Reducing Effects of Sensory Disorders with Innovative Technologies

Dymon Blango, Caroline Moore, Raegan Williams, Julia Kohake, Trinity Schoeneberger, Fabiola Cabanas

ECU Honors College

Signature Honors Project

Dr. Tim Christensen

April 30, 2021

Abstract

Sensory Processing Disorders affect 5-16% of school aged children. In addition, 40% of children with ADHD also share the Sensory Processing Disorder. Furthermore, sensory deficits are prominent in the learning environment and hinders many students from reaching their full potential.

SENSE-ational began as an Honors 2000 team at East Carolina University with the goal of helping reduce distractions in the classroom for students with sensory processing issues. Our original idea was to design, create, and manufacture kits that were to be distributed into those very classrooms. Due to COVID-19, and the lack of children in the classroom, we were unable to implement these kits. We needed to pivot in our attempt to help children who were struggling with online learning. We produced "DIY" YouTube videos of how to make sensory items. We now have a handful of quality, engaging, and useful videos on our YouTube channel, as well as our very own logo and a plan to move forward with our brand. We are utilizing the 3D printers in the Innovation and Design Lab at ECU to create and test our prototypes. In the future, we plan to donate all of our new designs to community schools here in Pitt County, so that our work throughout this project can have an impact on the children of Greenville, North Carolina. This will hopefully improve access to sensory items, and increase focus and learning for the kids of this community. In addition, we hope it will serve as a way for teachers and parents to view the benefits of sensory items in everyday school environments.

Introduction

The Signature Honors Project is a key part in the curriculum of the Honors College. It allows for students to go out and research, collect data, create, and design innovations that they are interested in. We chose to conduct our Signature Honors Project based on our Honors 2000

and 3000 group projects. As you read through this reflection you will notice how we started off completely different from how we ended. Throughout the creative process of our project we encountered many setbacks and criticism that only helped us to push harder. The Signature Honors Project helped our group to grow as a team and individually. We have learned so many things, acquired so much knowledge, gained new skills, and went well out of our comfort zone to accomplish some things we never imagined that we could.

Our mentor, Timothy Christensen, Bhibha Das, Wayne Godwin, and plenty more challenged us to the max. This push made the impossible seem so simple. They sparked creativity in us that lay dormant until a small conversation started to burst with new ideas. Having a mentor really helped us to achieve major accomplishments throughout our journey. We received lots of feedback and encouragement on our project that ultimately led to ground breaking progress for our team. Our mentor, Tim, gave us relentlessly, direct feedback that actually helped us realize what we were doing right or wrong and we were able to take that, improve, and progress.

After four semesters, Honors 2000, Honors 3000, Honors 4500, and Honors 4550, we are called team SENSE-ational. We provide educational tutorials and technologies to children who have sensory processing disorders or who simply need help focusing during school activities. We have worked hard to create, promote, innovate, and produce quality-filled content and materials to students in need of a focus strategy for school. Moving forward, this paper will examine the progress made since the very beginning of our Signature Honors Project until now.

Honors 2000

In Honors 2000, the team started out with a wicked problem. Before coming into the semester, every member of the team read a book called Designing Your Life by Bill Burnett and

Dave Evans. This book explored design thinking, which is a way of approaching challenges that can be applied to issues big and small. The first week of class, each team was given a 'Wicked Problem'. A wicked problem is one that does not have a clear solution or definition to it. The wicked problem our team was given on the first day was 'Adulting Skills.' With that, the team knew that we could take so many different routes with this. Our first instinct was to look into simple tasks that adults do that they may not have been taught how to do before being on their own. We liked the idea of making some kind of post (blog, video, etc.) with tips and tricks about how to write a check, how to file taxes, manage money, etc.

Once we started to do research, we realized that there was already a plentiful amount of resources to help young adults on the internet already, so we decided to take a different approach. As a team, we discussed some of the issues that we were facing at the time. Being first semester college kids, most of us were struggling with the general transition to college. We first began by conducting interviews with our peers to see what exactly they were struggling with the most. We also interviewed resources at The East Carolina Office of Student Transitions. We brought back all of the information and realized that most of the issues revolve around time management and classes. Most students said that the lack of structure in college leads to increased stress due to procrastination. The responsibility of college was like no one had experienced before. With the answers from peers and faculty, our team stepped back and wanted to look at different ways to help students focus better and be more productive.

