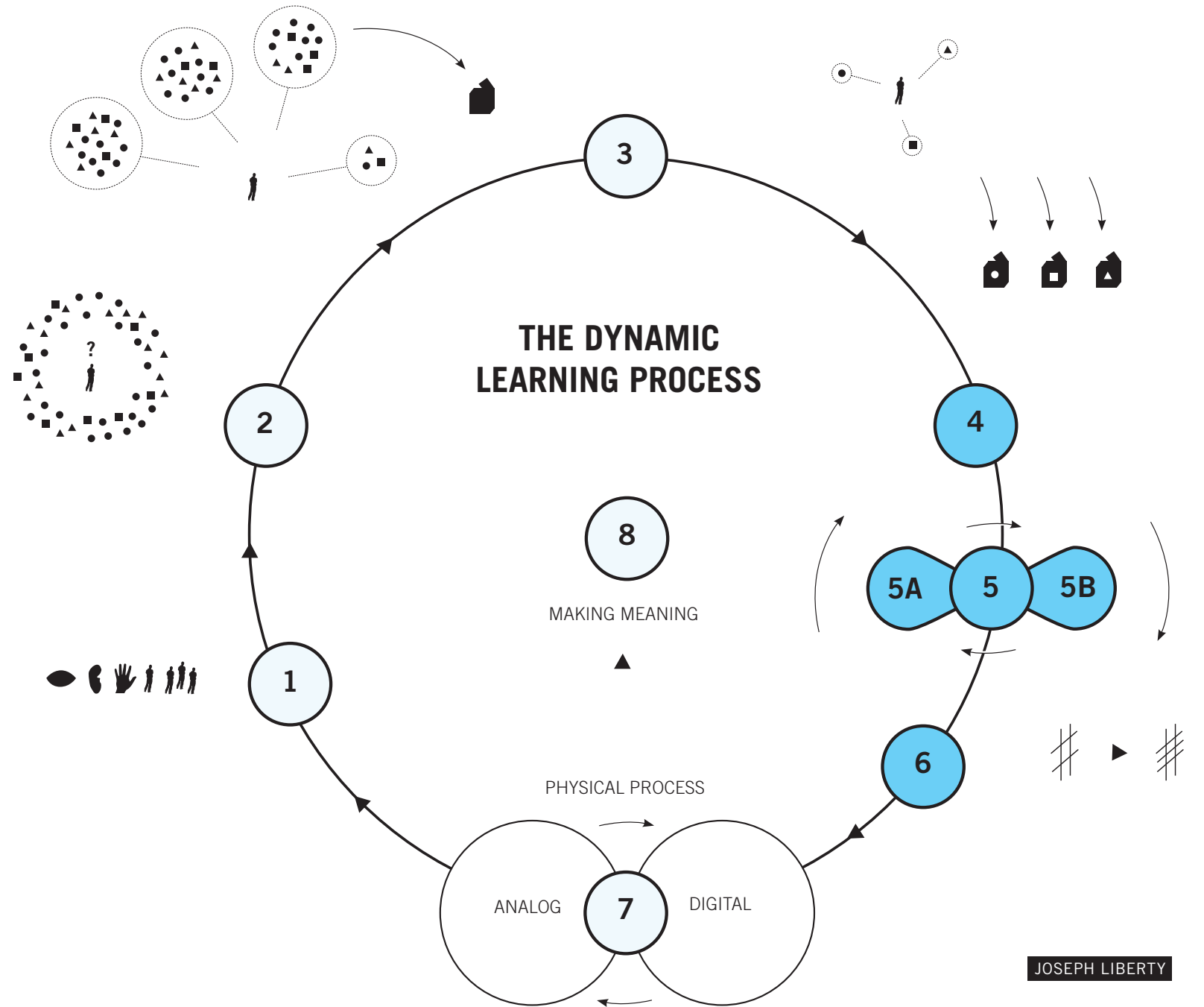




THE DYNAMIC LEARNING PROCESS



THE DYNAMIC LEARNING PROCESS



This thesis is submitted in partial fulfillment of the requirements for the degree of Master of Fine Arts in Design and approved by the MFA Design Review Board of the Massachusetts College of Art and Design in Boston.

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Abstract

This thesis proposes the creation of an interactive learning tool for students – specifically adolescents ages 14-18, with Auditory Processing Disorder (APD). The tool will provide a multi-sensory, collaborative, and kinesthetic learning experience through writing, reading, and drawing. This thesis utilizes an ethnographic process involving high school students with APD in a classroom setting. Students engage in an analog exercise enabling me to observe and document their experiences to inform my interactive prototype.



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Thank you for your love and support.

*“What I hear, I forget.
What I see, I remember
What I do, I understand.”*

Lao Tse



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Introduction



MY CHILDHOOD AND ADOLESCENCE

I have been spending a lot of time reflecting on my past and how it formed me. It started with curiosity, about how things looked, worked, and interacted with each other. As a kid I spent my time drawing, playing with blocks, Lego's, and constructing forts in the summertime.

I felt at home in the geometry of the hockey rink and baseball field. What made my experiences so enjoyable? I believe it was because of the gestural interaction I had with an object in space, whether it be blocks, hockey stick and glove, baseball bat and glove, golf club, or fishing pole. I had to have some sort of object in my hands in order to feel connected. To this day when I find myself standing talking to someone, I instantly feel the need to have something in my hand to keep me engaged. The simplicity of clicking a pen helps ease my need. If I don't have anything, my body starts to move in a rocking motion. I sometimes could catch myself doing it, but could not figure out why. I needed to be "dynamically engaged" in order to help me stay focused on what I was doing.

Auditory Processing Disorder: affects the way the brain processes auditory information — the brain cannot process information through hearing, which leads to difficulties in recognizing and interpreting sounds, particularly sounds associated with speech.

Dynamic Learning: Education through a step-by-step multi-sensory, collaborative, and kinesthetic experience.

FIRST EXPERIENCE WITH DYNAMIC LEARNING

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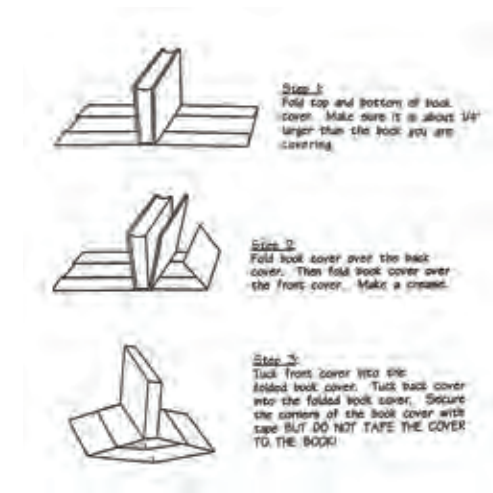
I remember sitting on the corner of my Boston Bruins bedspread when I was five feeling bored. I needed to pass the time, so I frantically rummaged through my wooden toy chest searching for anything of interest. There was the toy fire truck, slinky, and coloring books, but it was the box set of matchbox cars that got my creative juices flowing. I set up a variety of obstacle courses with the car and ramps all over my room — off my bed, floor, and chair-allowing me to see things from different perspectives. I learned that when the car and ramp were on the floor at a low

trajectory the car did not move as fast. When the car and ramp were at a higher trajectory the car went faster.

I realize now that I was an interactive designer at this young age. The cars in my hand and the imaginary course in my head allowed me to play and create an interactive world through play.



Matchbox cars from different perspectives.



At the age of seven I wanted to escape the realities of being the only kid on my block to come from a divorced family. Art was a way to express my feelings — an outlet for emotional release. For example, my grandmother, rest her soul, shared her love of art with me, opening me to the world of artistic expression. She would always tell me to look with a keen eye and allow the hand to become the extension of the eye.

When I started middle school I asked her to help me create a book cover to protect my textbooks. By taking a paper bag that was left over from the daily groceries, she taught me how to cut, fold, and wrap the paper to cover my books. I can remember the clean lines when the paper folded over the cover to make that crisp edge and how smooth it felt to the touch. Why is this so memorable to me? It was her hands-on, one-to-one

approach in a safe, collaborative learning environment and working together that made it dynamic to me. The exchange of a step-by-step instructional process between two people helped me understand what I was doing. Our back and forth conversations consisted of me asking questions and her verbalizing and demonstrating the visual steps of the process. The process was easier for me to understand and, upon reflection has left me wanting to recreate a social environment for those afflicted with APD.



Packaging project Thermo Fisher Scientific's new meter line of water products.

REDISCOVERING MY CREATIVE PROCESS

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As a graphic designer, I had an opportunity to work on a packaging project for Thermo Fisher Scientific's new line of water testing products. I started my creative process by sketching with paper and pencil when certain problems came to mind. I had to consider: what is the project; what are its goals; what type of research is needed; and what should the visual form be? Going from one idea to the next, trying to figure out what would work best, my subconscious instincts took over and told me that I should start applying these two-dimensional sketches to three-dimensional form. So I decided to build small paper prototypes to help see how different sketches would wrap around the object. The paper prototypes suggested new ways of approaching the problem by moving from two-dimensional to three-dimensional space. The process was not about moving from point A to point Z, but it was these steps in the middle (B to Y) that intrigued me. I realized how I applied my creative process to this project and began to take a closer look at how I move from step to step.

Through my experience with sports I learned that using a physical tool to interact with my environment engages me to focus attention. This inspired me to create my own dynamic tool to help others with APD. My play with matchbox cars built problem-solving, kinesthetic skills. It also was a way of telling a story as I moved the car from one place to another. It forced me to work step-by-step, and in translating what was in my imagination to a physical reality. This provided me with *interhemispheric transfer training*, which is training the two hemispheres of the brain to work together, and transforming sensory information or knowledge back and forth between the halves. Interhemispheric transfer training is one of the recommended therapies for those with APD.

