MOBILE FARM STAND
A Vehicle for Education
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An Interactive Qualifying Project
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WORCESTER POLYTECHNIC INSTITUTE
in partial fulfillment of the requirements for the
Degree of Bachelor of Science.

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ABSTRACT

Turn Back Time Inc. (TBT) provides inclusive farm and nature-based programs for children to learn and develop through play-based learning. The purpose of the project was to design and construct a mobile farm stand to better connect students with self-grown food and teach them critical math skills, which will help them work through their math anxiety or prevent its onset. We approached these objectives by interviewing TBT teachers, researching farm stand designs and building materials, virtually sketching our designs, and constructing the farm stand. Our project’s goal was achieved through providing TBT with a constructed mobile farm stand and adaptable math lesson prompts.

MEET THE TEAM

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EXECUTIVE SUMMARY

Project Background

Turn Back Time Inc. (TBT) is a nonprofit farm that connects children with the educational benefits of nature. TBT has products that they want to sell to the local community but do not have a proper farm stand to facilitate sales. A mobile farm stand could serve as an operations center, as well as a community attraction and vehicle for children’s education through play-based learning. These play-based lessons would allow TBT students to have additional education programs to further develop their math skills and, in turn, prevent them from developing math anxiety later on in life.

Goals & Objectives

Design and construct a mobile farm stand on a repurposed trailer for Turn Back Time Inc. (TBT) with an integrated educational program for children in Worcester County, Massachusetts from ages 3 to 8 to help them develop math-related socio-cognitive skills.

Objective 1:
Develop lesson prompts that successfully teach children about mathematics and integrate into our farm stand design.

Objective 2:
Research common farm stand designs and synthesize a design that incorporates TBT’s needs and values through sponsor meetings. Create a corresponding itemized budget.

Objective 3:
Collect materials from the finalized materials list and construct the farm stand on-site.

Methods

1. Lesson Prompt Development
   - Teacher Interviews
   - Meta-analysis of farm stand elements

2. Farm Stand Design
   - Visualization in SketchUp
   - Meta-analysis of materials

3. Farm Stand Construction
   - On-site construction
   - Meta-analysis of building plan
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The visual report was designed by Minh Anh
Math anxiety begins in early childhood due to lack of practice in numeracy and spatial skills as well as environmental factors, such as stereotypes (Beilock & Maloney, 2015). Children with math anxiety have lower math achievement due to the anxiety limiting their working memory (Ashcraft & Kirk, 2001; Beilock & Maloney, 2015). This traps them in a perpetual cycle, where they become continuously discouraged from doing math or pursuing STEM careers. Early math interventions to promote competency in basic mathematical concepts can prevent math anxiety from ever developing.

Many children practice math concepts in their spontaneous play, showing they already have an understanding of these ideas (Drenten et al., 2008; Worthington & van Oers, 2016). With more guidance, spontaneous play activities can help children learn more complex mathematical concepts (Weisberg et al., 2015). Utilizing open-ended play-based learning better engages students, encouraging them to more actively participate and solve problems compared to traditional teaching strategies (Derman et al., 2020).

For this project, we worked with Turn Back Time Inc. (TBT). TBT is a nonprofit organization located on a farm in Paxton, MA that focuses on inclusive play-based learning through nature for children. Using the resources at the farm, provided including the animals, play-based lessons, gardens, and nature trails, children get a well-rounded education in many topics. These play-based lessons are also very beneficial for at-risk students at the farm as many of them may have trouble with traditional learning approaches.

Our project solution provided TBT with a mobile farm stand with integrated play-based math activities so children can learn from selling farm produce. While our solution was designed to teach children about math, the farm stand was made to be adaptable for the wide variety of lessons and dynamic learning experience at TBT.
2.1. Math Anxiety

In the United States, many adults report feeling anxious or fearful of math, and students tend to avoid math-heavy disciplines such as STEM (Meece et al., 1990). This fear of math is known as math anxiety which is linked to low math achievement (Lee, 2009). Originally, the fear of math was thought to start in junior high when more complex topics are introduced (Ashcraft et al., 2007). However, math anxiety can stem from many environmental factors starting at a young age, with the most noticeable sources being parents, teachers, and peers (Wigfield & Eccles, 2000). Teachers who are anxious about math will sometimes transfer these negative attitudes around math to their students, through which the students will begin to develop math anxiety. Students already struggling with math may actually pick up on those negative social cues when they start school more easily than students who do not struggle as much (Maloney & Beilock, 2012). This creates a larger gap between students who feel more math anxiety and their peers because the former will be pushed to a more negative mindset. It will then become even harder for those who have the negative attitude to catch up and pursue math further. Similarly, parents can also reinforce these negative social cues to their children when they help them with their homework for extended periods of time (Maloney et al., 2015). The influences that teachers and parents have are crucial to students' attitudes towards math.

It is important to note that someone having math anxiety does not mean that they have low math ability. Instead, when they are faced with a math problem, they often worry about performing poorly on the task which impacts their working memory needed to carry out that task (Ashcraft & Kirk, 2001; Beilock & Maloney, 2015). Working memory is the short-term system in charge of keeping one focused on the task at hand. When disrupted, the person will perform their task poorly. In other words, highly math-anxious people are doing two things at once when performing math, therefore, math anxiety can cause people to perform worse in math than their actual abilities.

When left unresolved, math anxiety can be carried from childhood into adulthood, preventing them from exploring math further. This perpetual aversion traps them in a never-ending cycle with their fear of math (Beilock & Maloney, 2015). To prevent this, math should be addressed early on in a child’s development to stop the cycle. Doing so will allow children to be more confident in their math abilities and be open to different career paths.
2.2. Early Math Interventions

Solutions that address math anxiety often focus on reducing its impact on performance instead of preventing the development of math anxiety itself (Maloney & Beilock, 2012). As math anxiety develops due to social factors and competency in mathematics, cultivating numeracy and spatial skills at an early age can prevent its onset (Beilock & Maloney, 2015). These early interventions are especially important as having poor math skills when entering formal education will increase awareness of negative social cues. These negative attitudes towards math begin to develop before preschool and anxiety negatively affecting math performance can be seen as early as in first grade (Beilock & Maloney, 2015; Kukey et al., 2019; Maloney & Beilock, 2012). Difficulties in basic mathematics for children are a result of underdeveloped precursors, including the ability to count and associate numbers with quantities, during early development (Shulze et al., 2020). Improving these skills through early math interventions, such as playing with puzzles and blocks as well as talking about numbers and shapes, may prevent math anxiety from ever developing (Beilock & Maloney, 2015).

In conjunction with the prevention of developing math anxiety, early math interventions also have long-term effects in academic success and cognitive development. Math skills developed as early as preschool can predict future mathematical achievements as observed in as late as high school (Classens & Engel, 2013; McClure et al., 2017). Children who learn about math in kindergarten and first grade have reliable success in math throughout their adolescence (Watts et al., 2014). As math skills are built on the mastery of past concepts, students who explore multiple mathematical topics early on will reap the most benefits later in life. Early math skills are also important indicators of future success in other academic areas, including reading and science, and reduce the likelihood of grade retention (Classens & Engel, 2013; Clements & Sarama, 2012; Watts et al., 2014). Future academic success has been shown to be more accurately predicted by early math skills compared to early reading or attention skills (McClure et al., 2017). These future academic benefits of early math intervention persist even after accounting for differences in other academic abilities, attention spans, personal backgrounds, and home environments (Watts et al., 2014). The wide-reaching effects of mathematical comprehension may be due to the subject’s contributions to cognitive development (Clements & Sarama, 2011). The “quantitative, spatial, and logical reasoning competencies of mathematics” create a cognitive foundation that may be used in all other subjects. In other words, learning mathematics can help children learn how to understand and analyze concepts (McClure et al., 2017).
2.3. Stereotypes in Math

When math stereotypes are internalized, children risk developing math anxiety. Stereotypes are developed subconsciously in elementary school and consciously endorsed during adolescence (Cvencek et al., 2011; Cvencek et al., 2014). Most elementary school students are sheltered and are unable to fully comprehend differences in identity. However, as children grow up and gain more freedom, they will become more aware of cultural stereotypes and begin to develop an opinion of them (Nasir et al., 2014). Consequently, children’s understanding of stereotypes is also dependent on their exposure to differing identities including gender, race, and ability level. Different identities have stereotypes that vary in severity and connotation. Regardless of the context, stereotypes have a negative impact on an individual’s sense of self. In terms of academics, this compromised sense of self can cause children to underperform on assignments (Desombre et al., 2018).