As we conducted more research, we came across sensory rooms. Immediately, our team knew we could do something great with those! We decided to take a major pivot and step away from adults and focus more on children, specifically elementary and middle school children that have sensory processing disorders. These rooms would be safe spaces that students could go to

during the day with teacher supervision in order to calm down when/if they become overstimulated in the classroom. We conducted extensive research on the uses of sensory rooms, the benefits, and the students that use them. We interviewed Occupational Therapists asking them about what should be in the room, the time the children should be in the room, how to make the room the most efficient it can be, and if they thought this was genuinely feasible. The therapists' also gave us tips and tricks on how to make sure the room is calming and serving it's main purpose- to calm the brain from overstimulation. We talked to parents of students that have a sensory processing disorder and asked them if they thought their students would benefit from this room and if students would be willing to go to a space designed for them. We also talked to some teachers, administrators, and Speech Language Pathologists about our idea of implementing a sensory room into an elementary school.

They talked to us about the logistics that we had not thought about. The cost, space, and staffing were all issues that the teachers/administrations were concerned about. As a team, we knew that the cost would be a major factor, but we assumed we would be able to fundraise, find grants, and acquire the funds to put it into action. With the issue of space, we decided that we would find a school that had the space and make it as efficient as possible. Even if it was simply a broom closet, we knew we could make it work. Staffing was something our team had not thought about- who would watch the students in the room? Teachers can not leave their other 20+ students unattended in the class to watch the one student, and most classrooms do not have consistent teacher assistants anymore. Another issue that was brought to our attention was sustainability. Who would maintain the room once we move on? How would we acquire funds to fix or buy new equipment when something breaks? With these questions and ideas in mind, we continued on with our project, and hit the ground running in Honors 3000.

Honors 3000:

We began our journey into Honors 3000 with the same mindset and wicked problem which we ended Honors 2000 with. Our goal was to reduce distractions in the classroom with sensory items which would both increase student focus and retention and decrease teacher burnout. We hoped to target all students with and without sensory processing disorders that could benefit from our sensory rooms, including those on the autism spectrum, children with adhd, and children with anxiety or even anger issues. We began by making plans to build rooms within Pitt County Schools and began to reach out to those who could shed some light on what we were trying to do.

As we began to talk to experts within the field of psychology, education, and sensory items, we learned a lot about the actual logistics and what it takes to build a sensory room. We spoke to a multitude of individuals ranging from parents of children with autism who have experience engaging with sensory therapy everyday, to school psychologists, and educators. Our first challenges began to arise when we interviewed with school psychologist Dr. Christy Walcott here at ECU. She was able to provide some much needed insight into what sensory rooms could do for students, but also shared with us a unique challenge that would eventually lead to a key pivot in our signature honors project.

Dr. Walcott pointed out that the problem with instituting sensory rooms in public schools that are isolated from the classroom, is that they tend to isolate the child who needs to use it. It would unintentionally cause the child to most likely feel alienated or like they were in trouble. This was a huge reason why SENSE-ational eventually pivoted a second time from focusing on sensory rooms to begin thinking about sensory kits. These kits would theoretically be present in the classroom for use should any child need it, and would most likely include at least 5 sensory

items. Some examples of sensory items that we considered including in these kits were soundproof headphones, a fidget stick or cube, a fidget spinner, and a weighted snake or sock.

This new model for SENSE-ational was also great in terms of sustainability and reliability. There were many different examples around the community for us to gain inspiration from including sensory bags that were distributed at ECU football games. In addition, we also had access to sensory spaces to go and view, one at the Belk Building here on campus and the other at the famous PNC arena. This also opened up an opportunity for us to partner with Autism Alliance here at ECU which would help keep our project sustainable for years to come. Furthermore, the feasibility of our project was becoming more and more apparent as we interviewed with Bobbie Nichols who was responsible for creating the PNC arena sensory space. She was able to put us into contact with KultureCity who are responsible for providing sensory bags at big events, and even re-assured us that she never lost anything within those kits, which was one of our main concerns when prototyping them. In addition, we were able to research and find out that in Iowa City, the autism community had started doing a very similar thing to what we were attempting to do. They had begun distributing sensory “Care Kits” to high need elementary schoolers, for only $60 per kit!

However, right at the height of progress for SENSE-ational, our project came to a sudden halt. In fact, the whole world came to a sudden halt. With the rise of the COVID-19 pandemic, SENSE-ational had to hit pause on our project all around. Unfortunately, we never made it into a school before the lockdown, and did not manage to ever step inside any Pitt County Public School and test our prototype. With the rise of COVID-19 SENSE-ational was hit hard, considering schooling was all of a sudden remote, and we no longer had a normal way of

learning. This is not to say that SENSE-ational was discouraged, since if there is one thing we have learned to do in Honors 3000, it's pivot.