All of these experiences — with perspectives, dynamic learning, and the creative process, have inspired the research and development for my WRD³ project. I want to give students a tool to interact with each other and their environment, requiring them to work step-by-step, changing perspectives to provide interhemispheric transfer training and giving them the satisfaction of using their imagination to communicate their ideas.

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HOW MY BRAIN IS WIRED

Freshman Year of High School

As a high school freshman I was performing poorly in school, and not for lack of effort. Action was taken to determine the cause for my difficulties, and testing diagnosed that I had APD.

The symptoms of APD, involve distractibility due to noises in the environment-such as a ventilator system, a passing siren outside, hallway conversations, etc. Which interferes with my ability to concentrate on lectures and conversations. I also have difficulty engaging in discussions for more about ten minutes without becoming fatigued. The fatigue factor is a result of being over stimulated with a variety of background noises, which means it takes me longer to process the spoken word. My inspiration for my thesis project comes from my own frustrations with learning. Learning how to use visual tools that integrate step-by-step sequences in my own learning process help changed my life. Learning tools such as hand-outs, study guides, graphic organizers for lectures,

and organizational strategies gave me better work-arounds and helped organize the way I deal with my disability.

APD entails a weakness in auditory processing, problems confronting new ideas and concepts, and weak math skills. Ideas and concepts are more “global” references whereas “math” is specific. I needed visual tools for learning, the repetition of words, outlines, and summaries to topics. I have developed approaches to navigate APD over the years and understand that it takes me longer to process information than others. To fully understand what I am doing I have my own visual organization in order to make sense of complex ideas, concepts, and logic. My leaning and creative processes have become a collection of different strategies I have developed over the years. Looking back,



I realize that these strategies are a form of dynamic interpretation. Dynamic interpretation is the ability to filter the process of complex information into simplistic form for better understanding.

Through my experience I believe every learner is unique and has individual learning strengths and weaknesses. Every learner can benefit from learning experiences that are varied and multi-sensory.

DEFINITION OF TERMS

Auditory Processing Disorder: affects the way the brain processes auditory information – the brain cannot process information through hearing, which leads to difficulties in recognizing and interpreting sounds, particularly sounds associated with speech.

Dynamic Learning: education through a step-by-step multi-sensory, collaborative, and kinesthetic learning experience.

Dynamic Interpretation: is the ability to filter the process of complex information into simplistic form for better understanding.

Dynamic Media: “dynamic” means, “pertaining to or characterized by energy or effective action” (Dictionary.com 2011). Meaning, in order for something to be dynamic it takes an action or in my case movement to make it dynamic. The definition of “Media” is, a tool used to store and deliver information or data.

Ethnographic Research: studying and learning from people with different cultural backgrounds and different learning styles to understand how their experiences may differ.

Interhemispheric Transfer Training: training the two hemispheres of the brain to work together, by transforming sensory information or knowledge back and forth between the halves.

Learning Disabilities: a broad classification encompassing several disorders involving difficulties with learning, such disorders affect the brain’s ability to receive and process information.

Learning Styles: various approaches or ways of learning that involve educating methods, in particular to allow an individual to learn best.

Metacognition: knowledge of, when and how to use particular strategies for learning or for problem solving.

Kinesthetic Learning: is a learning style involving a student performing a physical activity, rather than listening to or watching a lecture or demonstration, also referred to as “tactile learning.” Students needing a kinesthetic learning approach are also called “do-ers.”

Early Case Studies

THE BIRD (2010)

Showing My Process through an Analog Project

For “Design as Experience” class with Professor Gunta Kaza, I was required to create a response to another student’s project. DMI colleagues Chris Field and Alex Wang created a nest for five birds, covered in shredded pieces of rope. The figures of the birds had been dipped in clear wax so the shape was visible, but eliminated any details of their actual appearance. This led me to create an artifact of what one of the birds might look like in detail. My inspiration came from found material around my apartment to construct the bird, and the “making” phase became the focus for this project. I let my subconscious construct the bird without knowing what the final product would look like.

My process consisted of two phases: the construction of the body and the feet, and then the stuffing of the bird with feathers. I really enjoyed the hands-on approach. It made me realize I missed working with physical materials while letting my creativity unfold

through an analog process. My goal was both to appreciate my classmates’ design and use it to inspire my own. In other words it was a form of communication.

The feathers I used as a kid would be placed into the bird giving it a special meaning to me. Reliving my childhood through the creation of something new was really inspiring to me. Stuffing the bird gave it the appearance of being both attractive, but a little disturbing at the same time.

Design Process:

For the construction of the body and feet I used hanging wire. I treated the body in six sections, ranging from small to large and back to small circular rings. This structure would be the skeleton for the bird to hold its shape. One segment would be an inch apart from each other as the circular rings start to elongate and fill the body. Once the body was secured I started to work on the feet. I began to construct the feet strictly from memory of what birds feet would



Final phase of
The Bird



DMI colleagues Chris Field
and Alex Wang created a nest
for five birds, covered in
shredded pieces of rope.

look like. A long stem resembled the leg as three toes that would make up the feet. I knew that the feet would have to hold the weight of the bird so I had to reinforce them with thicker wire that I had found. Overlapping of wire became a common strategy for me to make the body and feet stronger. I attached the body and feet together to give the appearance of the bird taking shape. I noticed that the bird being hollow was a little unstable so I decided to go outside and use leave stems to use for its tail and head. I constructed fifteen stems to be grouped together by hanging wire at one end. The shape of the stems was placed inside the birds skeleton to give it balance. After all of this was done, I realized that something was missing. Phase II allowed me to add feathers to the bird to be complete. Where will I get the feathers? As a kid I used to make lures out of my fly-fishing kit. I cannot believe I kept that for all of these years. The feathers I used as a kid would be placed into the bird giving it a special meaning to me. Reliving my childhood through the creation of something new was really inspiring to me.

What I Learned:

I really enjoyed the process of this project. By trusting my instincts, I first saved a lot of time instead of second guessing myself. The freedom of exploring physical materials and letting things unfold during my creative process helped build my confidence in what I was doing. This project became important to my thesis development because:

- I was able to focus on the creative process of making.
- I was able to tap into my subconscious by allowing myself to take my process step-by-step without the limitations of being rushed or fatigued.
- Reinterpreting someone else's idea inspired the development of my tool, in which students reinterpret a story written by their peers.



Process consisted of two phases:
the construction of the body and the feet,
and then the stuffing of the bird with feathers.





VISUAL COLLABORATOR (2010)

Showing My Process through a Digital Interface

The Visual Collaborator project for Design Studio II class involved brainstorming, sketching, researching, organizing, planning, and designing a visual prototype for a “holistic” encyclopedia of the arts. The interface allowed professionals from different backgrounds, including an architect, a graphic designer, and a chef, to interact with words and images in a collaborative and creative setting. My goal was to facilitate professionals in multiple disciplines with different vocabulary associations to learn from each other. I imagined a process for a database of images and words in which a graphic designer would display the word “Italic” (slanted script) on the screen and each of the other professions would have to find an image in the database to illustrate the word.

Design Process:

My design process consists of three phases:

1. Creating user personas for an architect, graphic design student, and chef;
2. Developing a database of imagery for each persona;
3. Creating user interfaces with screen and paper prototypes.



Developing a database of imagery for each persona.

PERSONA 1 - ARCHITECT
JENN

- Woman
- Mid level experience
- Age 34
- Cornell University
- Likes creating small scale models
- AIA member
- Boston Society of Architects member
- Married with two kids
- Hiking
- Has a dog
- Works at CBT Architects firm
- Lives in Cambridge

Jenn's love for the outdoors started as a little girl going hiking with her dad. In her work she brings the use of nature and raw materials to create unique organic and geometric scale models.

PERSONA 2 - GRAPHIC DESIGN STUDENT
KAYNE

- Man
- Intermediate experience
- Age 18
- MassArt
- Wants to be a type designer
- Curious on how to draw typography
- AIGA Boston student member
- Avid bike rider
- Lives in Bolton
- Listens to electronic music

Kayne is studying to become a type innovator. He feels through the use of exploring hand drawn and unconventional type methods would help develop his craft.

PERSONA 2 - CHEF
SALVATORE

- Man
- Experienced
- Antico Forno
- Age 36
- Johnston & Wales University
- Italian food
- Creating experiences that bring people together
- Travel
- Rock Climbing
- Lives in the Boston's North End
- Married with one kid
- Listens to classical music

Salvatore brings an Italian passion for simple yet flavor packed foods to his role as chef at Antico Forno. Innovative and fresh describe his approach to the Neapolitan and Sicilian dining experience he creates.

Creating user personas for an architect, graphic design student, and chef.

Personas:

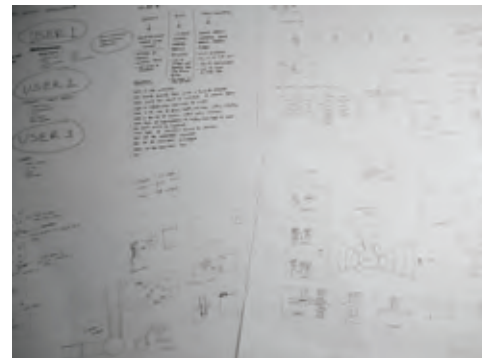
I created the three personas from three users (architect, chef, designer). I pieced together the personas' look, age, and interests, and then created a short story about each one. Doing this helped me create the world in which my personas lived.

Jenn, the architect, has a love for the outdoors and as a little girl started hiking with her dad. In her work she brings the use of nature and raw materials to create unique organic and geometric scale models. I focused on the work of Frank Lloyd Wright to choose the words and images that Jen might use.