The gendered math stereotype follows the assumption that girls are worse than boys at mathematics. A common sentiment that is shared by those who believe in this stereotype is the idea that boys are expected to strive at math while girls are expected to do poorly at it (Cvencek et al., 2011). Meanwhile, the racial math stereotype follows the assumption that some races are better at math and academics in general than others. An example being the idea that Asian Americans are always smart and excel at math. On the other hand, Black people and Latino Americans are seen as less intelligent and, as such, are perceived as objectively worse at math (Nasir et al., 2014). Finally, the math stereotype regarding ability levels follows the assumption that students with disabilities are inherently worse at math than their peers. They may be viewed as being incompetent and dependent on others for assistance (Desombre et al., 2018).

Given that stereotypes impact an individual’s sense of self, it is common for people to let their assigned stereotypes influence their career path regardless of their interests. This influence usually manifests during childhood as children are unlikely to pursue academic courses and careers that go against their self-concept (Cvencek et al., 2011). Consequently, students who are impacted by an internalized math stereotype will either be drawn to or pushed away from the topic based on the perception of whether they should be good at it or not, instead of their personal interests. This is demonstrated through the gendered math stereotype as girls often feel as though they cannot pursue STEM careers because they have internalized the idea that it is not for them (Cvencek et al., 2011). Meanwhile, boys feel inclined to give in to external expectations that associate their self-worth with math performance.
2.4. Turn Back Time

Our sponsor, Turn Back Time Inc. (TBT), is a nonprofit educational organization that operates on fifty-eight acres of farmland in Paxton, Massachusetts. The goal of TBT is to connect children and parents to nature and help them recognize nature’s ability to teach and heal through inclusive educational programming. It was founded by Lisa Burris after seeing the benefits that nature had with her own children and wanted to share those benefits with other families. Children learn how to grow fruits and vegetables in the farm’s garden and then sell them to the parents but there was not a dedicated retail space. For our project, we designed and constructed a mobile farm stand to display and sell the grown produce and serve as a vehicle to teach children about mathematics in addition to financial literacy and healthy food. While this is our intention, the ultimate utility of the farm stand will be determined by how the teachers at TBT use it.

Farm stands are used by local farmers to directly sell their produce, handmade crafts, and other products to customers. A mobile farm stand can be attached to the back of a vehicle, allowing vendors to sell in other locations and ease the process of transporting goods. Some farm stands are fully enclosed and large enough for the sellers to walk around inside while others only display products. If the farm stand will serve as a permanent structure, elements that contribute to its durability and weatherproofing, such as the frame and sealable openings, need to be carefully considered.
2.5. Play-based Learning

TBT employs play-based learning as the central part of children's experience with nature. **Play is a natural and essential part of early childhood development and communication.** Specifically, play has been used to research children's socio-cognitive development as play often requires children to engage with their peers and reenact real themes and scenarios (Derman et al., 2020; Drenten et al., 2008). Children who play more show better social skills, self-regulation, self-confidence, and mental development (Derman et al., 2020; Weisberg et al., 2015). In other words, early childhood studies have observed children’s play as an indicator for their level of cognitive development. Past literature findings show that children from a young age display certain math understandings more often in their application in daily lives rather than in their abstract forms (Drenten et al., 2008; Worthington & van Oers, 2016). Children ages three to four engage in mathematical concepts in many episodes of spontaneous pretend play in a study conducted by Worthington & van Oers (2016). That is, outside the framework of adults’ guidance, **children-initiated play in the study demonstrated that children as young as three years old have developed certain concepts about numbers, number sequences, and number quantities in terms of money and time** (Worthington & van Oers, 2016). In a more specific context such as in a grocery store, Drenten et al. (2008) observed preschool students' dramatic play and found that children from ages three to six are able to adopt adults' shopping behaviors by imitating monetary exchange and reenacting certain math activities such as discussing and sorting money.

While spontaneous play provides an insight into early childhood's current math comprehension and other socio-cognitive development, **more guidance in play has the potential to bridge spontaneous activities to more complex concepts** (Weisberg et al., 2015). Indeed, studies have shown that children benefit from guided play-based learning where they can exercise their freedom to independently explore within a controlled environment while educators can adopt a variety of learning outcomes (Weisberg et al., 2015). This is specifically relevant to our project as the team aims to build upon children’s prior understanding to introduce them to math and other relevant concepts through hands-on play-based learning. While math is included in preschool activities, they are often carried out in restricted manners that are limited to textbooks (Derman et al., 2020). On the other hand, using physical examples and materials help children visualize different math concepts and develop their own ideas, which is consistent with how they demonstrate math comprehension in concrete applications (Kukey et al., 2019). Previous research has also shown that **open-ended play-based activities attract students’ attention and encourage them to actively participate and solve problems; this allows students to better retain complex information** (Derman et al., 2020). Moreover, exposing children to entrepreneurial experiences such as selling goods to family and friends not only introduces children to working with money and math but also fosters a sense of independence and goal-oriented behaviors (Loderup et al., 2021). **These findings have implications for our mobile farm stand project as such a structure would engage children’s socio-cognitive skills through a variety of retail activities such as interacting with customers and “coworkers” as well as sorting and counting produce and money.**
2.6. Farm Stand Implications

Allowing children to contribute to the operations of a farm stand provides them with a chance to learn about business from a young age. The input involved with growing and selling food creates a positive work environment. Through this environment, children are introduced to the concept that an economy should be built on sufficiency, instead of solely on competition (White, 2008). Promoting healthy perspectives of the economy can help children avoid developing a sense of unfulfillment from their occupation(s) later in life. Through the self-efficacy of operating a farm stand, children will learn to appreciate the things that they have in life, instead of focusing on things they wish they had.

Beyond teaching children about business, farm stands also provide children with a vehicle for personal growth and connecting with their community. Through a self-driven approach of earning their own money, children learn the value of hard work from an early age (White, 2008). By earning their money instead of being given an allowance, children will learn to value money and the effort that goes into making it. Through this process, they will more likely develop healthy spending and savings habits. Furthermore, running a farm stand also provides children with something that is more important than money: connections. Since they will be selling goods to their community members, children will learn the importance of active involvement in the community (White, 2008). Through consistent social interaction, children develop critical social skills and feel like a part of their community. This opportunity may be critical for breaking social barriers that they may encounter otherwise.
Our goal was to design and construct a mobile farm stand on a provided trailer for Turn Back Time Inc. (TBT) with an integrated educational program for children in Worcester County, Massachusetts from ages 3 to 8 to help them develop math-related socio-cognitive skills. This project builds upon existing research of children’s math anxiety and play-based learning. In this chapter, we will be discussing the following objectives and their respective methodologies (See Appendix A for Project Timeline):

1. LESSON PROMPT DEVELOPMENT
   - Teacher Interviews

2. FARM STAND DESIGN
   - Meta-analysis of farm stand elements
   - Visualization in SketchUp

3. FARM STAND CONSTRUCTION
   - On-site construction
   - Meta-analysis of building plan
   - Meta-analysis of materials
3.1. Lesson Prompt Development

**Teachers at Turn Back Time**

For our project, the team aimed to ensure that the lesson prompts will positively impact children’s understanding of math. To understand the teaching environment, we conducted interviews with teachers at TBT before the development of our educational program. Although previous research investigated how children comprehend math concepts through play, teachers at TBT provided instrumental insights into working at the site and with the target audience of the program. **Interviews were our chosen method for this objective because they allowed us and the participants to expand beyond the scope of the predetermined questions** (Mitra, 2021). With this open-ended structure, we pursued a holistic understanding and analysis of lesson prototypes (See Appendix B for Lesson Prototype Interview Questions).

