

Inclusive Play: An Accessible Device to Promote Social Development at Recess

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Problem Statement/Research Question and Background

Our client, Jill, is a seven-year-old girl with spina bifida. Spina bifida occurs when the fetal spinal column does not close completely, and can lead to muscle weakness and partial paralysis [1]. Jill does not have full functionality in her legs, and uses either a power or manual wheelchair for mobility. Jill has difficulties accessing her school playground because the grass around the playground gets muddy when it rains, and the playground is enclosed by a raised wooden ledge. Additionally, the playground equipment is not wheelchair accessible. During recess, Jill often sat with her teachers while the rest of her first-grade class played on the playground equipment, making it hard for her to form friendships. Childhood play is important, as it aids in various aspects of child development. Socialization is important for social-emotional development in children, while play centered on creativity and imagination aid with self-expression and cognitive development [2, 3, 4]. Therefore, Jill needs a device that allows her to play with the other kids in her class without adult intervention. Jill's teachers tried introducing more inclusive activities, such as bubbles and chalk, but these activities only held her classmates' attention for a limited time. Additionally, there are commercially sold accessible playground swings, but these devices are expensive and Jill is concerned about the safety of such devices [5]. Jill needs a device that is exciting for everyone in her class, but that is also safe and easy to use.

Methods/Approach/Solutions Considered

In the first stages of development, we observed recess at Jill's elementary school. We spoke with Jill, her classmates, and her teachers to determine a type of product that would meet the needs of all involved. Through surveying and observation, we created our design goals for this project. The goal of this project was to create a device that will allow Jill to play safely and independently with her classmates, and make new friends during recess. The device was to be installed in the recess yard, so it needed to be weatherproof. The device was also constructed to be taken apart and moved with ease so that it may be transferred when Jill reaches a new school grade with a new recess area. The device was also designed to have adaptable components that keep Jill and her classmates interested throughout its use. We determined that a successful device should be exciting and should allow Jill to be more involved in recess with her classmates. Our design process led us through multiple prototypes, including an advanced

playhouse. However, we determined the most inclusive, compact, and interchangeable design was one that involved a weatherproof box with pull-out interactive panels. We first designed a small-scale version of our box, shown below in Figure 1. This allowed us to fine-tune the track system and to figure out how to fit large panels into a compact device. We then developed full-scale interactive panels using some of the fun ideas we collected during surveying and interviewing Jill and her classmates.

Description of Final Approach and Design

Our final device design, as shown in Figure 1, consists of three components: the outer box, the track system, and the panels. The box houses three interactive panels that are designed to foster inclusive play through artistic activities, short games, and baby doll play. The user opens the door of the box, and chooses one of the three interactive two-sided panels. The user then attaches a 24" portion of track in front of the desired panel, and slides the folded panel along the track. The user finally unfolds the panel at its hinges, locks the panel straight, and secures the distal portion of the panel with a channeled wooden block. The next three sections of this paper describe in greater detail the box, the track system, and each of the three themed panels



Figure 1: Inclusive play device

I. Outer Box

The box is 41" tall, 27" deep, and 42" wide. The box is made from pressure-treated plywood and reinforced with waterproof sealant and caulk so that it may withstand inclement weather conditions without rotting, thus increasing the life of the device. The box is designed to have a side-opening front door so the box may be locked for overnight storage. The outer box is also reinforced with 2" by 2" boards of wood along the inner corners, so that it can withstand loads created by the user. The box was sanded smooth to minimize the effects of wood splintering, and was painted to look more aesthetically pleasing and inviting. The outer box serves to protect the panel and track systems from damage, and to provide a compact casing for our device so that it can be installed at the playground without taking up too much space.

II. Panel System

The box has three rolling, fold-out panels that represent different interactive play environments. Each panel is 36" tall and between 44-64" long. The panels are sectioned into either two or three pieces: one 24" by 36" piece that is the most proximal to the box when extended, and at most two additional 20" by 36" pieces that are distal to the box when extended. These pieces are hinged together so that the panels are large when extended, and small when stowed, as shown in Figure 2 below.

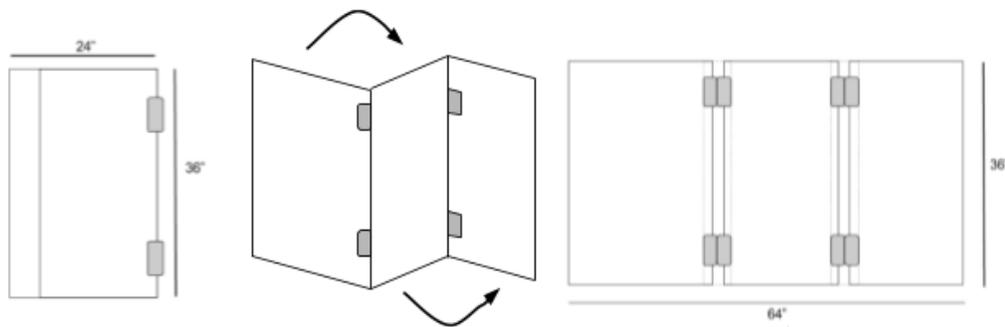


Figure 2: Fold-out panel design (3-fold)