Kayne, the graphic design student, is studying to become a type innovator. He feels the use of exploring hand drawn and unconventional type methods would help develop his craft. Since typography has always been a passion of mine, I choose the words and images describing type.

Salvatore, the chef, brings an Italian passion for simple yet flavor-packed foods to his role as chef at Antico Forno. His approach is innovative and fresh bringing a Neapolitan and Sicilian dining experience to his customers. I was inspired by Antico Forno to imagine a vocabulary he would use describing Italian cuisine.

I collected an image database for some of my personas including people they admired such as Frank Lloyd Wright, Stephan Sagmeister, and Anthony Bourdain. I then created a story-board for how the first interface would work.



First interface was color-coded with green for the architect, blue for the graphic design student, and orange for the chef.



Design Concept I:

My first interface was color-coded with green for the architect, blue for the graphic design student, and orange for the chef. I chose to have a white background for ease of navigation for the user. The user would select which professional personas they wanted to play. In the word “Italic” would be on one side of the screen and the word form on the other. Once the user selects a word, in this case “Italic”, a series of images would appear on the screen each depicting what the other professionals have chosen from the database. Both a two-dimensional and a three-dimensional rendering of the image would be selected and then lines connecting them would appear on the screen, showing the relationships between the two.


I needed to build a bigger database of images and words. Organizing and thinking about what the personas would select was difficult as I was too close to the content and this became an obstacle. I later realized that I could have a database that can be used

through crowd sourcing. Allowing users to select their own content. Some of the words that I chose for the graphic design student were: “bold”, “scale”, “light”, “order”, “shape”, “space”, “color”, “content”, “variety”. Some of the words I chose for the architect were: “interior”, “exterior”, “modern”, “contemporary”, “white”, “black”, “urban”, “construction”. Some of the words I chose for the chef were: “roast”, “reduce”, “steam”, “whip”, “strain”, “sear”, “poach”, “infuse”, “season”, “bake”, “brown”, “broil.”

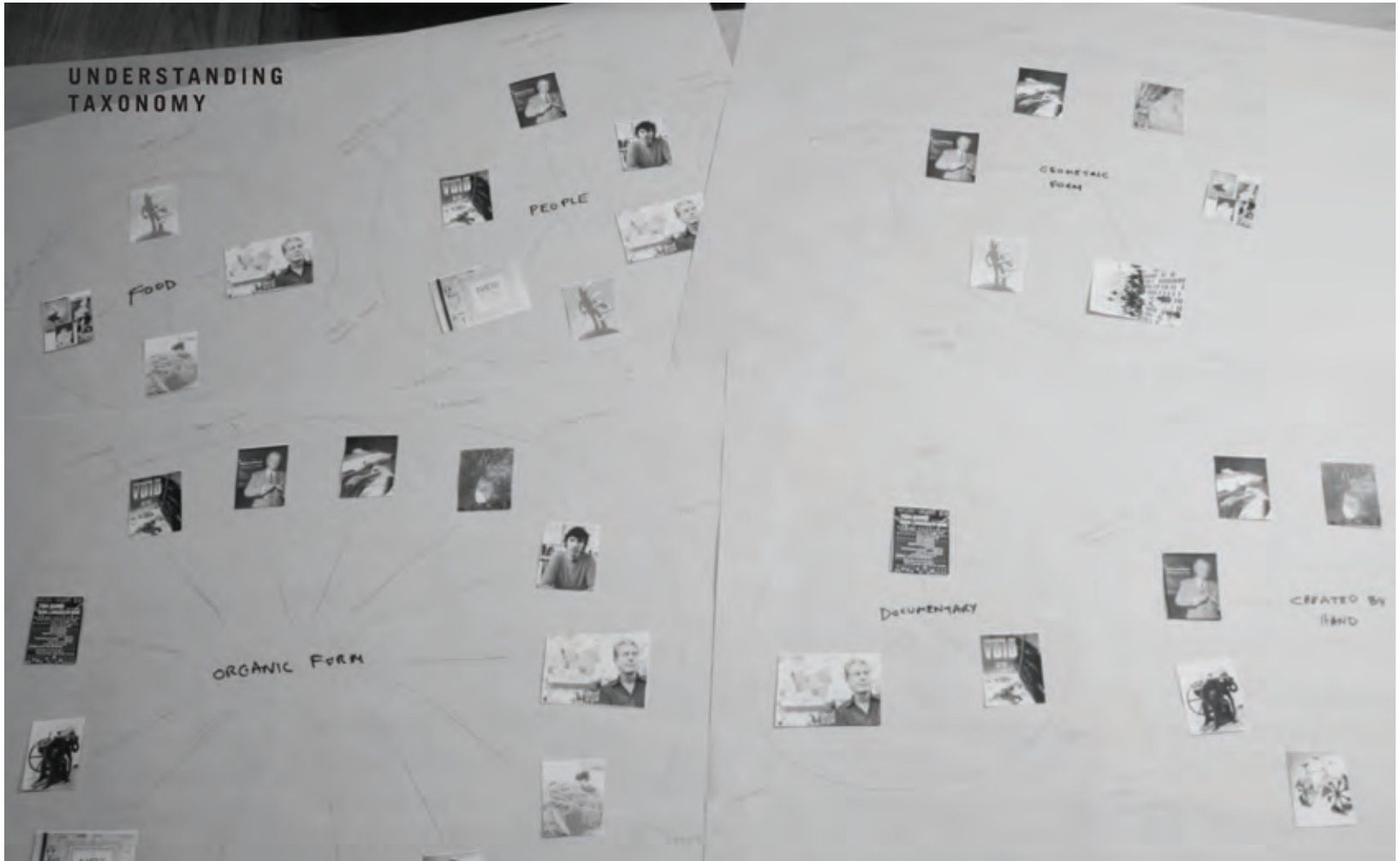
Design Process:

I cut out the images and sketched the taxonomy of my database to get a better understanding of what I was doing. Some of the categories were food, people, organic and geometric forms, documentaries, and objects that were handmade. I used building blocks as metaphor of play to symbolize what I wanted the user to experience while using my interface. As a child I could remember playing with these blocks to explore how to fit simple block shapes (square, triangle, circle)

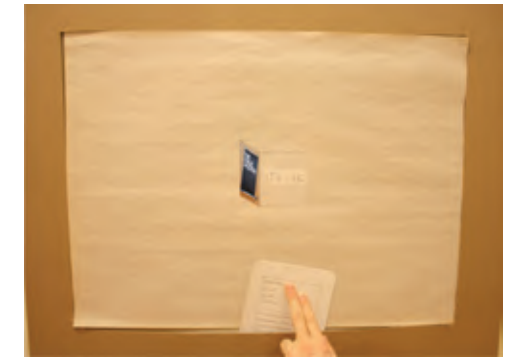
UNDERSTANDING ORGANIZATIONAL STRUCTURE



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I cut out the images and sketched the taxonomy of my database to get a better understanding of what I was doing.



Paper prototype using paper, cardboard, and stop animation.

which would be placed into a bigger box that had cut-out outlines of what the shapes looked like. I was able to figure out the relationships between the outline and the shape of the object as a child and wanted to have the same experience for the user to figure out the relationships between words and images.

Design Concept II:

After choosing my vocabulary, I created a prototype using paper, cardboard, and stop animation. This proved to be an effective and cheap way of helping me to think about the user's point of view while using my hands.

Design Process:

In creating my paper model I imagined the user would start by selecting the word "Italic", and then a key would appear in the top left telling the user to place an object on the screen. Once the object was placed onto the screen, the user would have the option to rotate it clockwise and counter clockwise. In doing so, the word "Italic" would rotate as well, revealing the image of the italic poster on the left. By rotating the object, the image on screen would go from two-dimensional to three-dimensional giving depth and motion to the interface. The user would have the ability to move to access the control panel on screen. From there the user could select any filter to navigate through the interface.

Design Concept III:

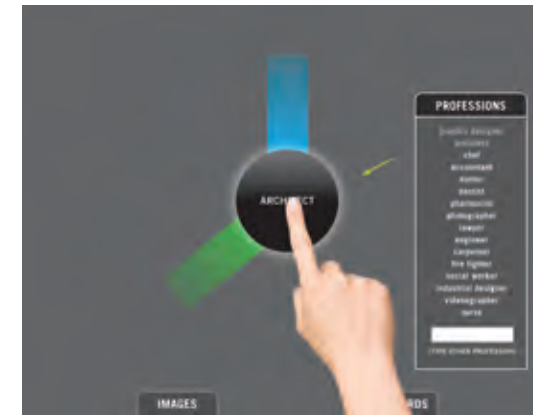
Designing the interface for the multi-touch table allowed me to use a hand to show how the user would navigate in this space. The background and the tool pallet were depicted in a gray gradient. In the center of the interface was a key allowing the user to select and drag three professions onto the stage. On the bottom of the screen were three pallets: on the left were images, in the center were professions, and on the right were key words.