We decided to use this new age of learning to our advantage. Yes, perhaps we couldn't get into a school and address the known distractions of a classroom. However, it was important that we now take advantage of the learning struggles that everyone now faces with remote learning, and try to use our ideas to help relieve some of these struggles. It was with an open mind, and some crazy ideas that we next entered Honors 4500.

Honors 4500

We began Honors 4500 with our same goal of improving focus in the classroom, but had gone away from our initial goals tied to reducing student burnout in the classroom. With class no longer being inside a classroom, our focus shifted more to students of all ages and what we could do to help improve focus, especially in distracting environments like the home. We researched how our previously studied sensory tools could be beneficial to everyone, including those without any sensory processing disorders. We learned that having something in hand can help increase focus for a lot of people by giving them an outlet for their senses.

Our team got through Honors 3000 with a plan to produce and distribute sensory kits. However, by the time August came around, it was clear that COVID-19 was not going anywhere any time soon. As a result, we decided we needed to pivot again. We still wanted to address the need for sensory and attention issues in the classroom, and with students learning virtually, this need was even greater than ever. After some brainstorming and discussion with Tim, we concocted the idea of "Do-It-Yourself" sensory items. Since students were stuck at home and struggling to pay attention in their online classes, we decided to take our proposed sensory kits and make them reach a wider audience.

We began to research various types of sensory items and ways that you could make them at home. To share this information with the world, we created a Youtube channel and a TikTok account to share our creations so that others who needed them could make them at home as well. We chose these platforms because this is where most younger aged children spend their time on the internet. Before each video, we chose an item and researched how to make that item at home, as well as the benefits that that particular item has to offer. We then shared this information through Youtube videos and TikToks.

