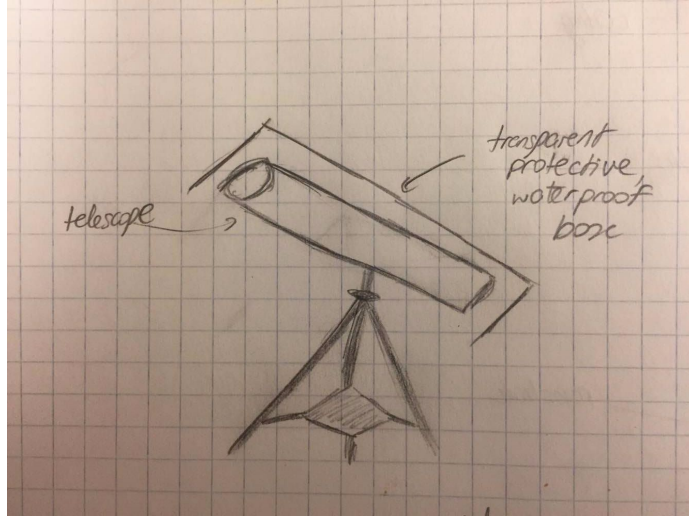
Gears and crank on plywood.



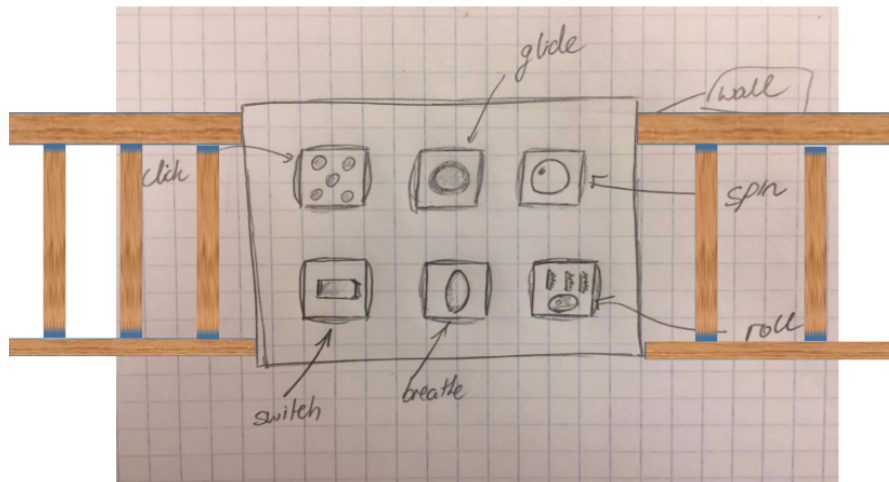
Spinning poles for a matching game.



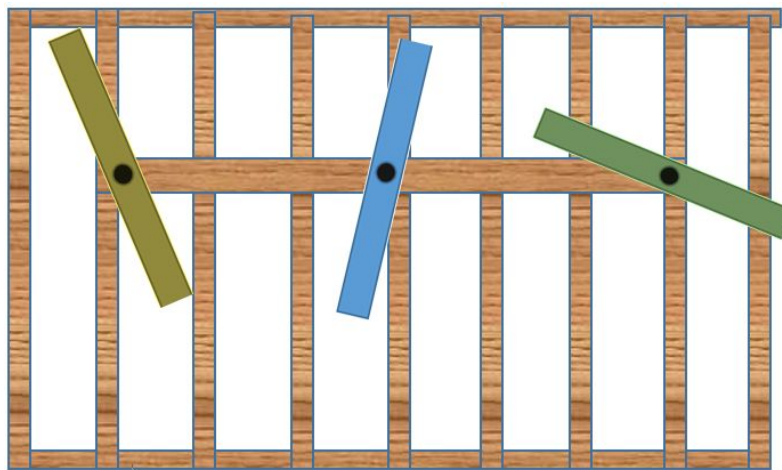
Calming bottles with springs so the campers can safely mix the bottle.



Telescope with outdoor friendly cover.



Enlarged fidget cube on plywood.



Rainsticks pinned to wood so the children can spin them.

Proof-of-Concept Prototyping

Rain stick Prototype 2/28/17

1. Drill holes through PVC pipe
2. Insert screws in holes
3. Tapes around the entire pipe to ensure screws stay in place.
 1. Close off one end of PVC pipe
 2. Fill pipe with items (this prototype has nuts)
 3. Close off other end and bolt to wood