Design Process:

The user would pull out the profession palette and drag it to the top right hand corner of the screen. From there the user would touch, drag, and drop the three professions they wanted to choose. The colors would change per profession giving the user a visual cue that they had completed the task and they could move on. After the selections were made for all three professions, the user would put back the professional palette and a key would appear telling the user to

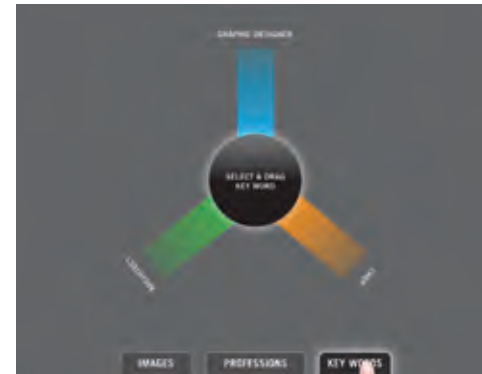
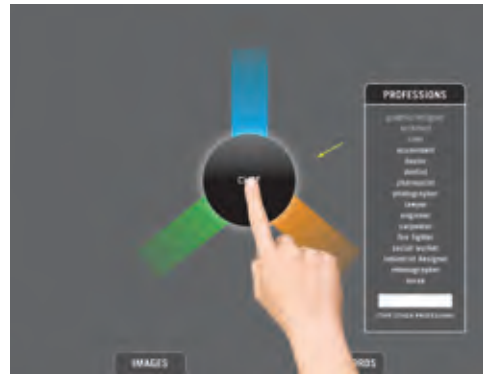
select and drag a key word to the middle of the stage. As the user moved the key words palette to the upper right corner of the screen, the user would choose from a list of words to drag to the middle of the screen. The user selected the word “Italic” and it appeared in large and the bold text. The user would drag the key word palette back to the bottom of the screen and would drag the image palette to the top left corner of the screen. The user would then drag and drop the images onto a triangular shape that would symbolize the different professions by color. The user would select what image representing “Italic” that they think would be a good fit for that particular profession.

The user chooses three images per profession. The user has the option to save all the images that pertain to the word “Italic” and would have the ability to save multiple new words and images. The interface would reset itself and the user would be able to choose a new profession.



The interface featured a key that allowed the user to select and drag three professions onto the stage.





Process to show how the user would navigate in this space.

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Triangle-shaped table to accommodate the three people standing around it.



Design Concept IV:

I made a three dimensional model on the computer screen to work out the details on how the table would fit in a physical space. I imagined of a triangle-shaped table, which I chose to accommodate the three people standing around it.

Design Process:

I refined my idea of how each user would interact with the table. I kept the same look and feel of the previous interface, by having the background screen gray. The user would start by touching a black start button that would glow signaling the starting point for the user. The user would then place a circular object onto the table to take control of the interface. After the user takes control of the interface, touches the start, another prompt would be displayed telling the user to select a key word. A database opens at the bottom of the screen that includes an array of words. The user would then have the option to scroll through to select a word from the screen, in this case "Italic".

The selection of the word would appear below the scrolled words to prompt the user that the selection had been made.

The user would see another prompt that would be displayed in the middle of the interface instructing them to touch to register on the iPhone. Once the user would go to their iPhone they would be able to click on the Visual Collaborator application to register their name and profession. After selecting the next button, the user would have the ability to click on the Google images link to access and download images to the Visual Collaborator table.



Interface instructing the user to touch to register on the iPhone.



Once the user selects and downloads the image it would appear in the middle of the table. At this point I wanted to experiment with how the user would experience the interaction of my system through the use of video. I decided to have two classmates Yaoming Hao, Lou Susi, and myself perform the roles of an architect, a chef and a graphic designer. This taught me to see first hand how my system would work on how I had envisioned it.

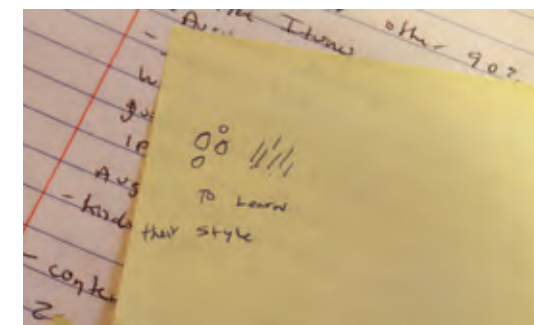
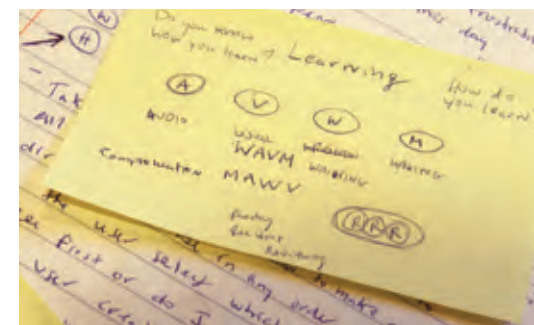
I started to drop the idea of professions and collaboration and wanted to integrate how the learning process works into my project. I learned that I could not get into the minds of these professionals and that I was role-playing in a sterile environment. I also learned

that others have a different set of associations and images and learn differently. The Visual Collaborator project changed and from this point on would be now known as the WRD³ project. I wanted to make it a dynamic experience in which students engaged in different learning styles.

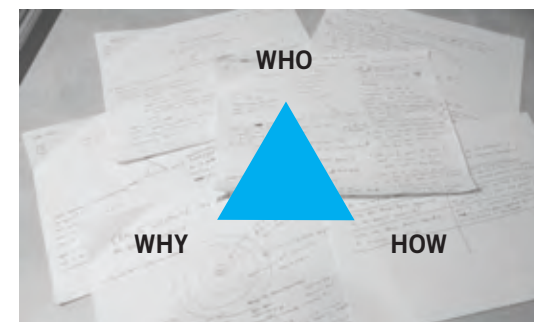
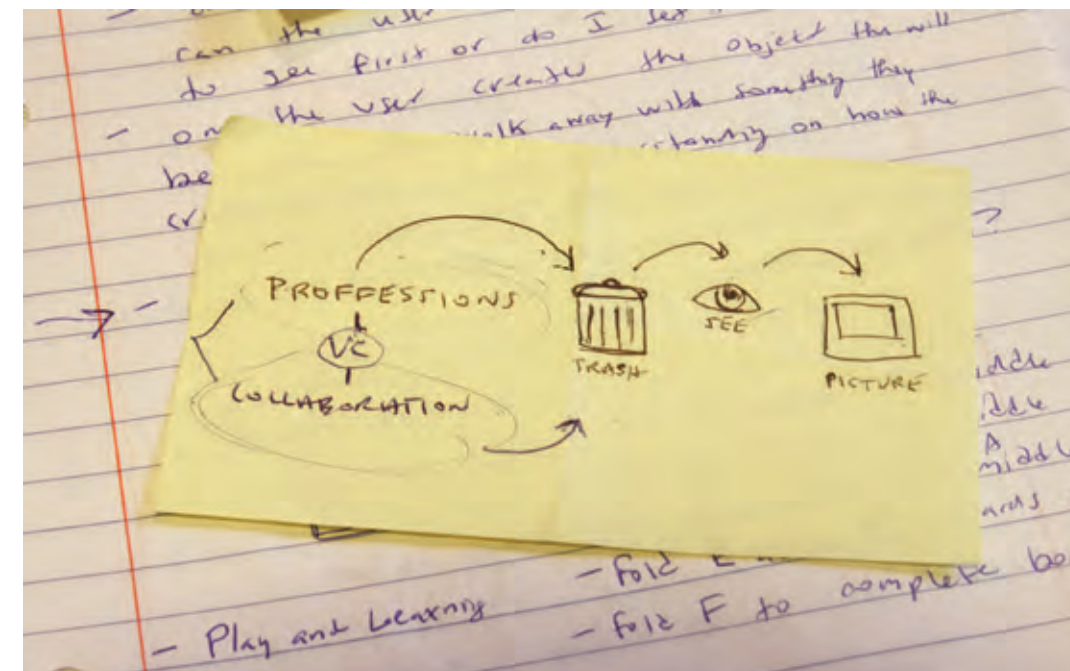
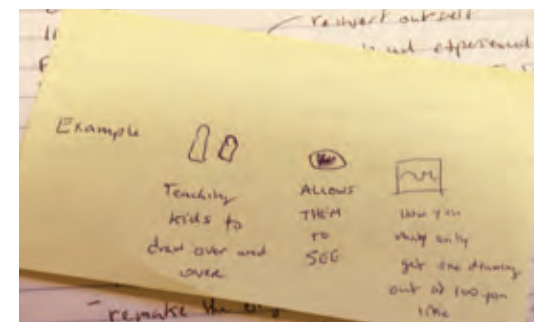
Design Concept V:

From this point on WRD³ became the basis for my thesis project. In my new design concept, I wanted to slow down the learning process and make students aware of how they learn and how others learn. This project would bring in writing, reading, and drawing components to the piece. My concept was that the first user would write a brief story, pass it on the next

Two classmates Yaoming Hao, Lou Susi, and myself perform the roles of an architect, a chef and a graphic designer.



I started to drop the idea of professions and collaboration and wanted to integrate how the learning process works into my project.





Video simulation for each imaginary user that would be projected onto the backside of a poker table.



First user would write a brief story, pass it on the next user who would draw the story, and finally the third user would reinterpret and write a new story from the drawing.

user who would draw the story, and finally the third user would reinterpret and write a new story from the drawing. I wanted to see how some of the experiences would be visualized on a smaller scale by focusing on the interactions of what would happen from one user to the other. Being at DMI has taught me how to retrain myself by realizing how I learn. Writing, reading, and drawing are at the core of my development as a student and how I learn best.

Design Process:

Each stage of the analog process is a repetition that reinforces and engages different learning styles in a step-by-step task. Each step is a distinct filter for the different information, which allows them to focus on

what they are doing. I designed a video simulation for each imaginary user that would be projected onto the backside of a poker table giving the appearance of being a multi-touch table. This proved to me to be a valuable step in developing my tool. I was experimenting with how the page would be passed from one user to the other and how I could develop this tool moving forward. I realized that small visual prompts would be more valuable to convey the idea of simple tasks.

What I Learned:

I realized that even though I was trying to create a dynamic interface it was not really playful at all. It felt too rigid and just allowed the user to move things

around the page. I tried to bring in another medium by using the iPhone but later realized it was not necessary because it did not solve the problem of having the user experience different professions. It was just a means of retrieving images from the internet.