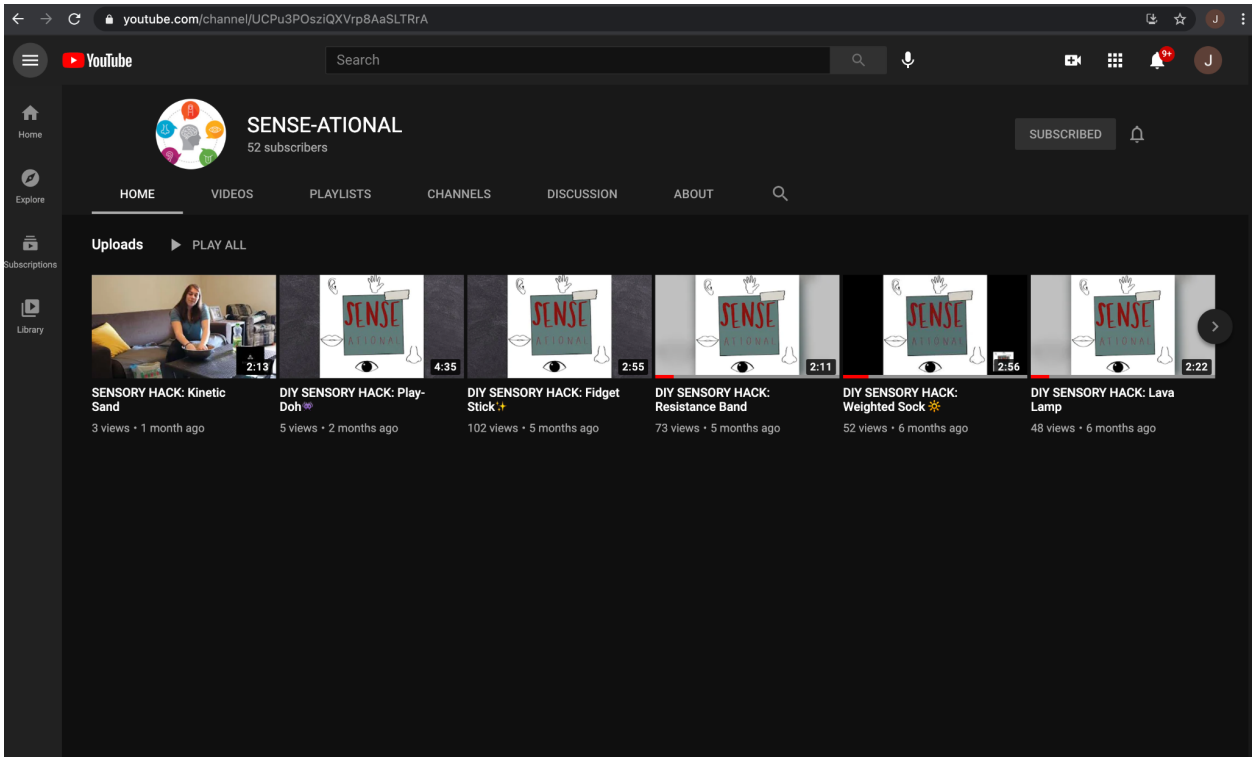

Figure 1. Screenshot of our YouTube account (SENSE-ATIONAL) that you can access at this link: https://www.youtube.com/channel/UCPu3POsziQXVrp8AaSLTRrA

On our YouTube channel we created a series of "DIY Sensory Hacks" that allowed students to create their own sensory tools using at-home items. Some sensory tools we created included: "Make Your Own Stress Ball" using a balloon and flour, https://www.youtube.com/watch?v=XuktPzS_t5A&list=PLiVYpsP0w42sPddtTo-VWlzdzEHtrX

f90. Another demonstrated how to make “Interactive Slime,” https://www.youtube.com/watch?v=pjcCsTUEah4&t=54s. Also, the channel featured how to make a “Resistance Band,” out of stockings or a sock, https://www.youtube.com/watch?v=MZXpY89oQbg&t=19s. Some of our videos featured children who helped to make the sensory items, this showed just how easy and realistic it is for any child to be creative at home. The videos also talked about the benefits of each sensory tool and how it could help to improve focus, retention, and relieve stress.

Quickly, we realised that people weren’t just going to flock to our videos and we needed to do something to draw them in. We began to work on solidifying our brand and making videos more cohesive. This was difficult initially because a different person recorded each week, but we found a few ways to tie things all together using intro and outro slides and music, as well as using the same words at the beginning and end of each video. Additionally, we began to share our channel and videos with children, parents, and teachers that we knew. This helped us to gain some traction, but not enough that we felt like we were really making a significant impact on our wicked problem. Toward the end of Honors 4500, our team decided we wanted to shift in another direction. We wanted to really create a brand for ourselves and begin to manufacture our own products. We began looking into options of sensory tools to make and the benefits of each, as well as exploring where and how we could manufacture and potentially distribute these items. We also began to further solidify the SENSE-ational brand so that it was more well known and easily recognized.

In order to be sustainable, we put our videos on Youtube so that they could be there forever. Additionally, we shared our information and insight with teachers, students, and parents who will hopefully pass it onto their students, friends, etc. We also worked on having a solid

brand by researching and implementing various video recording and editing techniques to make our videos more cohesive, memorable, and consistent with what we believe. We researched how to effectively use a camera and it's functions to make our videos more engaging and professional. Having this in place allowed our ideas and methods to be preserved for years to come and shared with others. Additionally, we felt that with the creation of sensory tools, we would be able to make a real difference in the lives of students who could benefit from our items. With this new plan in mind, and newly gained access to ECU's Innovation and Design Lab, we got straight to hands on work in Honors 4550.

Honors 4550

We started Honors 4550 still creating youtube videos, however as the semester panned out we turned our focus on prototyping and creating our own sensory item. Continuing our fellowship with the Innovation and Design Lab (IDL), we spent a lot of time in the lab working with the 3D printers. Due to COVID-19, the lab had been closed for most of the fall semester. When the lab reopened, we got the opportunity to tour it and learn more about the printers and design programs we'd be using throughout the semester (shown in Figures 2 & 3.) We began exploring Thingiverse, which is a platform that allows creators to share their digital designs, for different designs of sensory items and toys we could take inspiration from for our own designs. Once we found several items we liked, we decided on four items to print out as our first prototypes for beta testing. When downloading the files from Thingiverse, we found we would have to make some changes on the measurements and scales of the items. We were able to do this with the program on the computers in the IDL, MakerBot.

Figure 2. MakerBot printer in the Innovation and Design Lab.