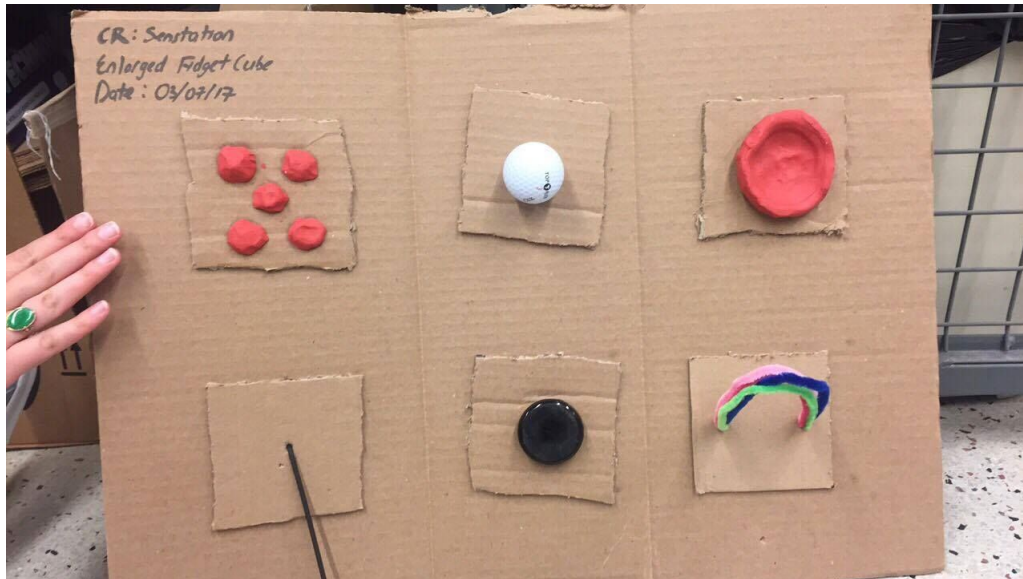
Calming Bottles Prototype 3/7/17

1. Fill bottle with glitter glue and glitter, or the swelling beads (it only takes a pinch of the beads, they grow)
2. Seal lid shut with epoxy



Enlarged Fidget Cube 3/7/17

- Cut out 6 individual 4x4 rectangles from cardboard to
- Create 6 different textures by taking ideas from the sides of a fidget cube, for each 4x4 rectangle
- Glue/ Screw these rectangles onto a larger cardboard platform



Rainstick Prototype 3/23/17

- Clear PVC with insert
- Insert made by placing nails in wood dowel



Gears and Crank 3/28/17

- Play toy gears
- Stabilized in plywood with nut and bolts



Texture Wall Prototype 4/17/17

- Spray Painted a large piece of wood
- Used 3D paint to create a texture
- Attached gears, straws and springs using glue in order to create various textures.



Calming Bottle Prototype 4/17/17

1. made the wooden frame with scrap wood in the lab.
2. Originally screwed in the eye rings, then decided that the range of motion with that design was not enough to produce the desired spilling result.



Bill of Materials

Sub-Assembly	Item	Vendor
Rainstick/Calming Bottles	PVC Cap - 2 inch	Mernards
Rainstick/Calming Bottles	Clear PVC Pipe	https://flexpvc.com/cart/agora.cgi?p=PVC-CLEAR-PIPE-UV-Thinwall&p_id=CLUVTh020&xm=on&ppinc=detail
Calming Bottles	Rainbow Water Beads	https://www.amazon.com/MarvelBeads-Rainbow-Orbeez-Refill-Sensory/dp/B018HSB7GW/ref=sr_1_2?ie=UTF8&qid=1485881808&sr=8-2-spons&keywords=rainbow+water+beads&psc=1
Gears and Crank	Toy gears and crank	https://www.amazon.com/Learning-Resources-Gears/dp/B00000DMCE/ref=sr_1_3?s=toys-and-games&ie=UTF8&qid=1486154329&sr=1-3&keywords=toy+gears

Assembly Process

Calming Bottles	
Tools	Epoxy glue, Drill, Screwdrivers, Nails, Hinges
Materials	Wood, PVC pipe, Glitter, Plastic Caps
Steps	<ol style="list-style-type: none"> 1. <i>Drill holes into 2 plastic caps used to enclose the PVC pipe</i> 2. <i>Insert eye bolts into these caps and secure bolts using epoxy</i> 3. <i>Attach one cap to one end of the PVC pipe</i> 4. <i>Fill three-quarters of the PVC pipe with water and the last quarter with glitter</i> 5. <i>Attach the second cap to the other end of PVC pipe to completely close the pipe on both ends</i> 6. <i>Build a stand using 2 slabs of wood and 1 long piece of wood.</i> 7. <i>Attach each slab to either side of the long piece of wood using hinges.</i> 8. <i>Insert an eye bolt into the top slab of wood</i> 9. <i>Hang the completed PVC pipe using rubber band - connecting the eye bolt on the PVC pipe to the eye bolt in the slab of wood</i> <p><i>This prototype doesn't allow the pipe to rotate completely causing the glitter to settle at the bottom of the pipe. Use strong magnets to connect the PVC pipe to the stand to achieve free rotation.</i></p>

Rainstick	
Tools	Drill, Nails, Rubber band, bolts
Materials	PVC Pipe, Wooden Insert, Pebbles
Steps	<p><i>Begin by drilling the main hole into the PVC pipe and the wooden 'wall' that will hold the PVC pipe to the wooden 'wall'. Proceed by hammering in nails into the wooden insert in a spiral-wise fashion. Place the wooden insert inside the PVC pipe and drill in the main hole through the wooden insert the PVC pipe and the wooden 'wall' that will hold the wooden insert in place inside the PVC pipe with a big nail. Continue by placing a handful of pebbles inside the PVC pipe and enclosing it with 2 caps. The next step is to insert a big nail (the size for which was drilled for earlier) through the PVC pipe and the wooden 'wall' to hold them together with a bolt at the end of the nail to keep the nail stable and in place. Add a rubber band in the space between the 'wall' and the PVC pipe so that the rain stick is free to rotate.</i></p>

Final Delivery - Sensory Trail Fixes

Objective	Status	Issues	Next Steps
Waterproof ball and toss objects and rope	Almost Complete	Two unaccounted stations	Finish last 2 stations
Redesign peg pieces	Completed	N/A	Follow-up necessary
Replace xylophone mallet	Completed	N/A	Follow-up necessary
Paint xylophone	Not Completed	Time constraint	Paint xylophone
Replace painted gold buckets on drum sets	Not Completed	Buckets were flimsy/too small	Find new suitable buckets

The pegs were redesigned to slide better in the boards. The original design had the back piece glued to item and did not hold. The redesigned peg at a nail and glue holding the back piece on.