The Bird and Visual Collaborator Summary:

My creation of the bird was a silent collaboration. That is, I was responding to a work of another but using my own imagination. This project was important to me because when I began to create an analog exercise as a prototype for my digital tool. I was inspired by my freedom of creating with simple tools and making my own visual story from the prompt of my classmate's project.

In my Visual Collaborator project I was also trying to create a collaborative learning tool. Because the user would work with a limited database of images and words, it did not inspire creative thought. Through this project I learned that unless I allowed users the

freedom to use their own imaginations, the tool would be sterile and frustrating.

Both of these projects helped me formulate my research questions which are:

1. How can I create an interactive tool that would help students with APD to discover different learning styles by engaging them in writing, reading, and drawing?
2. How can I make a multi-sensory, kinesthetic, and collaborative tool, while keeping it simple enough to challenge, but not exceed the student's frustration tolerances?

I wanted to create an interactive tool that would help students learn through creative expression. I wanted this tool to be simple enough to challenge, but not exceed the students' frustration tolerances.

Auditory Processing Disorder

AUDITORY PROCESSING DISORDERS

History of the Recognition and Diagnosis of Auditory Processing Disorders

The history of diagnosis and treatment of APD began with Helmer Myklebust (1954) who pointed out the importance of testing central auditory function in children who show signs of communication disorders. A team of physicians in Italy began developing a test to quantify the auditory difficulties reported by their patients. In 1961 Doreen Kimura developed tests to diagnose the disorder and formulated a model to explain the underlying physiology. It was not until a 1977 conference that real interest in APD in children began (American Working Group). The tests used today, as well as the approaches to auditory training, are the key to diagnosing and training APD.

According to audiologist Terri James Bellis, exercises to train interhemispheric transfer such as writing dictation and verbally describing a picture while drawing, can promote “phoneme-to-graphen” skills (sound

to visuals cues). Interhemispheric transfer training involves activities to stimulate information exchange between the two hemispheres of the brain. This helps those with APD to follow auditory directions, which require integration of speech, understanding, and motor response (American Working Group). These scientists have discovered that interhemispheric transfer training is effective in helping those with auditory processing disorder by connecting the sounds they hear to written and visual meaning.

HISTORY OF APD TIME LINE

1954

Helmer Myklebust

Who pointed out the importance of testing central auditory function in children who show signs of communication disorders. A team of physicians in Italy began developing a test to quantify the auditory difficulties reported by their patients

1961

Doreen Kimura

Developed tests to diagnose the disorder and formulated a model to explain the underlying physiology.

1977

American Working Group

It was not until (1977) that real interest in APD in children began

90% of what they say and do

10% of what they read

26% of what they hear

30% of what they see

HOW STUDENTS RETAIN INFORMATION

50% of what they see and hear

70% of what they say

defined by Caroline Gilmore based on multiple learning styles

Common Symptoms, Five Primary Subtypes:

Five primary subtypes of APD have been identified (Bellis) *When the Brain Can't Hear: Unraveling the Mystery of Auditory Processing Disorder*, 2002), and each subtype presents its own challenges and specific symptoms. According to the National Institute of Deafness and Other Communication Disorders (NIDCD), children with auditory processing difficulty have been generally observed to:

- Have trouble paying attention to and remembering information presented orally
- Have problems carrying out multi-step directions
- Have poor listening skills
- Need more time to process information
- Have low academic performance
- Have language difficulty (confuse syllable sequences, have problems developing vocabulary and understanding language)
- Have difficulty with reading, comprehension, spelling, and vocabulary

Diagnosing and Treating APD:

Audiologist Terri Bellis discusses both diagnosis and treatment of APD in her article, “*Understanding Auditory Processing Disorder in Children*”. Bellis discusses the variety of listening problems, such as:

- Difficulty understanding speech in noisy environments.
- Telling the difference between similar sounding speech sounds.

Key Points:

- APD is not a global deficit, such as autism or attention deficit disorder.
- Accurate diagnosis can only be made by an audiologist.
- Treatment is individualized, there is no one approach that works for all.

Bellis’s article notes that there is no “one-size-fits-all” method of treating APD. The treatment needs to be tailored to the individual and his/her specific deficit. Helping those with APD usually focuses on three primary areas:

1. Helping students to understand the disorder.
2. Changing the learning environment to eliminate background noise.
3. Helping students discover different learning styles to compensate for their disorder.

Some approaches include use of electronic devices such as head- phones and digital recorders and simplifying information so the student can focus on the message rather than the sound. The educator must make a judgment of whether the student could be helped by computer-assisted training, one-on-one training with a therapist, or group therapy in a school or clinic.

Some children grow out of APD, while others improve significantly with early detection. All students with APD can learn strategies for listening and learning that can help them compensate for their deficiencies.

Digital Learning Tools to Use in the Classroom for Students Who Have Difficulty Learning

Among the digital learning tools that have been introduced into the classroom are:

- Kurzweil 3000 translates written text to oral language for struggling readers;
- Dragon verbally translates oral language to written text;
- LibriVox is an online digital library of free public domain audiobooks, read by volunteers;
- Interactive White Boards (SMART Boards) shows students anything which can be presented on a computer's desktop, and allows student to access information later, reinforcing repetition.

These learning tools allow both the teacher and students to interact with a classroom and are helpful to most. However, no tools specifically developed for APD currently exist.

Interactive Metronome is program that provides a structured, goal-oriented process that challenges the students to synchronize a range of hand and foot exercises to a precise computer-generated reference tone heard through headphones. Essentially, the student needs to match the rhythmic beat with repetitive motor actions. An auditory-visual guidance system provides immediate feedback, scoring the student's success. This is a form of interhemispheric transfer training used in one-on-one therapy with an audiologist. This inspired me to create an exercise in interhemispheric transfer training that could be used in the classroom.

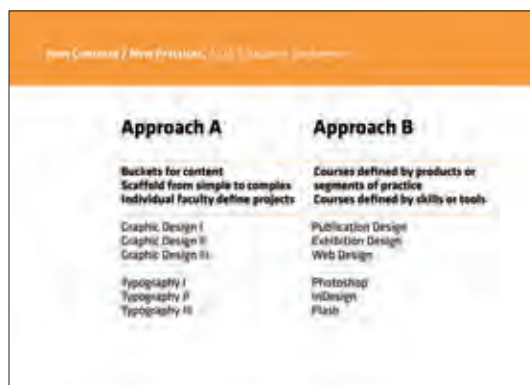
APD Teaching Approaches

Some of the technologies that have been used in the classroom to help individuals with APD include:

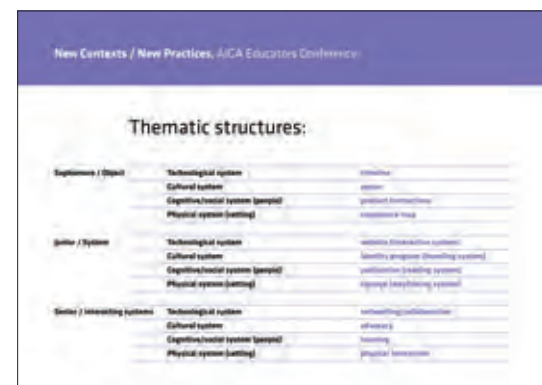
- An FM amplification device that uses a transmitter worn by the teacher and receiver worn by the student to enhance auditory discrimination by reducing distractive noise.
- Laptop computer or electronic notebook to take notes and pull up information.
- Variable speed sound recorders to play back recorded material at a slower or faster rate. Increasing the playback rate can help for practice in strengthening listening skills. Decreasing the rate can help in listening to taped textbooks. The recorder can be used to record class notes or instructions given in the classroom. Listening to a taped book while reading it in printed form allows a multi-sensory approach to learning.
- Books on disk provides multi-sensory input (auditory and visual) for students with APD.

- CART (Computer-Aided Real-time Translation), which can be in classrooms, translates the spoken word into English text performed by a CART reporter using a stenotype machine, notebook computer, and real-time software. The text is then displayed on a computer monitor to students with learning disabilities to learn unique combinations of letters to represent sounds or phonemes.

These devices are particularly effective in helping students with learning disabilities because they provide interhemispheric transfer training and allows students to use their own learning styles.



Meredith Davis, Professor, proposes that graphic designers be given a thematic structure.



and Industrial Design at NC State University, proposes that graphic designers be given a thematic structure that puts emphasis on basic skills that students would put together to complete more complex assignments. This structure supports larger classrooms and challenges the teaching studio setting.

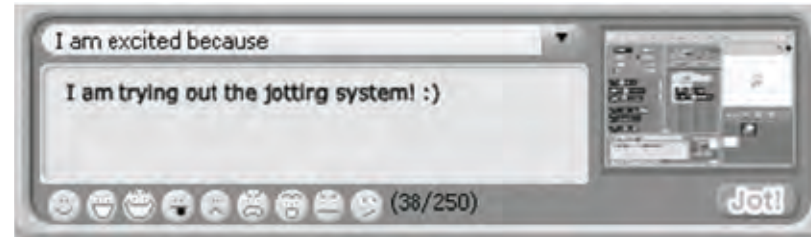
My own experience as someone with APD is that students also need coaching to break down the complex into simple steps. In general, the classroom teacher takes what Meredith Davis calls a simple to complex approach, while the learning coach, meeting one-on-one with the student tries to break down the step-by-step process of simple components in a complex problem.