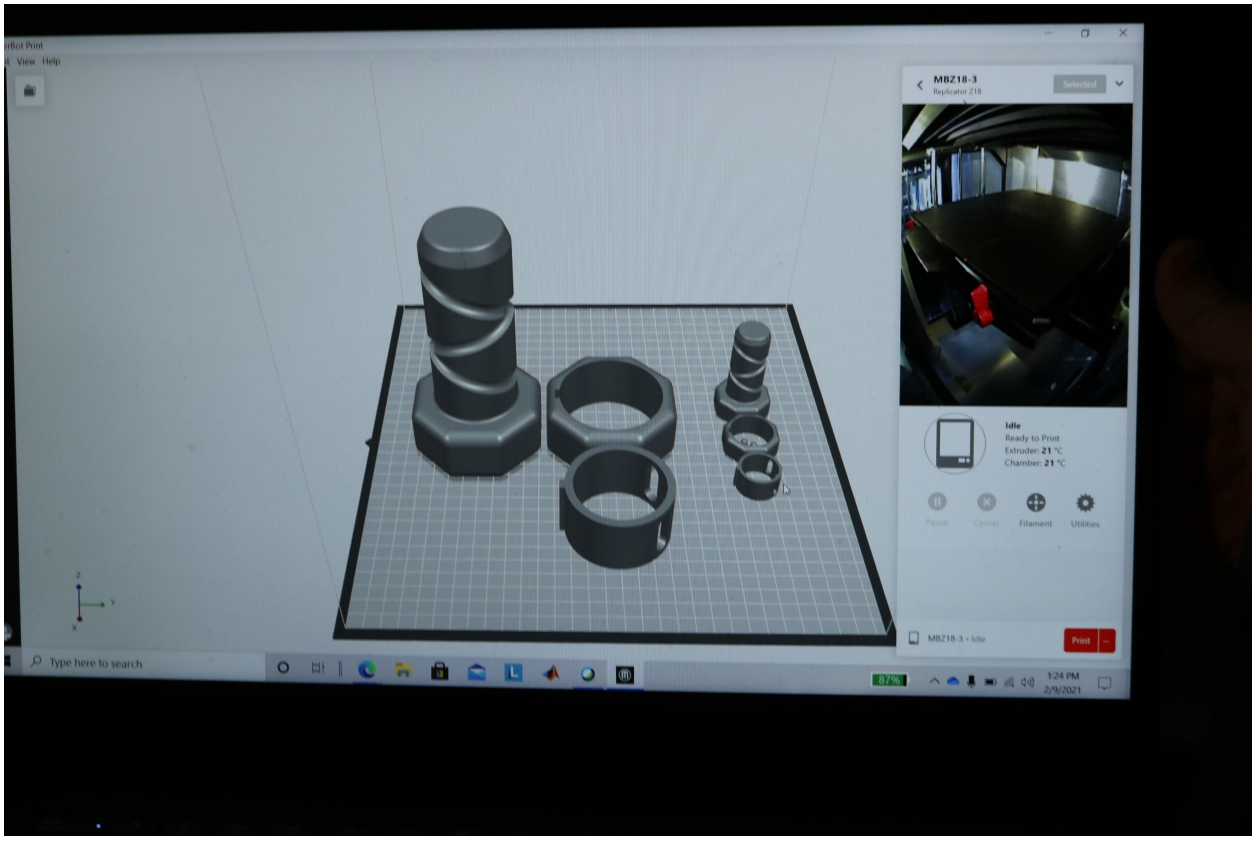

Figure 3. MakerBot design program that shows an outline of what you are printing.

Our plan going into this semester was to partner with different schools in the Pitt County area to help us with testing our prototypes. We had started last semester contacting schools in Pitt County by emailing the guidance counselors and vice principals at each school. We each contacted four to five schools each. A few of us began to hear back, but most of our attempts led to a dead end. Schools were still for the most part closed and not allowing outside visitors due to the pandemic. One of our teammates, Caroline Moore, had connections with the ECU community school and reached out to them about partnering with our team. We began to form a new plan of collaborating with classrooms at the ECU community school for the beta testing of our first prototypes. We planned to split our group into three different teams that would each work with one classroom, one 3rd grade class, one 4th grade class and one 5th grade class. We created a plan to go into the classrooms once for the first round of testing and a second time after

we finished our final product. Our plan consisted of taking a total of 30-40 minutes, in which we would take groups of five kids at a time to play with the toys and then answer a series of followup questions. This would take about five minutes for each group, and then we would sanitize each toy and testing area for the next group. However, after several weeks of being in contact with the school, we found that our testing plans would not be able to be completed at that time. This was a big roadblock for our project, and we began to feel very discouraged. We were running out of time in the semester and were losing motivation to complete our project. We were still working in the lab at this time, but did not feel our project was making the progress we wanted it to. This led us to have a very hard but necessary conversation with Tim. In this conversation we admitted we were losing motivation and were slacking with our project. He gave us some tough criticism but helped us to formulate a new plan for moving forward. From here we decided to do testing with children we knew in the Pitt County area and in our home towns. We were able to find 20 kids in the age range of 6-11 that became our new beta testers for our prototypes.

