Toying With Adapted Toys

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Toying With Adapted Toys: Designing a Toy for Use by Occupational Therapists

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Background

My project started out as an idea from my mom who is an Occupational Therapist (OT) working with kids in several school districts. OTs are people who help others to be able to do daily tasks that they need to do live their lives. This can look like helping a person who has been injured or has a disability to accomplish tasks like getting dressed or feeding themselves. It can also involve helping school children to improve their writing or to use assistive technology. For one of the kids she was working with, she was using a coffee tin with a hole in the lid and some balls with the goal of working with the kid to be able to drop the ball into the tin. By doing this the kid was working on praxis, the ability to plan new motor movements, as a kid needs to figure out how to grab and move the ball to the hole, grasp and release for being able to grab the ball, and hand eye coordination for getting the ball into the hole. This DIY setup, while functional and cheap, left much to be desired in terms of making it something that would be attractive to play with for the kid and something that would be accessible to kids with different types of disabilities. Toys that are modified to be usable by a kid with disabilities are known as adapted toys as they are adapted to suit their needs where other toys are not. This can take the form of modifications made to an existing product or a product made to suit the needs of people with specific disabilities. This made this idea stand out when I was figuring out what to do for my project as it would provide an opportunity to learn more about accessibility issues faced by kids, parents, and those working with them.

The Idea

Starting out, my first step was to figure out the requirements and improvements that could be made to my design. Keeping similar to the DIY setup I imagined a similar cylinder that one could drop a ball into the top but to have it roll out the bottom into a collection area. The collection area would make it easy to cycle the ball through the toy without having to stop and empty the can. Along with this it would provide a space to keep the ball from rolling away, which could be a difficulty for a kid with motor issues when they are trying to pick it up. To make the toy more adjustable it would have several different lids with different sized holes allowing for an OT to adjust the difficulty to different kids they are working with and to scale the difficulty of the task as a kid improves. Most importantly when thinking about improving the design I needed to make this toy something exciting for the kids to use. For this I decided on putting a ring of lights around the top edge and having a speaker inside it so that when a ball was dropped in a sensor could pick this up triggering it to light up and play noise as a reward for getting the ball in.

With these features in mind, I used a CAD (computer aided design) software to model out a simple body for the toy shown below:
This model does not feature the lights or electronics I planned for but does show the basic structure of what I wanted it to look like. Those details weren’t necessary as after creating this my next step was to interview OT’s working with or that have worked with kids to get more feedback on my design and improvements I could make to it.

Research
To get feedback on this design I planned to interview a handful of OTs virtually or how they used adapted toys followed by more specifics on what they think of my design. To do this I came up with the list of questions below:

- What types of adapted toys do you use?
- Do you tend to use off-the-shelf adapted toys or make your own?
- When do you use adapted toys in your work?
- Are there activities that you would like an adapted toy for but can’t find or can’t get?
  - What adaptations specific to the toy would be useful?
- If you are working with a kid on praxis, hand eye coordination, and functional grasp and release what types of activities would you use?
  - Do you have any adapted toys that help with this?
  - What types of adapted toys would be useful?

*Explain my current toy design.*

- Is this something that would be useful to you?
• Are there any features or improvements you would want in the design?

From these questions you can see a few topics I wanted more feedback about. I wanted to learn more about what types of considerations an OT might have when looking at getting or making an adapted toy to make this more appealing for them. If OT are more concerned about cost, setup, or ability to be easily transported than that will affect my final design if I want this to be something they’ll use. Learning about how OTs are currently using adapted toys would help me figure out the types of activities that I could design my toy around to make it more useful with what OTs are already doing. Along with this I asked about the toys and activities for the specific skills the DIY setup was helping with. These are praxis, the ability to plan new motor movements, as a kid needs to figure out how to grab and move the ball to the hole, grasp and release for just grabbing the ball, and hand eye coordination for getting the ball into the hole. From this I could learn more about competing products that might do a similar thing to my own design and have features I might want to look at adding to my own. Finally, there are their thoughts on my own design for more focused feedback on changes I could make to my current design to make it better.

With these questions and other material, I obtained IRB approval to conduct these interviews as part of a study but was met with limited success. I had initially got interest from several OTs about being interviewed for my project when I reached out about it. Once I actually followed up to schedule interviews however, I only got a response from one of them. Even more unfortunately, when I went back after the interview to view the recording and transcript of it, I found out I must have forgotten to hit record and had to rely on my memory of the interview for the feedback I received. Despite these setbacks I still managed to get some good feedback and ideas I could incorporate into my design which I have summed up into two main points.

The first point is that there are many ways a toy that can keep a kid engaged can be used. My original understanding was that this toy would be used only for working on praxis, grasp and release and hand eye coordination but there are many other ways an OT might use it if it is something the kid enjoys. For example, an OT could put the toy to the opposite side of the hand they’re using to work with the kid on reaching across their midline. They might have the kid on their stomach on a ball so they have to use their core muscles to reach out over the toy and drop it in. They could have the kid on a platform swing where they’re trying to toss the ball into the toy so that they’re working on planning and making small adjustments when they’re aiming. They could even have kids play with it together to work on social skills and interacting with others. With such a wide range of possibilities I realized that to make my design more useful to an OT it would help if the toy could be tailored to the interests of the kid somewhat to encourage engagement.