Teaching Model Examples

Practice to Help Provide an Environment for Interactive Student Engagement

I explored various models of dynamic learning to stimulate student's creativity to help them recognize different learning styles. All of them emphasize interactive student engagement with the teacher acting as a coach or guide. In some approaches the teacher begins by teaching basic concepts and then pulling them together into a complex whole. For example, students would be taught to skate in a straight line and then taught more complex skills such as: skating backwards, crossovers, starting and stopping. Other courses are defined by focusing on the skills or tools. For example, Meredith Davis, Professor and Director of Graduate Programs Department of Graphic Design

Analog and Digital Learning Tool Examples



Jots system is a software tool that allows learners to reflect on their own learning processes.

ANALOG AND DIGITAL LEARNING TOOL EXAMPLES

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Interactive Play to Help Stimulate Creative Learning MIT's *Lifelong Kindergarten*, Harvard's *Project Zero*, WGBH's *The Fin, Fur, and Feather Bureau of Investigation (FFFBI)* are all programs that advocate interactive play to help students learn a particular lesson and how to approach complex problems by breaking them down into simple steps.

Massachusetts Institute of Technology:

MIT's *Lifelong Kindergarten* is located within the Media Lab. The goal of the program is to engage people of all ages in the design, creative, and inventing process. In kindergarten children learn to mix colors with finger paint and make structure with blocks. Once in school, in most cases, children learn specific facts and skills but rarely get the chance to design and make things. At home they play with video games and electronic toys, but they do not learn to invent their own toys. The *Lifelong Kindergarten* engages learners of all ages in this kind of experimentation, exploration, and creation through various interactive applications. The *Jots* system is a software tool that allows learners

to reflect on their own learning processes. This tool is integrated with *Scratch*, a graphic programming environment designed for middle schoolers that invites them to create games, animations, and interactive art and share them on the computer. Children can then use the *Jots* program to comment on their learning processes as they use *Scratch*.

Scratch is a programming tool that includes a palette of different shapes and colors that the user puts together like a puzzle to create interactive art. The *Jots* program is integrated with the *Scratch* stage and allows students to comment on their experience, describing their thoughts, frustrations and excitement. In this way the students engage with creative activity and cultivate a habit of reflection.



Harvard's *Project Zero* explores how we learn through studio and art appreciation.

Project Zero:

Harvard's *Project Zero* began in 1967 when the philosopher Nelson Goodman brought together an interdisciplinary team of researchers and educators from the Harvard School of Graduate Education. Their goal was to explore how we learn through studio and art appreciation. Research at *Project Zero* has shown that engaging students by creating and appreciating art helps them understand cultural values and to see creative solutions by thinking from different perspectives. These skills are important in intellectual development because they help students to think differently about what they are creating and the process it takes to get there.

In the last five years the research has focused on teachers' and students' practices as they reflect on how the processes of their thinking as they create and observe art. In their artistic expression, students move from the simple elements of art to a complex composition. This teaches them to see simple patterns and themes as they analyze the art of others. From a

cognitive perspective, experiencing art strengthens certain patterns of thinking including: attention, question-asking, connection-making, and complexity-seeking.

This approach was found to strengthen attention and help students make logical ($A + B = C$) and analogical (it is like this or that) connections. This training in different learning styles is especially important for those with APD to compensate for their disability.

FFFBI:

The Fin, Fur, and Feather Bureau of Investigation (FFFBI) is a website developed by WGBH Boston in collaboration with clinicians at the Alvin V. Baird Attention and Learning Disability Center (ALDC) at James Madison University. *FFFBI* targets students ages 8-13, especially those with attention issues to help them with schoolwork and organization skills.

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FFFBI allows kids to be engaged in how they learn through interaction.

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The *FFFBI* uses humor and storytelling to teach students about places and cultures around the world. The website helps them develop critical thinking, problem solving, reading and research skills. The games are designed to encourage players to complete a progression of tasks, each with a degree of difficulty. This type of teaching style is important because it allows kids to be engaged in how they learn through interaction.

This interaction engages students through a variety of games and cartoon characters that interact with students by taking them step-by-step. This helps them read by giving them audio files to listen to at their own pace, and requires problem solving. This game inspired me as I develop WRD³ because it involved step-by-step sequencing and simple motion to capture the student's attention and not distract them for what they are doing to reach a goal.

A study is now underway to identify common patterns of reflective learning and the “narrative structure” used by different students as a pattern into reflecting on their learning process. (Rosenbaum)

The research at Harvard *Project Zero*, involves demonstrating and evaluating the kinds of learning not captured by IQ linguistics or mathematical measures (Orchestra web page).

FFFBI has been funded by the US Department of Education and toad-tested by reading professionals.

Understanding My Auditory Processing Disorder



Using the TV as the instrument, I placed a box-like structure with a screen cut out of squares that allow degrees of light to pass through.

DAZED AND CONFUSED

As someone with APD I need others to understand what I go through in translating Auditory signals into language and meaning. I used the next three projects to try to stimulate for others what my world is like. I also used the idea of filters in my *Dazed and Confused* project. The idea of filtering stimuli was very important in the development of my WRD³ project.

Project Overview and Objective:

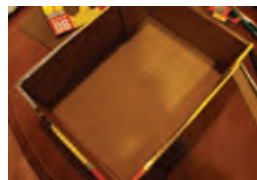
As someone with APD, I wanted to create an interface that would allow the user to experience visually the auditory confusion I feel when being oversaturated by media. Using the TV as the instrument, I placed a box-like structure with a screen cut out of squares to create grids that allow degrees of light to pass through. I made this screen using materials of different transparency and placed the box over the TV.

Design Process:

1. Define the tools that I need to make the object that I imagined;
2. Found household material that I could use to make the box;
3. Collected materials:
 - Empty trash bag box
 - Xacto knife
 - Ruler
 - Pen or pencil
 - Proctor and Gamble Swiffer sheets
 - Bounce dryer sheets
 - Tape
 - Rope



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Process of making the box filter.

I wanted to start small and be able to move quickly with the materials that I was using. I used household materials because my budget was low and I wanted to keep it basic. I used an empty trash bag box as the frame for my filter and cut out 2"x 2" squares in a grid pattern running horizontally and vertically on one side of the box. I put this over my TV screen and kept it on as I watched a program on the Discovery Channel. I found that the filter helped me watch the program with more curiosity as I relaxed my eyes.

What I Learned:

Using household materials, I was able to move quickly to construct my project. It was fun building something out of nothing, and the end result turned out to be beautiful, allowing light to come in from the TV and shine through the filter of the dryer sheets. I was unable to see the project through, to its full potential because the box I created did not cover the full size of the TV. The filter from a visual perspective, worked for me because it blocked out the visual

noise and made me realize that I could create filters to block out background noise. In creating my *Dazed and Confused* project I realized how important filtering auditory and visual information was for me. My WRD³ tool would use filters to navigate each step of the process so I could break it down into its simplest form. Transforming the analog and digital step-by-step to task-by-task approach would later be done through writing, reading, drawing.



Same box-like structure with different imagery.



Classmate Andrew Ellis instructing me on how to use a particular computer program.

AUDITORY SIGNALS AS CHAOS

Project Overview and Objective:

As someone with APD, I get oversaturated with a variety of background noises while trying to have a conversation and it becomes extremely hard to pay attention and stay focused on what the person is trying to say. I become frustrated and needed to ask the person to repeat themselves over and over again. So, I decided to make a video to explain what it's like living with APD.

I started thinking about how I could create the ideal scenario for my video. By chance, the opportunity presented itself when I was sitting in the DMI space talking to another classmate. We were positioned near a loud and obtrusive heater. Trying to talk over it and hear what he was saying was annoying. Then I started to hear another conversation in the background that two other classmates were having, which increased my fatigue level. To my surprise another sound came into my sound landscape: a train that I could hear going by with its load horn.

After the sounds subsided, I could hear my classmate again talking about his project. He looked at me and I had to ask him to repeat what he had told me. I told him that I did not hear what he was talking about because of all the noise. I knew at this moment the direction I would take. I started sketching out a storyboard on how I wanted this video to play out, what sounds to use, and how to shoot it.

Design Process:

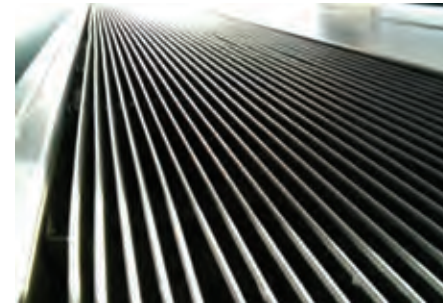
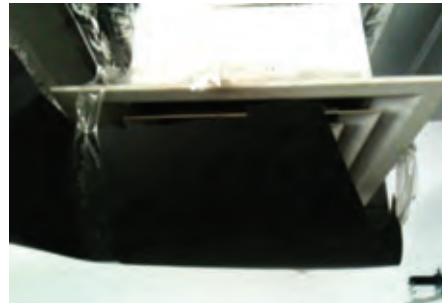
I started my project with the help of classmates Andrew Ellis and Lou Susi. Using nothing but my iPhone and storyboard, we shot all the scenes and completed the video within two hours.

The scenes included:

- My classmate instructing me on how to use a particular computer program.
- Hearing talking in the background
- Hearing heater #1
- Hearing a train go by
- Hearing the heater #2 going on and off
- Hearing the noise of classmates opening their lockers.
- Back to hearing my classmate instructing me on how to use a particular computer program.
- Asking my classmate to repeat what he had said because I was distracted and trying to concentrate on the background noises.

What I Learned:

I learned that I had difficulty verbally explaining to people what my experience was with APD. Creating a video that incorporated sound and visuals around an every day activity helped me say what I wanted without verbalizing it.



Video to explain what it's like living with APD.