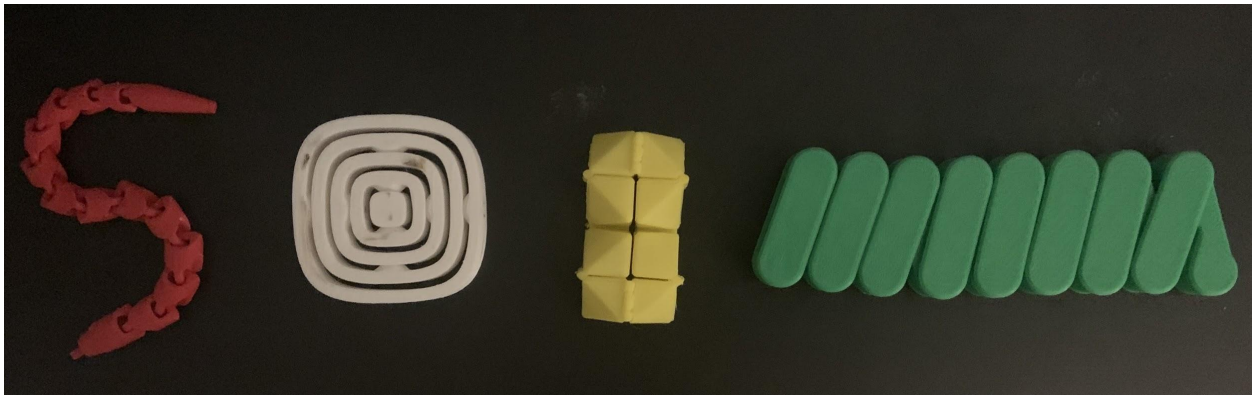

Figure 4. Four sensory items used in the preliminary beta testing of research.

Pictured above are the four main sensory prototypes we 3D printed in the ECU Innovation Design Lab. These objects were found through a 3D printing website,

www.thingiverse.com, that has numerous creative files that people can use to create 3D items on their own. We used this site to find inspiration for our own sensory product and we used the sensory tools above to collect preliminary data for our research. This farthest to the left is a snake that has the motions of a real snake, https://www.thingiverse.com/thing:1709106. The second from the right is called an air spinner, https://www.thingiverse.com/thing:2938561. The third from the right is a folding fidget cube, https://www.thingiverse.com/thing:230139. Lastly, the fourth from the right is called a shape shifter link, https://www.thingiverse.com/thing:4712643.

No one in our group had ever taken part or conducted a research study before, so we knew we needed to gain further knowledge on this process. We planned a meeting with Dr. Bhibha Das to hear more about her experiences and expertise on research. In our meeting we discussed the purpose of our research and came to the conclusions that we wanted to focus on collecting qualitative data, as opposed to quantitative. She then gave us advice on narrowing down our focus groups and creating followup questions for our testing that were specified for this group. After our meeting with Dr. Bhibha Das began formulating followup interview questions that we would be asking the kids. We narrowed down our ideas to five questions: Which one did you like the most? Why? What did you like about each product? What do you not like about each product? If you could pick one product to keep which one? Why? Would you make any of them bigger or smaller? We then created a Google Doc where we could type out the answers for these questions as well as observations we made throughout the testing process. We analysed the data we collected and picked out repeating themes we saw in the students' responses. From here, we concluded that those of a younger age range were more likely to pick the snake toy because of it being appealing to the eyes and easy to understand and play with.

However, those of older age were drawn to the items that were more mentally than visually enticing, the folding cube and the air spinner.