The pieces are spaced at least 1½" apart to minimize the risk of finger pinching when the panel is fully extended. The panel system is the main component of our device, as it is the component that fosters inclusive play. Each of the panels is designed to capture different types of play, as described below.

i. Baby Doll Panel

The baby doll panel, as shown in Figure 3, is made from plywood, with rounded edges to prevent splinters and injuries. The panel pieces are hinged together using smaller pieces of plywood so that the panel does not fold at an angle against protruding baby doll accessories, minimizing panel thickness for storage. This panel consists of a fold-down changing table with a decorative hanging mobile, a



Figure 3: One side of the baby doll panel

highchair, mirrors, a sliding door baby doll clothing closet, and a cabinet to store baby doll food. The baby doll panel is designed to foster imaginative play, which is important for cognitive development in children [3].

ii. Games Panel



Figure 4: One side of the games panel

The games panel, as shown in Figure 4, is made from plywood with rounded edges and PVC pipe. One plywood piece has a three-dimensional Hangman game, and another has a Plinko game made from screws and 3D-printed plastic pucks. The third piece has a PVC frame to reduce the weight of the panel, and includes suspended 3D-printed plastic tic-tac-toe blocks that are spun to show “X” or “O.” The games panel is designed to be familiar and fun for multiple users with different interests. This panel is designed to emphasize socialization, which is important for social-emotional development in children [2].

iii. Art Panel

The art panel, shown in Figure 5, is made from plywood with rounded edges. Two of the panel pieces are covered on one side with a magnetized layer, and coated with chalkboard paint. The other side is whiteboard and a mounted pull-down roll of art paper for imaginative drawing. The art panel is designed to promote creative play, which is important for self-expression in children [4].

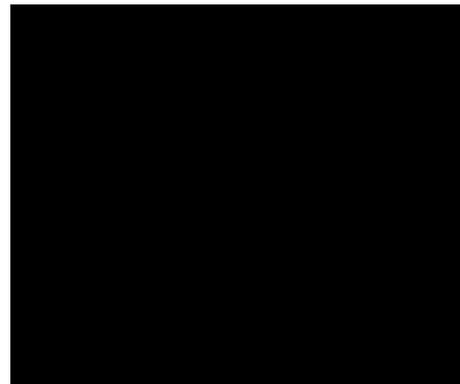


Figure 5: One side of the art panel



Figure 6: Attachable track connection

III. Track System

The track system is designed to allow each panel to be rolled easily out of the box for use. Four 1½” diameter rigid wheels are mounted to the piece most proximal to the box on each panel. These wheels roll along Aluminum C-Channels mounted to the inside of the box on the top and bottom faces as shown in Figure 6. The two

wheels on the bottom of the panel piece allow the panel to roll out of the box, and the two wheels attached to the top of the panel piece guide the panel out of the box without tipping. A PVC pipe locking system slides through U-bolts mounted on the top of each panel. This locking system keeps the selected panel from being pulled completely out of the box and falling. It also prevents more than one panel from being pulled out at once, which allows children to use the box without adult supervision. The track system is designed to provide a safe and easy way to use the panels within the box.

IV. Summary

The outer box, panel system, and track system are all necessary components for our device to achieve the goal of fostering inclusive play for our client. The box and track system are designed to be durable and weather resistant so that the device can be permanently installed at the playground, and the track system allows for removal of the panels for transportation if needed. The three panel designs enforce creative and imaginative play while also encouraging socialization to ensure Jill and her classmates are engaging in valuable and inclusive play.

Outcome

The final device was evaluated across durability, safety, and client enjoyment categories. The outer box was designed to withstand anticipated worst-case loadings with a factor of safety of 2.0. The device could withstand loads created by our client's power wheelchair and by her classmates during testing. Extended panels were not capable of sustaining loads comparable to the box; for this reason, warnings were posted on all extended panels to prevent excessive loading. The device was also designed to fit within the space provided. We observed that there was ample room around extended panels, and our client's teacher stated that the device is not obstructive to recess play. The outer box was equipped to withstand inclement weather conditions to allow for a semi-permanent installation in the outdoor pavilion. The protective measures implemented in the design and development allowed the device to withstand three weeks of outdoor storage with no weather damage. The device was designed to accommodate our client and one other child, or three of our client's classmates comfortably. We observed that the panel dimensions exceeded this requirement, as more than three children could use a panel with our client at one time. The device was designed such that our client would not have any issues accessing its components from her wheelchair. We observed that our client had no problems reaching any component on the panels. During evaluation it was apparent that the children were not able to pull out multiple panels at once, thereby satisfying

another of the design requirements. The entire device was designed to be very easy to set up; our client's teacher verified that the total set-up time for the device was under two minutes, and expressed no concerns in the setup or breakdown of the device. Satisfaction surveys administered to the client, her peers, and her teacher all yielded very positive results, indicating high satisfaction with the device and its activities.

Cost

The price to assemble the final design was under \$400; this price is cheaper than most adaptive playground installations of a similar scale on the market.

Significance

Overall, the device created for our client and her classmates was successful in several realms. The fully assembled device was shown to help our client form better relationships with her peers on the playground, while reducing the supervisory demand on her teachers. Most importantly, the device was very fun for both our client and her peers, as was evident through observation of inclusive play as well as verbal testimonies. The device also exhibited appropriate durability and safety, indicating longevity of use throughout our client's elementary school experience.

References

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