Our sponsor provided us with the contact information of teachers who work closely with children from early childhood to elementary school age. To make the scheduling process easier for our participants, we set up a Calendly page for one-hour meetings so each teacher could select a time slot that works best for them. Upon confirmation, the website would automatically send the teacher a calendar invite with the interview information. Due to the impact of COVID-19, we interviewed teachers through online Zoom video calls. Interviews were recorded with consent and the audio was used to transcribe the interviews. After the meetings were fully transcribed, we performed thematic and content analyses on the recordings to identify possible lesson approaches (Elsharnouby, 2021). Initial interviews assisted the team in understanding what defines successful programs and what it is like working with children at TBT. These analyzed themes along with literature findings were then used to create lesson prototypes.

3.2. Farm Stand Designs

**Meta-analysis of Farm Stand Elements**

For our initial farm stand design, we consulted a wide variety of sources and media with different search terms for varying levels of specificity while having our sponsor’s needs in mind. The main results for these rounds of research were images; however, we also examined websites and video results that show the process of designing and running a farm stand. The team initially looked for general inspiration by using the search term “mobile farm stand” to look for sources that could help identify common elements. We focused on shelving, layout, and collapsible mechanisms in existing structures. During our second round of research, the team expanded the scope to include other similar structures such as stationary farm stands and food trucks. Considering our sponsor’s needs, we also looked into specific elements for our designs using keywords such as “storage,” “signs,” and “interactive play.” Various images and websites were compiled into an inspiration board slideshow and we visualized different elements of our design by sketching them. With the size limitation of the trailer, each element was integrated into the existing structure based on trial and error to develop preliminary farm stand designs in SketchUp.
Visualization in SketchUp

To efficiently visualize our concepts and communicate the farm stand design to TBT, we utilized SketchUp, a 3D modeling program often used for architecture. Measurements of the trailer were taken and used to create an accurate SketchUp model.

The accuracy and intricacy of 3D modeling allowed us to experiment with different farm stand elements and layout designs to ensure their functionality. The structure needed to be designed to consider both children ages from three to eight and adults. Several simple models representing the average heights of a three-year old, eight-year old, female adult, and male adult were used as references. These reference models were then used to determine the appropriate placement of various farm stand elements in accordance with their intended usage.

Multiple farm stand designs were created with different cost-saving measures employed to present to the sponsor. The SketchUp models allowed the team to effectively convey our design ideas to scale for our stakeholders. Multiple models can assist in the discussion and guide the sponsor's selection of a farm stand design. Furthermore, the sponsor could communicate any desired changes and these edits can be seamlessly implemented.

Meta-analysis of Materials

After the sponsor selected a design and provided feedback, we began breaking down the costs of each material and created an itemized budget. We sought product recommendations from construction videos, websites, and experienced builders. By watching videos on the construction of structures, we were able to understand what standard materials were used in most settings. We also learned about the purpose of each material and how they function within the design. Recommendations from websites allowed us to compare different types of materials and products to justify the costs spent on each component. Furthermore, recommendations from experienced builders provided insights into our specific project.

To find the total costs of each component, we first determined the quantities of the materials needed using the SketchUp model. We then researched nearby store websites with the needed materials available to calculate the final costs. Finally, the information was organized into a spreadsheet with the quantities needed, unit prices, total costs, and the suppliers listed. The itemized budget helped the sponsor determine the prices associated with each component and suggest different products or changes in the project's scope due to the overall costs.

The sponsor's initial desired budget was $1,000 with a reach budget of $1,500. Considering this financial limitation, the team determined which products need to be of higher quality and which can be cheaper. Because TBT is a nonprofit organization, another way to save money is through the donations of businesses and individuals. Many home improvement stores, including The Home Depot and Lowe's, offer grant programs for nonprofit organizations. People associated with TBT or those found through online marketplaces, including Facebook Marketplace and Craigslist, may be willing to donate their used products. By reaching out to these businesses and individuals, staying within the project’s budget can become much more feasible.
3.3. Farm Stand Construction

Meta-analysis of Farm Stand Construction Processes

Building a farm stand requires an order and plan of construction; to understand this process, we conducted another meta-analysis. Videos found through keywords such as “tiny house build,” “tiny house frames,” “DIY shed,” “trailer foundation,” and “basic framing” provided the information required to understand the construction order and logistics. These videos allowed us to gather methods others use when creating a foundation, the types of material needed to ensure the building is weatherproof and sturdy, and solutions to reduce the weight placed on the trailer. Referencing pictures and blog posts of existing mobile farm stands also assisted with determining how the construction processes were carried out. With the construction order determined, the construction process was more streamlined.

Using a meta-analysis also identified potential obstacles others have faced when constructing similar structures and how to overcome those challenges. Observing the building processes from videos allowed us to avoid common pitfalls experienced during construction, maximizing our efficiency. Many “do-it-yourself” (DIY) videos provided solutions to common problems in construction. Some obstacles dealing with construction limitations may be unavoidable and require creative solutions. **Acknowledging these challenges beforehand better prepared us for the construction process and any obstacles that may arise.**

3.4. Ethical Considerations

For the individuals we interviewed, we made it clear that all questions were voluntary and, if applicable, anonymous. Any quotes used in our report were granted permission from the interviewees. None of the individuals were reimbursed for their participation in our data collection. No vulnerable populations, including children, were a part of our research collection. All methods were approved by the Institutional Review Board (IRB) prior.
4. RESULTS

4.1. Lesson Development

To design our lesson prompts, we interviewed teachers at TBT to get their input from their experience with developing and teaching lesson prompts for students on the farm. We recorded and transcribed our four interviewees’ responses to analyze the interviews for thematic arcs (See Appendix C for Interview Coding Spreadsheet). The identified themes include:

- **Math Anxiety**
- **Students’ Learning Struggles**
- **Play-based Learning Development**
- **Benefits of Play-based Learning**

*Teacher Interview Coding*

**Math Anxiety**

This is kind of the most exciting part about it just exciting them like when they’re working on something they’re doing something and they’re excited to do a project that they’re really excited about because they know they’re going to do something good.

Devin Motlitz

**Students’ Learning Struggles**

Yeah, we’ve been doing open mic on Mondays and Tuesdays. So I’m with the class all day I’m switching over to garden now that it’s gardening season, but I’m still with the treatment groups. And so we do center centers or homeschooling or any of this doctor in the day or for those in the garden. We’re doing this for kids in the garden. It’s very hands on. We’re doing hands on things in the educational garden so that the kids can use...
Our interviewees discussed TBT students’ and teachers’ relationship with math. Students learn how to associate groups of objects with numbers, collect data, graph data, and record information by writing left to right. From the interviewees, we learned that students seem to struggle the most with visualizing abstract concepts and overcoming the notion that they’re “too cool for math.” Meanwhile, teachers feel anxious about their own math abilities and may lack confidence when teaching math-oriented lessons to students.