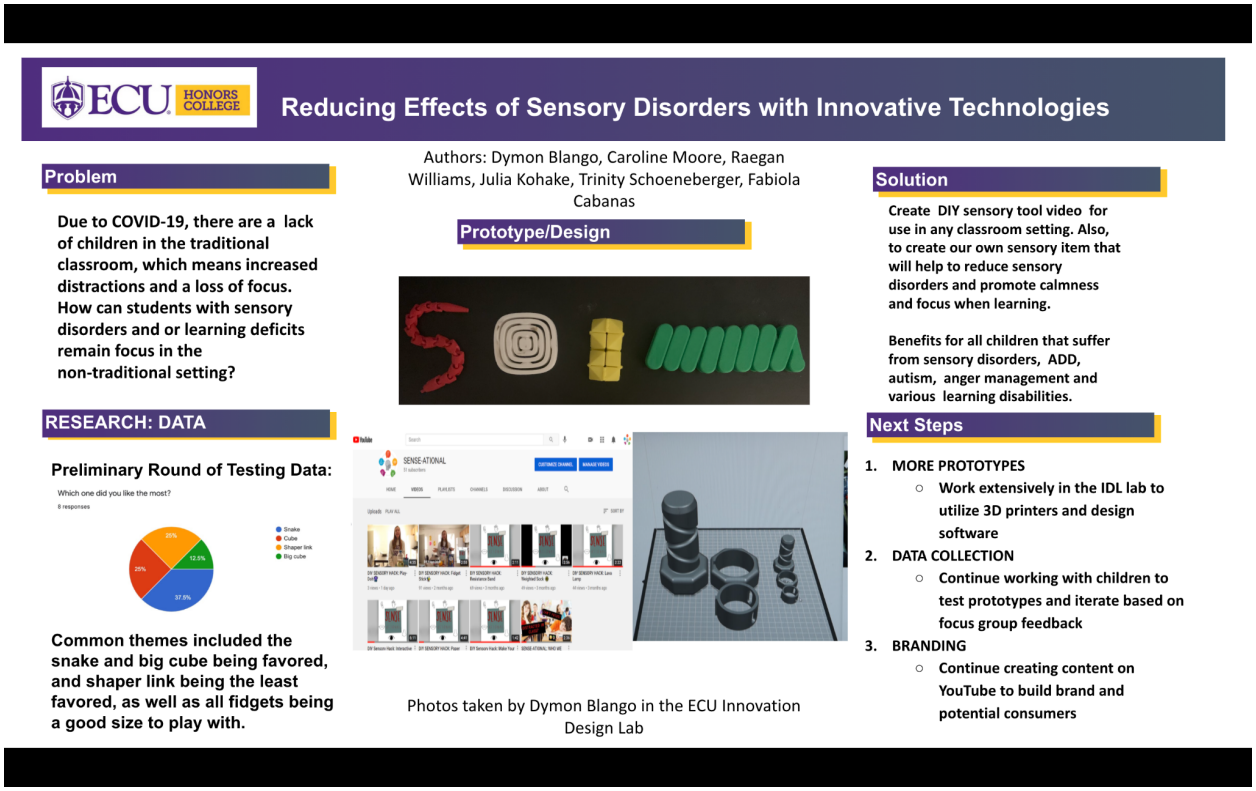

Figure 5. Our poster for Research & Creative Achievement Week. This showcases the process of our project, as well as the data from our research.