The second is that kids can be especially sensitive to different senses so having a toy that can be adapted to a wider range of preferences and sensory sensitivity would both make it more engaging, as with the above point, but also make it better adapted to the needs of different kids. This point is focused on addressing Sensory Processing Disorder which, while not a recognized disorder in the DSM 5 (Diagnostic and Statistical Manual of Mental Disorders) that is used for categorizing mental disorders, is a disorder that is commonly found with other developmental disorders such as Autism and ADHD. This disorder presents in two forms: being over-responsive and being under-responsive. If a kid is over-responsive, then they would be more sensitive to certain senses which can make them especially distracting or hard to process. An example of this might be a kid who can’t ignore the tag on the back of
their shirt. This is something that most people are accustomed to and don’t notice as they go about their lives but if a kid is especially sensitive to that tactile sensation they might be constantly aware and distracted by it which can be a problem especially in a school environment where they need to focus on the teacher. A kid being under-responsive especially means that they don’t respond or are slow to respond to certain stimuli. An example of this might be a kid who doesn’t notice when they’ve bumped into things. Because of this they might hurt themselves without realizing it which would be bad for their health. Being under-responsive can also result in the kid constantly seeking that stimulation which can also lead to them having a hard time sitting still in a classroom setting and being distracted or being a distraction. To accommodate these issues, I realized that having additional flexibility for the OT in how the toy lights up or the sounds it produces would allow the toy to be adapted to a wider range of individuals.

The Final Design

Taking my findings from my research I redesigned my initial idea into this final product. This new design consists of two parts: an improved toy that the kid would drop a ball into and a phone app that would allow an OT to control the toy’s electronics.

For the body of the toy I took inspiration from those ball tower toys for toddlers where a ball is dropped in the top and it rolls along a track to the bottom. As such, the top of the toy consists of a lid with a hole in the center, as with the initial design, but that leads down into a hopper which steers the ball out onto a track. The lid is still removable so that other lids with holes of different sizes can be placed on to adjust the difficulty of the task according to the abilities of the kid. The track spirals around the center rolling the ball downwards and around the toy and has a lip on the top and bottom of the track to keep the ball inside while also allowing it to be visible as it rolls. This provides some more visual interest to help keep the kids’ attention than simply having the ball fall in and rolling out the bottom as in the initial design. At the end it cuts through the center and rolls out into a collection basin for the kid to pick up again. This, as in my original design, would provide a contained area to not only prevent the ball from rolling all over a table or wherever the toy is placed but would also help keep the ball in place to make it easier for kids with motor difficulties to grab it without it rolling away.
Attached to this body I would have some electronics to provide the lights and sound for the toy. The hopper would have a sensor facing the exit so that when a ball enters and rolls out the sensor would detect it and trigger the lights and sound. This sensor could take the form of an ultrasonic sensor as this would not need a super accurate reading, just a relatively large change in distance, and ultrasonic sensors are cheap which would limit the expense for an OT buying the product. If that doesn’t work out, I think an infrared sensor such as you might find in a hands-free soap dispenser would work great as well as they are more accurate and without the same issues of an object being too close while still being relatively inexpensive though pricier than the ultrasonic sensors I looked at. The lights would be a strip of LED's glued inside the track either on the inside of the lip or recessed into the wall along the track to keep them out of the way of kids who might play rough with the toy. LEDs are both cheap and can be programmed to different colors allowing for an OT to adjust the color to something a kid likes or something a kid responds to more. The controlling electronics and speaker would be placed inside the main column of the toy to make use of the empty space while also being able to use the opening the ball rolls out of into the collection area to play sound through so the speaker can be both protected without muffling the sound too much.
Finally, the app would use Bluetooth to connect to a Bluetooth chip in the toy allowing an OT to use their phone or tablet to control settings for the device. The app itself consists of two screens: one to control the lights and one to control the sound. The lights screen would have controls to set a preset color as well as enter your own RGB value to give the OT flexibility with the color while also allowing ease of use for someone not familiar with RGB colors. Along with this there would be options to adjust the blink frequency or turn it off to accommodate kids with epilepsy. The sound screen would allow you to select from a series of preselected sound clips as well as upload your own to match with the interests of the kid an OT is working with. In addition, there it would include volume controls to allow an OT to adjust it to the needs of the kid. To make this easier to use with multiple kids there would be an option to save the selected options on both screens as a configuration you could name and select between allowing you to change the settings with just a couple button presses.
Going Forward

In this project I learned about many different topics from researching accessibility issues to how to use CAD and put together electronics, but with each topic I’ve kept running into the limitations of my skillset. To continue this project, I need to find other people with more knowledge and experience with working with CAD, electronics, and 3D printing to help turn this idea into something more detailed and then to put together a prototype of the design so it can be tested and iterated on. While these are all things I’ve dipped my toe in when working on these project, they are also something that takes a lot more work and time to get any type of proficiency in than I had initially realized when I first started on this project. As such having more skilled people to help me with them would go a long way to making progress onto turning my idea into reality.

Credits
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