“I feel like trying to get kids to measure accurately to build a treehouse is really difficult…. I’m like, ‘Okay, let’s measure it. Where do I need to cut it’ or ‘what is this math’ and they’re like, ‘I can’t do math I’m not at school.’” — Miss Amber

The next theme discussed was play-based learning and how lessons should be created. Exercises should include durable components that children can use to visualize the topics they are learning about. Other vital elements include: storytelling, dramatic play, songs, and ways for children to reflect on new information. When designing lesson prompts, it can also be beneficial to reference preexisting lessons from other teachers at TBT or from peer-reviewed sources, such as Ag in the Classroom, Project Learning Tree, Project Wild, and Growing Up Wild.

“’You know, some of the little kids will never even look at a lesson plan, they’ll just put on a cute smile and show someone their tomatoes and that’s part of the experience.’” — Miss Dawn

Interviewees also discussed their students’ learning struggles. Students have differing learning ability levels. Some also require special considerations as they can experience certain triggers, due to overstimulation and trauma, that make certain lessons difficult to learn. Finally, students also have varying attention spans, which can cause them to get distracted by environmental stimuli and their own frustrations.

“’We have students with all different learning abilities…. Some of them get really stimulated. And we want to make sure it’s an all inclusive program. . . . And so certain things for certain kids are really, really hard.” — Miss Michaela

Finally, teachers discussed the benefits of play-based learning and why it is preferable over traditional methods. For one, play-based learning tends to be more engaging for students and ensures that they are retaining information in an enjoyable way. It also helps educate kids about non-academic topics, such as developing their own sense of wonder, enthusiasm and excitement for new topics, and ability to grow from their mistakes. Moreover, it allows them to develop their conflict resolution skills and connect with individuals from differing backgrounds.

“I call it, trying to teach the kids how to wonder. You really want them to have that sense of wonder, so that they want to find the answers to things. . . . Kids don’t really know how to look for things or where to look for things and they’re not as excited to look for things and figure things out on their own and so . . . instilling that sense of wonder is just so important.” — Miss Katie

Students’ Learning Struggles

Math Anxiety

Play-based Learning Development

Benefits of Play-based Learning
Alongside our constructed farm stand, we provided Turn Back Time Inc. (TBT) with lesson prompts that were integrated throughout our design. They were most applicable through our design’s abacus, chalkboard, pegboard, hinged shelves, bagging area, and cashier table. The prompts themselves would help students improve differing skills but would mainly focus on providing math-based learning opportunities. Providing students with differing avenues to participate with the farm stand allows them to get what they want out of their experience.

As previously stated, the main objective of our lesson prompts is to provide students with opportunities to practice their math skills. These skills often include: graphing, creating straight lines, knowing when something is heavier than something else, assigning numbers to symbols and groups of objects, recording information by writing left to right, writing symbols in for objects, data collection, and counting. Our farm stand design aims to strengthen these skills by providing stations that will focus on one or more of them. For example, students using the abacus will track metrics from sales, such as fruits and vegetables sold, and move a bead whenever they witness the event. Doing so will provide them with an avenue to practice their counting skills, data collection skills, and ability to assign numbers to groups of objects. Next, the chalkboard will be used by teachers and students to visually display data from the abacus and other sources. This will help them practice their graphing skills and the ability to create straight lines and record information by writing left to right. Moreover, students working with the pegboard and hinged shelves will actively work with marketing the various goods that TBT looks to sell. Consequently, they will learn how to assign values to objects by labeling products with their prices, quantities, etc. and students working with the pegboard will also improve their spatial ability. Finally, students working at the cashier table will work closely with ringing out customer’s orders, so they will learn how to weigh things, associate values with currency, and practice calculating totals through addition and multiplication.

While the main objective of our lesson prompts is to assist students with practicing their math skills, they will also provide opportunities to practice other critical skills. Given that students will be interacting with customers at the hinged shelves and cashier table, they will be actively developing their communication skills. Additionally, working at the farm stand will provide students with an opportunity to strengthen their connections with each other. While each student will have their responsibilities and expectations, operating the farm stand will require them to all work together and navigate unique scenarios. Consequently, the trials and tribulations they encounter will also assist them with improving their problem-solving skills and ability to cooperate with others. A big part of the students learning how to cooperate will involve improving their ability to delegate work as there will be jobs that are better suited for some students based on their interests and current education level.
Initial Research of Farm Stand Construction

Farm stand construction research was crucial in bringing our project to life. From this meta-analysis, we learned how materials were supposed to come together and what tools were needed for the process. We also discerned the order of construction should begin from the foundation, to framing, to siding, and finally to roofing. This was important to determine our timeline of construction. We estimated the amount of time each section would take from our initial research and observations of others’ building processes.

4.2. Meta-analyses for the Farm Stand

Initial Research of Farm Stand Designs

Initial visual inspiration research showed what elements are commonly included when designing mobile farm stands. Specifically, we focused on the types of shelving and their placement within the farm stand. Because mobile farm stands often need to be compact, a lot of designs utilize collapsible shelves that also serve as windows, doors, or storefronts. Shelves are also configured at an angle to display the produce available while using crates as the main units of display. Storage is often built into the structure to maximize the amount of products each farm stand could carry. Moreover, certain roofing and awning systems are implemented to provide coverage for the produce sold throughout the day. Chalkboard signs are also common so business owners can easily advertise the produce available during each season. Most mobile farm stands adopt a natural and earthy aesthetic by using wooden structures and neutral colors to highlight the products they sell.

In addition to farm stands and similar structures, investigating what devices are often used to engage children’s interest in math brought us to toys resembling abacuses. This is consistent with our literature research about how children understand math concepts better through physical, visual, and interactive examples.

Research and Design of Farm Stand Elements
The sponsor described their initial ideas for the layout of the farm stand. The front of the farm stand could have an opening and provide a storefront to display products. The right side could serve as the cashier area and would require another opening. Due to the trailer step on the backside, the entrance could be located there, where it would not be seen by consumers.

We extended the floor area to the structural members beyond the frame beams to maximize the size of the farm stand. To preserve its structural integrity, the farm stand does not extend over the tires. As a result, many elements would be inaccessible by children if they were placed above these tires. The hinged shelf is the best use of the space as it would protrude enough to still be accessible to any children outside, which was verified with our average height references in SketchUp. Moreover, the storefront display shelves could be seen through the hinged shelf opening. Finally, the general storage shelves are placed on the left side of the farm stand, where they would not be as easily seen by the customers.

Preliminary Designs

We approached the preliminary designs through two major concepts: fully-enclosed and partially-enclosed farm stands. Specifically, we developed one fully-enclosed design and two partially-enclosed designs. All designs share some common elements, such as shelving, roofing, awning, and the store sign. While the fully-enclosed design has the entire space fully surrounded by walls and roofing, both partially-enclosed designs include less enclosed space and a platform for the cashier table (See table next page; See Appendix D for Preliminary Designs).

Between the two designs for the partially-enclosed farm stands, design A does not utilize the metal trailer step unlike design B. As a result, design A requires an extra stepping stool and has less outdoor counter space but more inside storage space.

A comparison between the general layout of all farm stand designs show that the fully-enclosed farm stand design has the most square footage and the most display space on the hinged shelves but, in turn, is likely to be the most expensive. The fully enclosed design has a wider area on the right side that could otherwise be awkward if used for shelf space. In the partially-enclosed designs, this space serves as the cashier platform. For the fully-enclosed design, a separate bagging area could instead be integrated with interactive play elements and can be seen by the customers through the opening above the hinged shelf.