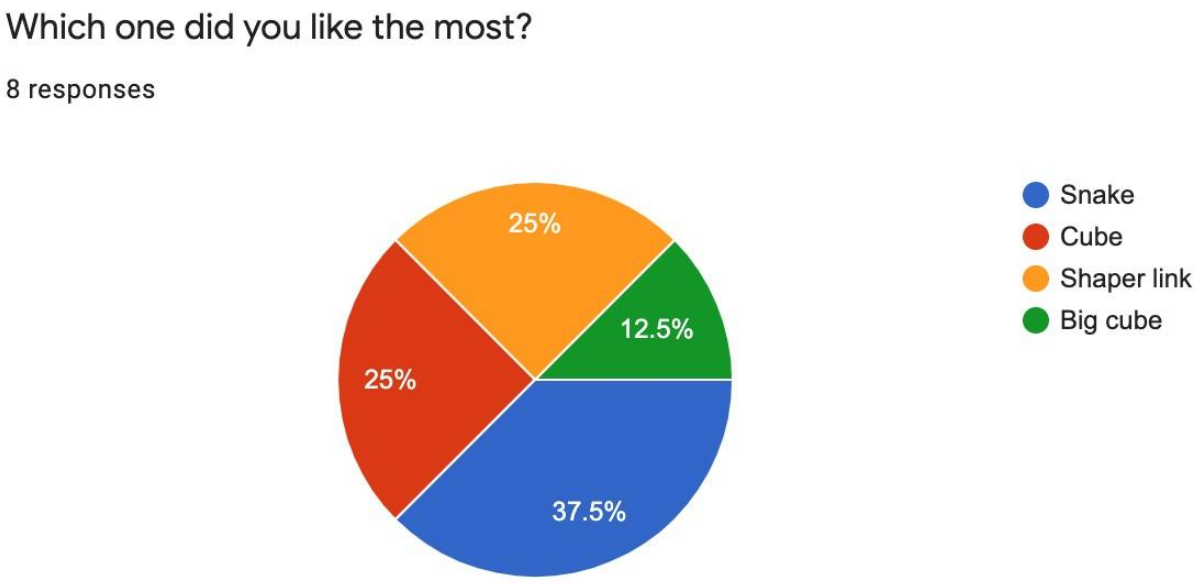

Figure 6. The results from the Google Doc we created for our research.

After further analyzing our data we began to formulate a plan for modifying our prototypes to create our finalized product. Since we had tested both younger aged and older aged kids, we decided on modifying two toys, the snake and the folding cube. We discussed our plan with Tim and decided to pivot from a business model canvas to a nonprofit, mission model canvas. Instead of looking to sell our products we are going to share our already printed items and links to the printable version of our products to schools in Pitt County that have 3D printers. We will also be making our edited versions of the prints available on Tinkercad, Thingiverse, and Pinshape. All of the websites we plan to upload the files to will be free, this way the prints will be available for anyone who wants and/or needs it. The profile we created on these websites will be named SENSE-ational and will include two categories on the websites in which the files to sensory items are available. The edited version of the snake and folding cube will be available as well as other objects of a similar nature. For younger kids this would include mostly animals.

Over the past two semesters we have found many types of printable animals that we will include such as butterflies, dinosaurs, octopi, and more. For older students we will include more mind stimulating toys such as the air spinner, the folding cube, and the nut and bolt. All of these would be free for schools in Pitt County to print for the students to take with them and use as needed. Teachers will be a big part of why our project will continue after this semester. With a little bit of searching students of any age will be able to find designs in which they can print in order to help them in school.

Conclusion

Overall, Honors 2000 lead us to realize a few key points. First, some things are inevitable, like becoming an adult, but there are things people can do to aid in those major life transitions. There will be financial, spacious, and administrative issues in all aspects. Honors 2000 laid a foundation for pivots to come. In the following semester, we learned how to solve problems, how to fail, and how to reach out and communicate. It was through our many interviews in Honors 3000 that we figured out what worked and what didn't work, and ultimately if we hadn't reached out and asked the important questions then we would never have been able to move forward.

Learning to fail was a huge lesson that we learned as a team during Honors 3000, because we learned to get back up and come up with something better each time, which ultimately led to our biggest pivot yet and prepared us for the worst yet to come. The pandemic has truly been the biggest example for all of us that nothing is for certain and things will never go according to plan. However, thanks to the skills that we learned from our previous failures, we were prepared to handle what was simply just another big pivot. During Honors 4550 we had to learn how to

deal with rejection. We went into the semester with a strong plan to finish out our project, however this did not end up going how we thought it would. After losing our main collaborator, we started to feel discouraged to keep going. We no longer had a plan and were running out of time. After talking to Tim, we were able to rediscover our passion for our project and turn that into the motivation we needed to finish out the semester.

We have learned that working in a group takes commitment, communication and effort. What makes a great team is great members. When each member does their part, it makes the team successful. Working as a team is not always easy especially when you are all excellent students with great minds. However, it humbles you tremendously and helps you to see that there are greater ideas than yours and compromising is essential to get things accomplished. One new skill we have gained during this project is learning how to 3D print in the Innovation Design Lab. This skill became essential during the last half of our project and made it very much enjoyable. It was exciting to work with new technology and take creations from the digital world and make them tangible. We learned throughout the course of our Honors project that sometimes our initial plan isn't how things are going to work out. It is important to be able to adapt to your situation and make the best of it. We also learned how to take criticism and use it to grow and better ourselves, our team, and our project.

SENSE-ational has made a tremendous impact on the educational community. We have provided an avenue for students to regain or remain focused during school. We have spread our knowledge, creativity, and research findings to students for their betterment. SENSE-ational has and will continue to help students of all ages. Every time a YouTube video is watched or a 3D model of our sensory tool is printed, we have aided in the educational success of another student.

The information or technology contained in these creations will be used in a way that will only benefit students directly or indirectly through their guardians or teachers.