DYNAMIC CREASE PATTERNS

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Patterns of Observations:

The Dynamic Crease Patterns project uses a software program called Processing to create a tool to observe the way I see my process of making a box. Exploring my process using organic and geometric shapes was a means for me to observe how I work step-by-step. It allowed me to visualize the boxes, first in 2-D then in 3-D. It also allowed me to observe the differences and similarities between folding paper with my hands and creating code to create a digital reproduction of this process. Again the process involves interhemispheric transfer moving from the concrete to the abstract. My hope was that this project would help me figure out a way to develop a navigational tool for my visual collaborator project.

Process:

I drew a two-dimensional box out of paper using a pencil and ruler to outline my prototype. As I cut out the outline I decided to score all of the creases that would be later used in folding the making of the box.

The “T” shaped six-sided paper prototype was taking shape by forming into what the final outcome would be. Once the box was complete I began to stare and wonder what to do next. The process of folding one side at a time heightened my sense of curiosity. I used photography to document the step-by-step visual experience for a total of six images. Some questions:

- Can the images be played continuously in a single frame or would the timing of the sequence be triggered by the user?
- Can the user move from frame by frame or one click at a time?

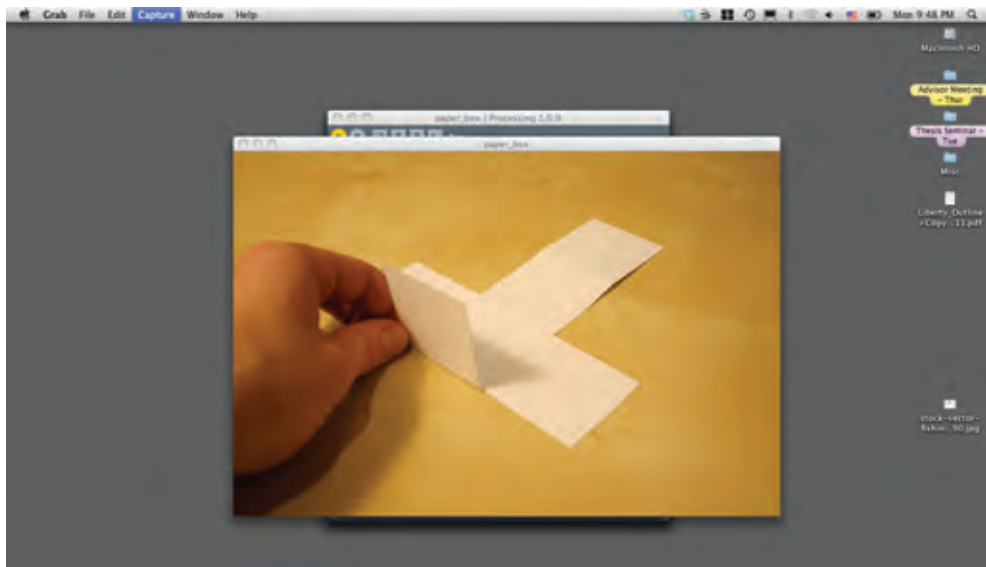
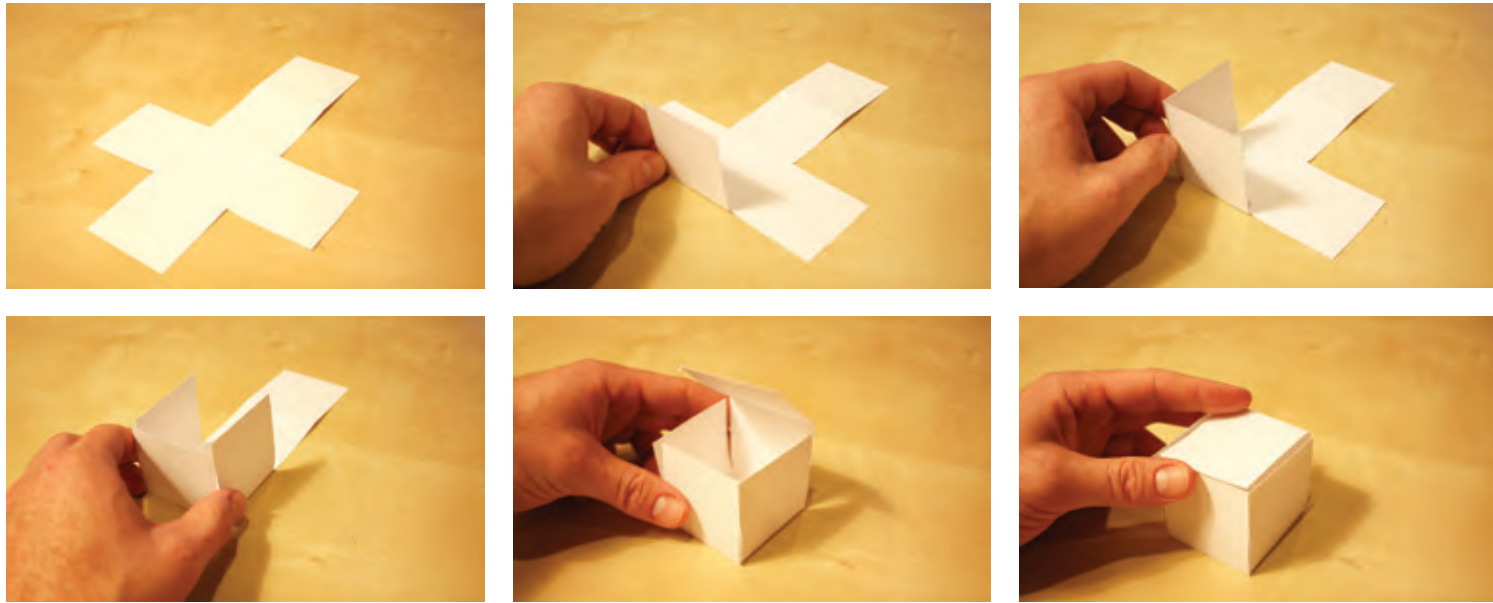
I learned in this small experiment that the slide show was entertaining but the speed of each frame was too fast and the user could not click through at his own pace. These questions helped me to develop a time-based image sequence of thirty seconds per slide. The user could speed this up or slow it down using the mouse. Once the user gets to the end of the sequence the slide show would go back to the beginning and start all over.

At this point, I was happy with my process and wanted to explore a variety of perspectives. Using the same paper box prototype I photographed it again from four perspectives — top, straight on, bottom left looking up, and bottom right looking up. I decided to suspend the box, to shoot as if it were floating. This step was a breakthrough. By manipulating the environment of the box I could visualize it in 3-D. To hold this structure in the air I took cardboard and created a curved arch while being attached to the wall with tape. I then layered the paper-box down flat so I could use a thread and needle to poke holes into paper. Each square had about three holes to each side. By doing this I would be able to push the needle and thread through to give me support, just like a puppet on strings. Once all the thread was through each hole I was ready to attach the flat paper box to the top of the curved cardboard holder. As I lowered the flat paper perspective of the box it worked and held in mid air. Here I was moving from making to designing.

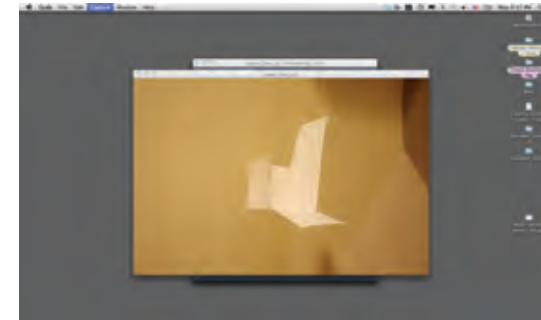
What I Learned:

In order to solve a complex problem I had to divide it into simple steps. Creating the boxes forces me to begin developing my concept by putting ideas through a 2-D filter before I was able to refine them using a 3-D filter. This two-step process changed the way I thought about my own creative process. The Dynamic Crease Patterns project forced me to slow down the design process and work step-by-step. I consider this experience to be the breakthrough of the WRD³ project as I realized that I needed to help users see their own creative processes as dynamic, that is step-by-step. As I photographed the boxes from different perspectives I learned how I move from making to designing. Again this is an interhemispheric transfer.

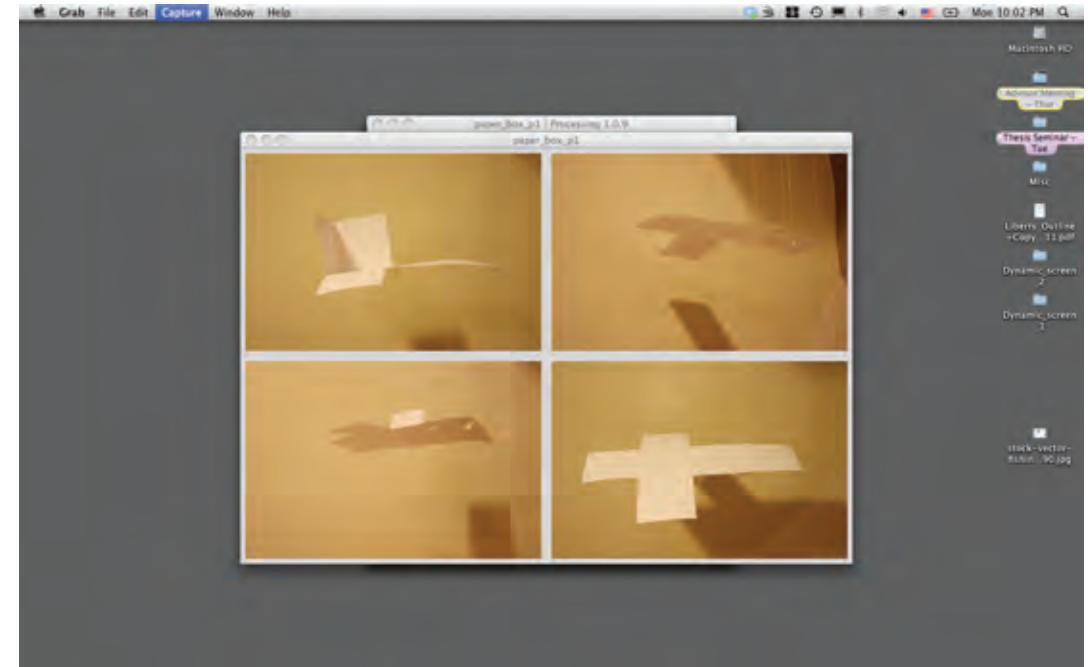
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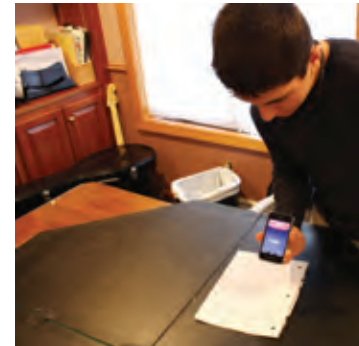
Exploring my process using organic and geometric shapes.