Due to the separate bagging area and ability to completely weatherproof the structure, TBT chose to move forward with the fully-enclosed design.
We considered how to maximize natural daylighting to avoid the necessity of artificial light. The team suggested the use of clear corrugated polycarbonate roof panels but the sponsor was concerned about the panels' long-term durability. Instead, the sponsor opted to use corrugated metal roofing panels and to address the lighting concerns after construction.

The weather in Massachusetts requires the consideration of snow loads. The recommended minimum slope for corrugated metal roofs in areas that receive heavy amounts of snow is 1:12, which is approximately a five degree slope. As a result, the height difference between the tallest and shortest walls is eight inches.

We chose to use corrugated steel roof panels provided by a TBT staff member to lower the costs. Eave, rake, and high side peak trim flashing in addition to foam closure strips prevent unwanted moisture leakage. Roofing screws fasten the panels and flashings to the frame in addition to the butyl sealant tape. The total estimated cost for the roofing materials came out to be approximately $230.

Roof

Floor

There are multiple ways to build a foundation on a trailer, but the simplest one is to put the frame on top of the original trailer structure and then bolt down the wood to the trailer. Many people also use insulation for their flooring; however, because this was not a structure people would live in, insulation is unnecessary and would only add to the cost of the stand. Instead of 2x6 joists, which are standard for flooring in homes, we determined that 2x4 joists would suffice. Because a farm stand is not as large as a house, they would adequately hold our smaller structure. Since our farm stand did not have undercarriage protection, we decided that using exterior paint to protect the exposed wood is both less heavy and more cost effective. With these solutions, we cut down on costs and provided a sound foundation for the stand.

The total cost of the floor joists, plywood, exterior paint, and miscellaneous items was around $870.

Floor

Siding

To determine what siding material to utilize for our farm stand design, we examined common siding materials for sheds. A popular product is LP Smartside, which is composed of engineered wood. Compared to other materials, these panels are easy to install and do not require sheathing. With an engineered wood product, the sponsor can have the desired rustic aesthetic of wood while having resistance against moisture, insects, and rot. Furthermore, LP is certified by the Sustainable Forestry Initiative (SFI).

LP Smartside 38 Series panel siding was selected as the specific siding product. To fasten the siding panels to the studs, we used 1.5” nails. All expansion joints and corner joints are sealed with sealant caulk. Additionally, two coats of 100% acrylic latex paint is recommended to increase the siding’s lifespan.

Using the SketchUp model as a reference, the total estimated cost for the siding materials is approximately $820.

Siding

Frame

A construction’s frame is the most significant determinant in its structural integrity. Wooden 2x4 studs placed 16” on center are the most commonly used configuration in tiny house construction. SketchUp was used to determine the placement of each stud and ascertain the total quantity needed.

Specific details were designed based on common construction practices. Corners that point outwards use two studs while corners that point inward use three studs for extra support. Any openings have additional jack studs and plates to support its frame as needed. The larger 10’ window also has a 2x8 header to prevent bending. Finally, the front roof overhang extends past the wall studs, so horizontal and angled supports were incorporated for additional strength (See Appendix E for Framing Implementation Plan).

The number of studs and plates used for the wall and roof framing is over 100 eight-foot studs. Combined with the price of the 16d framing nails, the estimated total cost is approximately $920.

Frame

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We designed the shelves for our farm stand by considering where products would be displayed and stored. Special considerations were given to our hinged shelves, as they are an essential part of the customer experience. Consequently, we designed them to be spacious and angled so TBT staff and children can display attractive wares and interact freely with customers. Storage shelves, which were not included in the initial construction phase and budget, are sturdy and large to hold various products and equipment. Additionally, storefront shelves were also not included in the budget and construction. Finally, the design also has a bagging station which includes a main shelf for bagging merchandise, as well as two auxiliary shelves that are designed for TBT staff to store products that children cannot reach. We built the hinged and bagging shelves ourselves.

The total estimated cost for the shelving materials came out to be approximately $400.

Shelves

A pegboard is also placed to the left of the hinged shelves to add onto the shelving and aesthetic. The customizability of a pegboard caters to the wide variety of products TBT aims to display and sell, including merchandise, herbs, and gift baskets. Customized shelving, with a variety of hooks, baskets, and surfaces also allows children to participate in organizing and encourages them to consider which appropriate accessories to use for the size and quantities of different products. The pegboard was estimated to cost about $85.

Pegboard

The interactive play area is an essential part of the farm stand to meet the educational needs of TBT. Considering our findings from the literature review and interviews with teachers at TBT, we included interactive elements in our farm stand design. The cashier and bagging tables allow children of different ages to engage with the operation of the farm stand and learn to develop math-related socio-cognitive skills through guided play. Moreover, the abacus serves as an interactive element that helps children visualize math problems and operations. The interactive area also includes a chalkboard to cater for the wide variety of lessons at TBT. For instance, the chalkboard could be used alongside with the abacus to help children count how many fruits or vegetables they sell a day by drawing pictures of different produce or drawing graphs. The idea that the interactive play area could be viewed from the storefront also adds on to the aesthetic and attraction of our farm stand design. Other tools the sponsors could also add for math lessons at TBT are scales and calculators. Making the interactive elements from scratch allowed us to keep the cost about $30 for both the abacus and the chalkboard.

Interactive Area

The awning system was designed to be minimal and movable. Our awnings utilize cheap and widely available materials like tarps and PVC pipes to cut down on the costs while still providing the necessary coverage for the farm stand. The PVC pipes are movable to close shop along with the hinged shelves and the cashier table. The awnings for both sections cost about $110.

Awning

The overall estimated cost for the entire farm stand is approximately $3,200 which is more than twice the cost of the sponsor’s reach budget (See Appendix F for Itemized Budget).

To cut down on these costs, we contacted The Home Depot and Lowe’s to ask for donations of building materials. Unfortunately, The Home Depot appears to have discontinued their community grant program and now only receives a limited amount of $50 coupons each month to give to nonprofit organizations. After giving the necessary documentation in person and through email as well as multiple phone calls, Lowe’s never responded to our donation inquiry. As a result, we did not rely on donations from home improvement stores.

Fortunately, we received some material donations, including roofing panels, from volunteers and TBT community members. We were also able to reduce costs by purchasing some materials from Habitat for Humanity ReStore, which could be sold for a third of the retail price.

Budget

The awning was estimated to cost about $85.

The cashiers and bagging tables allow children of different ages to engage with the operation of the farm stand and learn to develop math-related socio-cognitive skills through guided play. Moreover, the abacus serves as an interactive element that helps children visualize math problems and operations. The interactive area also includes a chalkboard to cater for the wide variety of lessons at TBT. For instance, the chalkboard could be used alongside with the abacus to help children count how many fruits or vegetables they sell a day by drawing pictures of different produce or drawing graphs. The idea that the interactive play area could be viewed from the storefront also adds on to the aesthetic and attraction of our farm stand design. Other tools the sponsors could also add for math lessons at TBT are scales and calculators. Making the interactive elements from scratch allowed us to keep the cost about $30 for both the abacus and the chalkboard.

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Budget
4.3. Construction

04/02: The trailer in its original state, covered in rust

04/09: Using metal wire brushes to clean the rust off the trailer

04/09: Preparing the trailer for painting using metal prep solution

04/10: The cleaned trailer after sitting overnight with the metal prep solution

04/10: Spray painting the trailer with primer

04/10: Spraying the trailer with a final coat of black paint

04/10: The finished trailer primed and painted!
04/27: Measuring stud lengths to prepare for cutting

04/27: Assembling floor frame

04/27: The fully assembled floor frame on top of the trailer

04/27: Assembling floor frame

04/27: The fully assembled floor frame on top of the trailer

04/30: Nailing the floor frame sections together

04/30: Visualizing wall frame on the trailer

04/30: Nailing the floor frame sections together

04/30: Ian using a line level to ensure the trailer is level

04/30: Screwing down plywood onto floor framing
05/01: Majority of wall frames were built

05/01: Making sure frames are flush against plywood floor

05/01: Clamping wall frames to level them

05/01: Nail gunning extra support studs

05/03: Inserting spacers for miscalculated studs

05/03: Nailing wall frames together

05/03: Nailing the corner of the frames together

05/03: Full wall frame assembled!
05/09: Roof framing partially assembled

05/11: Measuring the siding and putting it up on the frame

05/11: Mounting the roof panels onto the roof framing

05/12: Screwing the roof down to the frame

05/15: Nailing the siding down

05/15: Painting the first coat

05/16: First coat of paint!
05/15: Weatherproofing the pegboard with primer, exterior paint, and sealant

05/17: Mounting the pegboard onto the farm stand

05/22: Drilling the hinged shelves onto the farm stand

05/23: Sliding barn door is installed

05/23: Cutting cables and installing hinges and barrel bolts

05/23: Weatherproofing the interior with extra pieces of siding

05/23: The interactive play area
4.4. Obstacles

**COVID-19.** A major obstacle for our project was how COVID-19 restricted traveling for off-campus projects. We were not allowed to live on-site throughout the project, which in turn, required more travel time and limited our accessibility to the construction site.

**Inexperience.** We all had very little knowledge/experience in construction and needed to do extensive research to ensure. Due to our lack of experience with construction work, we made mistakes which cost us time and resources to redo them. For instance, we miscalculated the stud placements when designing the wall frames. The distances between the studs did not account for the overlap of frames at the corners so studs needed to be added to align with the siding. We were able to find solutions to these challenges, however, we did need to compromise in order to achieve them.

Another example of a mistake pertains to the roof frame that extends beyond the walls at the front of the farm stand. The original design modeled in SketchUp did not consider the weight distribution of the frame itself. After realizing that its substantial weight will be applied only to the nails fastening to the wall's top plates, we redesigned the detail on the construction site. Redesigning the overhang made original plans harder to follow and required compromising other material lengths on different parts of the frame. This process was tedious and took a lot of time to fix. With these mistakes, our construction process became longer and the number of extra resources became smaller.

**Material availability.** Many materials that were needed for construction were not readily available or accessible. The butyl putty tape, rake trim flashing, and high side peak trim flashing needed to be either ordered online or custom ordered, delaying the start and completion of the roofing. Furthermore, the team could not transport large materials due to limited vehicle space. Studs, plywood subflooring, siding, and drip edge flashing were either delivered by companies or were picked up by someone who owns a truck, possibly further delaying construction processes.

**Tool availability.** A major requirement was ensuring that we had the proper tools and knew how to use them. In the beginning of the construction phase, we were using many unideal tools and did not have access to more efficient options. For example, we used hammers and nails to assemble the frames which are much less efficient than using the nail gun that we were provided later on in the process. We were also provided with a scaffold during the middle of the construction process, which would have made wall erection easier. However, even when we had the tools we needed, we did not always have the knowledge to use them. Learning how to properly use tools took time and effort that could have been used to make more progress. There were tools, such as circular saws, that we needed to rely on others to be onsite and use the tools for us.

**Weather.** Inconsistent weather can negatively affect working conditions and construction progress. Specifically, we could not work onsite during rainy days. In anticipation, materials and tools needed extra coverage to prevent damage, increasing set up and clean up time.

**Physical demand.** A final challenge that we had to overcome was the physical demand of constructing a farm stand. Throughout the construction process, there were items that certain team members cannot physically pick up and transport, such as the pressure tank. Sometimes, we required outside assistance with tasks that our team could not do, such as lifting our largest wall frame. Additionally, one of our teammates had an unrelated toe injury which interfered with their ability to participate in the construction of the farm stand.
4.5. Next Steps

Due to the challenges, the team could not adhere to the construction timeline and was unable to fully construct the farm stand by the end of the semester. Many of the team members were fortunately available for a week after the term ended and continued to work on the farm stand. With this additional week, we completed siding, painting, trims, pegboard, hinged shelves, cashier table, bagging area with interactive elements, and door. The interior shelves, trailer bolts, roof flashings, sign, and awnings still need to be constructed and/or installed by TBT.

After construction is completed, TBT can incorporate the farm stand into their curriculum, possibly using our developed lesson prompts. Products and other items that need to be stored can be transported into the farm stand and children can begin operating the farm stand. Including additional interactive elements, such as calculators and scales, will help children develop their math skills further. TBT can also purchase and place the large storage shelves we had originally included in our preliminary designs to increase storage space.

5. CONCLUSIONS

Turn Back Time Inc. (TBT) required a mobile farm stand that not only allows students to sell farm-grown products to customers, but also teaches them critical math skills. Our IQP designed and constructed an affordable mobile farm stand that integrates interactive elements for teachers to build math-lessons around and improve their students’ math skills. Most importantly, our design provides TBT with adaptability in terms of operations and lesson development.
## Appendix A: Project Timeline

**Team**

<table>
<thead>
<tr>
<th>TASK</th>
<th>WEEK</th>
<th>EXTRA</th>
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<tbody>
<tr>
<td>Prep</td>
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<td>7</td>
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</tr>
<tr>
<td>Extra</td>
<td>05/14 - 05/30</td>
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- **Research Farm Stand Design**
- **Research Materials**
- **Workshop farm stand design**
- **3D Model Designs**
- **Construct Farm Stand**
- **Lesson Prototype**
- **Lesson Prompt Interview**
- **Finish Report and Deliverables**

### Tasks

- **Research Farm Stand Design**
- **Research Materials**
- **Workshop farm stand design**
- **3D Model Designs**
- **Construct Farm Stand**
- **Lesson Prototype**
- **Lesson Prompt Interview**
- **Finish Report and Deliverables**

### Appendix A: Project Timeline

- **Appendix A: Project Timeline**
- **Appendix B: Lesson Prototype Interview Questions**
- **Appendix C: Interview Coding Spreadsheet**
- **Appendix D: Preliminary Designs**
- **Appendix E: Framing Implementation Plan**
- **Appendix F: Itemized Budget**
Appendix B: Lesson Prototype Interview Questions

- What got you into teaching and working with kids?
- What’s your favorite part about teaching kids at Turn Back Time?
- What lessons do you teach at Turn Back Time?
- Could you provide examples of current and past successful lesson plans?
- What elements contributed to a successful lesson plan?
- Do teachers have layouts or prompts that you read off of or do you make it up on the spot?
- What challenges come with teaching lessons?
- How long are lesson plans? Does a unit span for multiple days?
- Will the farm stand be used more for the enrichment group or the curriculum group?
- What are the major challenges with teaching kids at Turn Back Time?
- What is the difference between teaching kids at Turn Back Time and kids elsewhere, if you have had previous experience with teaching? From your experience, are there any aspects that we should take into consideration when designing programs for these kids?
- Should lesson plans be specialized for children of different age groups?
- How do different age groups interact with each other in the same or different class in the same or different classes?
- How would you assess what makes a successful lesson plan?
- What other advice could you give us when developing these programs?
- Would you be interested in providing feedback for the lesson plan we will develop over the next few weeks?

Appendix C: Interview Coding Spreadsheet

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Mark Anson</th>
<th>Learning Strategies</th>
<th>iPad-based Learning Development</th>
<th>Benefits</th>
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Mobile Farm Stand - Paxton IQP D’21

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Appendix D: Preliminary Designs

Overview

<table>
<thead>
<tr>
<th>Common Elements</th>
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<tbody>
<tr>
<td>Specific Designs</td>
<td>10-21</td>
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<tr>
<td>1. Fully-enclosed Farm Stand</td>
<td>13-15</td>
</tr>
<tr>
<td>2. Partially-enclosed Farm Stand (a) - No metal step</td>
<td>16-18</td>
</tr>
<tr>
<td>3. Partially-enclosed Farm Stand (b) - Use metal step</td>
<td>19-21</td>
</tr>
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</table>

Comparisons

Hinged Shelves

- At an angle
- Serve as a storefront
- Along with the awning, could be used to fully close shop
Roof and Awnings
- Shed roof
- Corrugated roofing options
  - Clear polycarbonate sheets to allow for daylighting
  - Metal sheets for durability
- Awning options
  - Excess siding
  - Tarps

Storage Shelves
- Maximize space for storage where people cannot look in
- Cooler can go in here
- No sun exposure

Storefront Shelves
- Could be seen from the front
- At an angle so could show different products
- No sun exposure

Store Signs
- Place for logo and text

Pegboard
- Customizable shelving that could be used for
  - Merchandise
  - Mason jars
    - Flowers
    - Herbs
    - Jams
- Kids can participate in shelving
Macrame plant hangers

Hangers produce by knotting techniques

- Aesthetically pleasing to hang at the store front
- Could have different lengths
- Could hold jars
  - Herbs
  - Fresh flowers
- Might or might not have sun exposure depend on the location
- Can be a lesson where children learn how to make macrame

Two Concepts - Three Designs

1. Fully-enclosed Farm Stand
   - Fully-enclosed Farm Stand (1)
   - Fully-enclosed Farm Stand (2)

Partially-enclosed Farm Stand
   - Partially-enclosed Farm Stand (2)
1. Fully-enclosed Farm Stand - Kids’ Interactive Area

- Visible from the storefront
- Cashier’s table and awning folds to close shop
- Separated bagging area
- Interactive
  - Abacus and chalkboard to assist in counting or adapt to other lessons
- Possible storage underneath bagging table and overhead storage out of children’s reach
  - Space to store teaching material?

2. Partially-enclosed Farm Stand (a) - Cashier

- Only entrance is from behind cashier
- Has clothes rack with shelves underneath
  - Extra shelving readily grabbable for customers checking out
  - Prevent kids from falling off the platform
- No separate bagging area
- Detachable chalkboard for extra signs
  - “On sale!”
  - “Seasonal products!”
  - “Grown by kids!”

2. Partially-enclosed Farm Stand (a)

3. Partially-enclosed Farm Stand (b)
3. Partially-enclosed Farm Stand (b) - Cashier

- Has extra storage and counter space
- Has clothes rack with shelves underneath
  - Extra shelving readily grabbable for customers checking out
  - Prevent kids from falling off the platform
- No separate bagging area
- Detachable chalkboard for extra signs
  - "On sale!"
  - "Seasonal products!"
  - "Grown by kids!"

Cashier/Interactive Area

- Fully-enclosed farm stand
- Partially enclosed farm stand (a)
- Partially enclosed farm stand (b)
Front Overhang

- x10 at 12.75”
- x10, see above

- x17 at 5”

- x2 at 133.75” (11’ 1.75”)
- x2 at 232” (19’ 4”)

Back Overhang

Option 2

Three of the rafters will have an extra notch
## Appendix F: Itemized Budget

<table>
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<tr>
<th>Item</th>
<th>Product Link</th>
<th>Unit Price</th>
<th>Quantity</th>
<th>Total Cost</th>
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<td>Klean-Strip Concrete &amp; Metal Prep + Rust Inhibitor 1 gal</td>
<td>$17.97</td>
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<td>$17.97</td>
<td>04/06/21</td>
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<td>Spraypaint</td>
<td>Rust-Oleum Painter’s Touch 2X 12 oz. Flat Black General Purpose Spray Paint</td>
<td>$3.98</td>
<td>2</td>
<td>$7.96</td>
<td>04/06/21</td>
<td>Darius</td>
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<td>Spraypaint</td>
<td>Rust-Oleum American Accents 2X Ultra Cover Flat Black Spray Paint, 12 oz</td>
<td>$3.96</td>
<td>2</td>
<td>$7.92</td>
<td>04/10/21</td>
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<td>Basis of Design</td>
<td>$6.75</td>
<td>22</td>
<td>$148.50</td>
<td>04/26/21</td>
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<td>2x4x104 Lumber</td>
<td>Basis of Design</td>
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<td>2</td>
<td>$18.16</td>
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<td>OSB</td>
<td>Basis of Design</td>
<td>$98.68</td>
<td>5</td>
<td>$493.40</td>
<td>04/26/21</td>
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<td>Rubber Sealant</td>
<td>Liquid Rubber Waterproof Sealant 1 Gallon</td>
<td>$54.95</td>
<td>1</td>
<td>$54.95</td>
<td>04/23/21</td>
<td>Sophia</td>
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<tr>
<td>5/8&quot; Bolts</td>
<td>5/8&quot; Galvanized Bolts from ReStore</td>
<td>$2.50</td>
<td>12</td>
<td>$30.00</td>
<td>04/23/21</td>
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<tr>
<td>1/2&quot; Hex Nut</td>
<td>1/2-in x 13 Galvanized Steel Hex Nut</td>
<td>$0.41</td>
<td>12</td>
<td>$4.92</td>
<td>04/23/21</td>
<td>Darius</td>
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<tr>
<td>3/8&quot; Hex Nut</td>
<td>3/8-in x 16 Galvanized Steel Hex Nut</td>
<td>$0.24</td>
<td>6</td>
<td>$1.44</td>
<td>04/23/21</td>
<td>Darius</td>
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<tr>
<td>1/2&quot; Split Lock Washer</td>
<td>1/2-in Standard Split Lock Washer</td>
<td>$0.28</td>
<td>12</td>
<td>$3.36</td>
<td>04/23/21</td>
<td>Darius</td>
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<td>3/8&quot; Washer</td>
<td>100 pc 3/8&quot; washer</td>
<td>$0.08</td>
<td>100</td>
<td>$8.49</td>
<td>04/24/21</td>
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<td>5/8&quot; Washer</td>
<td>20 pc 5/8&quot; washer</td>
<td>$0.23</td>
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<td>$22.73</td>
<td>04/24/21</td>
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<td>2&quot; Exterior Screws</td>
<td>#8 x 2 in. Phillips Bugle-Head Exterior Screws (1 lb)</td>
<td>$9.48</td>
<td>3</td>
<td>$28.44</td>
<td>05/01/21</td>
<td>Darius</td>
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<tr>
<td>Drill Bits</td>
<td>5/16&quot; x 18&quot; Drill Bit</td>
<td>$26.55</td>
<td>1</td>
<td>$26.55</td>
<td>05/14/21</td>
<td>Sophia</td>
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<tr>
<td>Lag Screws</td>
<td>Zinc Lag Screw 5/16 x 2&quot;</td>
<td>$0.39</td>
<td>10</td>
<td>$3.90</td>
<td>04/28/21</td>
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<td>$6.75</td>
<td>118</td>
<td>$796.50</td>
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<td>2x8 Lumber</td>
<td>Scrap Wood</td>
<td>$0.00</td>
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<td>$0.00</td>
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<td>2x3x96 Lumber</td>
<td>2 in. x 3 in. x 96 in. Select Kiln Dried Whitewood Stud</td>
<td>$5.48</td>
<td>12</td>
<td>$65.76</td>
<td>05/03/21</td>
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<td>3&quot; Screws</td>
<td>#8 x 3 in. Phillips Flat Head Wood Screw (50 Pack)</td>
<td>$4.27</td>
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<td>$4.27</td>
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<td>Framing Nails</td>
<td>#9 x 3-1/4 in. Vinyl-Coated Steel Sinker Nails (5 lb)</td>
<td>$15.48</td>
<td>1</td>
<td>$15.48</td>
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<td>Sophia</td>
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<td>Framing Nails</td>
<td>3-1/2-in Galvanized Steel Framing Nails (200-Count)</td>
<td>$19.98</td>
<td>2</td>
<td>$39.96</td>
<td>04/29/21</td>
<td>Noah</td>
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<td>Quantity</td>
<td>Total Cost</td>
<td>Date(s) of Purchase</td>
<td>Purchaser</td>
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<td>Caulk Sealant</td>
<td>OSI QUAD Max 9.5 ft. oz. Sealant</td>
<td>$8.47</td>
<td>2</td>
<td>$16.94</td>
<td>05/01/21</td>
<td>Darius</td>
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<td>Dynaflex 230 10.1 oz. White Premium Sealant</td>
<td>$4.68</td>
<td>2</td>
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<td>Adhesive</td>
<td>Liquid Nails Heavy Duty Construction Adhesive</td>
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<td>$7.74</td>
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<td>Liquid Nails Heavy Duty Construction Adhesive</td>
<td>$2.26</td>
<td>8</td>
<td>$18.08</td>
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<td>Darius</td>
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<td>Siding Nails</td>
<td>Grip Rite PrimeGuard Max 2-in 13-Gauge Stainless Steel Siding Nails (1-lb)</td>
<td>$10.48</td>
<td>1</td>
<td>$10.48</td>
<td>04/23/21</td>
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<tr>
<td></td>
<td>#12-1/2 x 2 in. Hot-Galvanized Steel Box Nails (1-lb)</td>
<td>$5.48</td>
<td>4</td>
<td>$21.92</td>
<td>05/01/21, 05/20/21</td>
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<td>Siding Panels</td>
<td>38 Series Primed Engineered Panel Siding</td>
<td>$39.57</td>
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<td>$474.84</td>
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<td>Paint</td>
<td>Sherwin Williams Everlast Paint 1 Gal</td>
<td>$51.98</td>
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<td>$103.96</td>
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<td>Sherwin Williams Weathershield Paint 1 Gal</td>
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<td>1</td>
<td>$47.98</td>
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<td>Darius</td>
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<tr>
<td>Trim</td>
<td>1&quot; x 1&quot; Outside Corner Moulding (1 ft)</td>
<td>$1.88</td>
<td>56</td>
<td>$105.28</td>
<td>05/20/21</td>
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<td>Finish Nails</td>
<td>6D 2&quot; Finish Nails</td>
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<td>1</td>
<td>$4.98</td>
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<td>Darius</td>
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<tr>
<td>Insect Screen Roll</td>
<td>Insect Screen Roll</td>
<td>$2.99</td>
<td>1</td>
<td>$2.99</td>
<td>05/22/21</td>
<td>Darius</td>
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<tr>
<td>Roofing Panels</td>
<td>3.17 x 20’ Union Corrugating Ribbed Terracotta Red Metal Roof Panel</td>
<td>$0.00</td>
<td>3</td>
<td>$0.00</td>
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<tr>
<td>Foam Inside Closure</td>
<td>Foam Solid Roof Panel Inside Closure Strip</td>
<td>$3.08</td>
<td>6</td>
<td>$18.48</td>
<td>05/07/21</td>
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<tr>
<td>Foam Outside Closure</td>
<td>Foam Solid Roof Panel Outside Closure Strip</td>
<td>$3.08</td>
<td>6</td>
<td>$18.48</td>
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<td>Darius</td>
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<tr>
<td>Roofing Screws</td>
<td>#9 x 1.5” Zinc-Plated Roofing Screws (400c)</td>
<td>$36.48</td>
<td>1</td>
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<td>05/07/21</td>
<td>Darius</td>
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<tr>
<td>Pancake Screws</td>
<td>#10 x 1-in Silver Zinc-Plated Flat Wood Screws (8-Count)</td>
<td>$1.28</td>
<td>4</td>
<td>$5.12</td>
<td>05/07/21</td>
<td>Darius</td>
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<tr>
<td>Drip Edge</td>
<td>F4 1/2 Mill Finish Aluminum Drip Edge</td>
<td>$4.14</td>
<td>2</td>
<td>$8.28</td>
<td>05/05/21</td>
<td>TBT</td>
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<tr>
<td>Butyl Tape</td>
<td>1/8&quot; x 3/4&quot; x 30’ Butyl Seal Tape</td>
<td>$13.34</td>
<td>2</td>
<td>$26.68</td>
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<td>Butyl Seal Tape 1/8-Inch x 3/4-Inch x 30-Foot</td>
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<td>1</td>
<td>$17.99</td>
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<tr>
<td>Rake Flashing</td>
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<td>High Peak Slope Flashing</td>
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<td>Pegboard</td>
<td>Hardboard 96&quot; x 48&quot; Pegboard</td>
<td>$25.98</td>
<td>1</td>
<td>$25.98</td>
<td>05/14/21</td>
<td>Darius</td>
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<td>Paint</td>
<td>Valspar SeasonPlus Paint 1 Quart</td>
<td>$16.98</td>
<td>1</td>
<td>$16.98</td>
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<td>Coating</td>
<td>Rust-Oleum Stops Rust Matte Clear Spray Paint (12 oz)</td>
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<td>Darius</td>
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<tr>
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<td>$1.88</td>
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<td>Darius</td>
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<td>Shelf Brackets</td>
<td>13.5” White Shelf Bracket</td>
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<td>05/14/21</td>
<td>Darius</td>
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<td>Heavy Duty Shelf Brackets</td>
<td>Everbilt 8” x 11.25 x 1.05” Heavy Duty Shelf Bracket</td>
<td>$6.47</td>
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<td>$38.82</td>
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<td>Bracket Screws</td>
<td>Everbilt Platinum Bracket Screws</td>
<td>$3.98</td>
<td>4</td>
<td>$15.92</td>
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<td>Darius</td>
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<td>Abacus Dowels</td>
<td>5/16 in. x 48 in. Hardwood Full Round Dowel</td>
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<td>Glue</td>
<td>Gorilla 4 fl. oz. Wood Glue</td>
<td>$2.97</td>
<td>1</td>
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<td>Wooden Beads</td>
<td>100 Pieces Wooden Beads 20mm x Diameter 3/8” Hole</td>
<td>$9.99</td>
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<td>05/18/21</td>
<td>Darius</td>
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<tr>
<td>Chalkboard</td>
<td>Chalkboard, 17 x 23 Inches, Oak Frame</td>
<td>$11.99</td>
<td>1</td>
<td>$11.99</td>
<td>05/18/21</td>
<td>Darius</td>
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<td>Unit Price</td>
<td>Quantity</td>
<td>Total Cost</td>
<td>Date(s) of Purchase</td>
<td>Purchaser</td>
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<td>Barrel Bolts</td>
<td><a href="#">Gatehouse 4&quot; Zinc Steel Barrel Bolts</a></td>
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<td>$29.90</td>
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<td><a href="#">4&quot; Zinc Barrel Bolts</a></td>
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<td>Ferrules and Stops</td>
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<td>Screw Eyes</td>
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<td>Eye Bolt/Nut</td>
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<td><a href="#">#10-1/2 x 3 in. Galvanized Steel Box Nails (1 lb)</a></td>
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<td>Hinges</td>
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| Overall Cost       | $3,181.34                                        |