Exploring a variety of perspectives.



Process of creating a prototype to hold the "T" shaped box.



Thesis Project WRD³

(Writing, Reading, Drawing)

THESIS PROJECT WRD³

Psychologist Jerome Bruner states, the learning process has to visit and revisit basic ideas in different creative media. The idea of the spiral curriculum is defined the article “Theories of Learning in Educational Psychology:”

A curriculum as it develops should revisit this basic ideas repeatedly, building upon them until the student has grasped the full formal apparatus that goes with them. (Bruner 33)

My inspiration for WRD³ (writing, reading, drawing) is based on this idea of the “spiral curriculum.” It involves having the students write a story, draw that story, and then reinterpreting the same story from the drawing. Then the process would repeat three times. The repetition creates several variations on a theme. The process enables the students to use both sides of the brain in understanding the original visual prompts of the story.

Objectives:

To create an interactive tool that:

1. Exercises and strengthens visual, kinesthetic, and social learning styles to help those who have problems with APD.
2. Engages students through self-expression in a non-judgemental and playful environment.
3. Teaches students to use other leaning styles (work-arounds), such as:
 - Writing, reading and listening to the story being read out loud to help with reading comprehension;
 - Drawing the story to depict the beginning, middle, and end;
 - Reinterpreting the story through writing.
4. Enables students to work together and recognize their strengths and weaknesses in learning.
5. Provides Interhemispheric transfer training (which has been shown to be an effective therapy tool for those with APD).

Project — Original Model:

Originally, I imagined WRD³ as to be a multi-touch table around which as many as five people with APD could stand and engage in collaborative play. Each would have access to an array of applications including Dragon speech recognition software, white board, and a word processor. One scenario involved three students.

- Student #1, writes a story and uses Dragon to record what he/she has written.
- Student #2, reads the Dragon text and draws his/her interpretation of the story.
- Student #3, unaware of the original story writes a new story and records it into Dragon.

This process starts again with the first student drawing a picture of the new story, and so on. The switching of roles allows students to create their own stories and drawings while involved in a group experience. It also increases their awareness and exposure to their different learning styles. At the end of the process, students could compare the first story “read” and the last story “read” (like the old-fashioned game “telephone”) to see the difference in what is said and what is heard. The repetition helps the students retain and understand information. I have discussed and demonstrated this process to learning specialists and special education teachers, incorporating their input to make it more effective as a learning tool. My tool cues students to write the beginning, middle, and end

of a story; read the story out loud with voice playback; and draw the story to sketch out the beginning, middle and end.

Key points from the discussions with specialists and experts to inform my research:

2010

- Various learning styles approach to teaching
- Current state of the field for law cases
- Vocabulary validation of measurability
- Ethnographic approach for peer leaning
- Multi-sensory to teaching students with APD

2011

- First attempt of permission note and proposal
- Second attempt of permission note and proposal
- Access to students for testing exercise and tools
- Current assistive technologies
- Intervention and Interhemispheric transfer training

SPECIALISTS // EXPERTS

Larry Kotin
Education Disability Law
 Conversations informed my research for current state of the field for law cases

Valerie Lausier-Collins
Director of Admission Stoneridge Montessori School
 Conversations informed my research for peer learning and an ethnographic approach

Carolyn Sherman
Education Specialist Shrewsbury High School
 Conversations informed my research for the second attempt of permission note and proposal
 Access to students for testing exercise and tools

Kristine E. Strand, Ed.D. CCC-SLP
Clinical Associate Professor Department of Speech, Language and Hearing Sciences Boston University
 Conversations informed my research for intervention and interhemispheric transfer training

2010

Caroline Gilmore
Education Specialist Director Shrewsbury High School
 Conversations informed my research for learning styles approach to teaching

Rachel Buday, M.A.T
Academic Coach
 Conversations informed my research for vocabulary validation of measurability

Dr. Patrica Mytkowicz, Ed.D.
Education Specialist Curry College
 Conversations informed my research for vocabulary validation and multi-sensory approach to teaching students with APD

2011

Mary Jane Walsh
Education Specialist Lincoln-Sudbury Regional High School
 Conversations informed my research for the first attempt of Permission note and Proposal

Jennifer M. Bosma, MSCCC-SLP
Speech Language Pathologist
 Conversations informed my research for current assistive technologies

- Lawyer
- Educator (High School)
- Educator (College)
- Educator (Elementary)
- Ph.D. Candidate/Student

ONE STUDENT



| INPUT | OUTPUT |
|-----------------|------------------|
| WRITING A STORY | READING OUT LOUD |

| INPUT | OUTPUT |
|----------------------------|------------------|
| HEARING & SEEING THE STORY | DRAWING AN IMAGE |

| INPUT | OUTPUT |
|------------------|---------------------|
| SEEING THE IMAGE | WRITING A NEW STORY |
| | READING OUT LOUD |

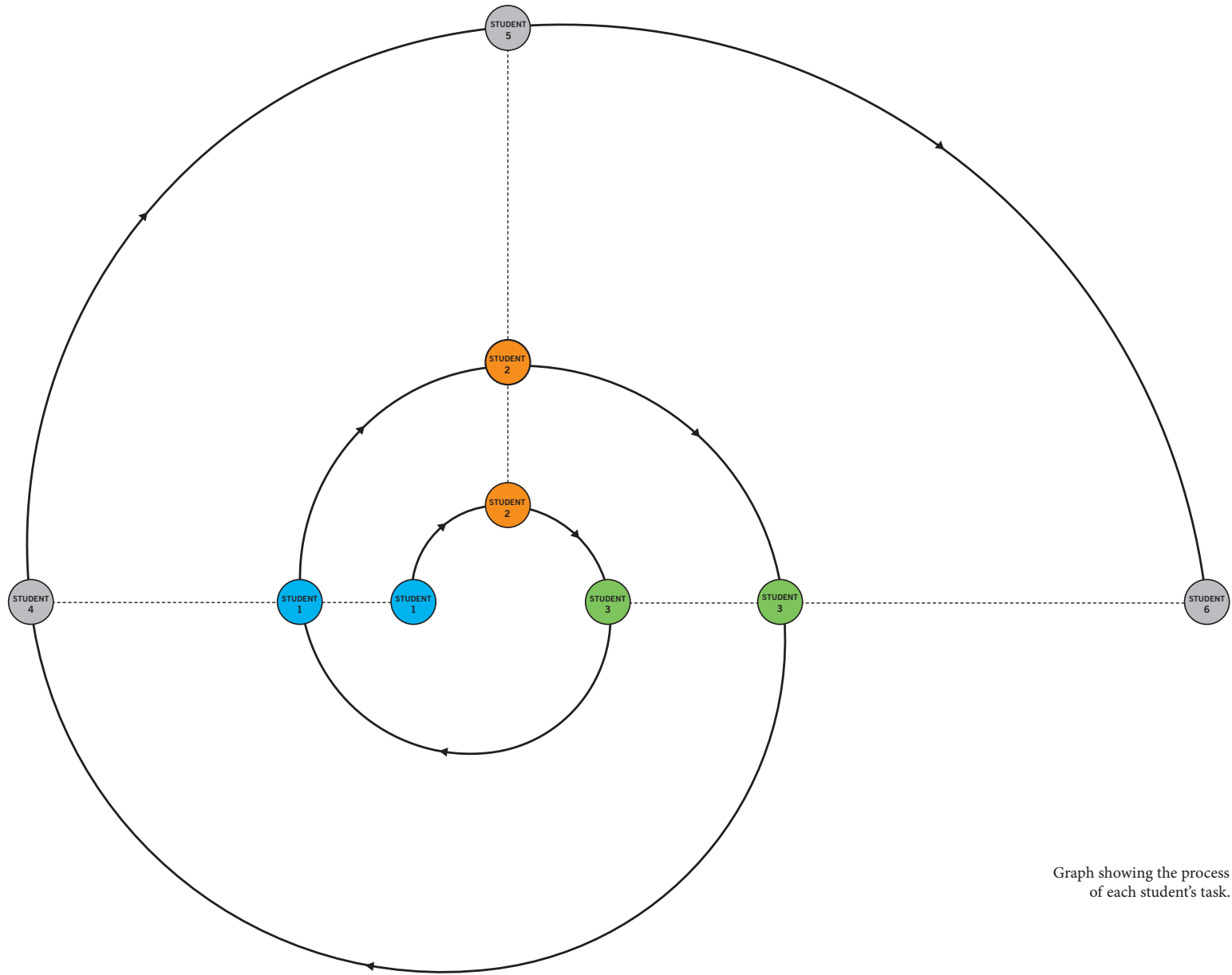
THREE STUDENTS



| INPUT | OUTPUT |
|-----------------|------------------|
| WRITING A STORY | READING OUT LOUD |

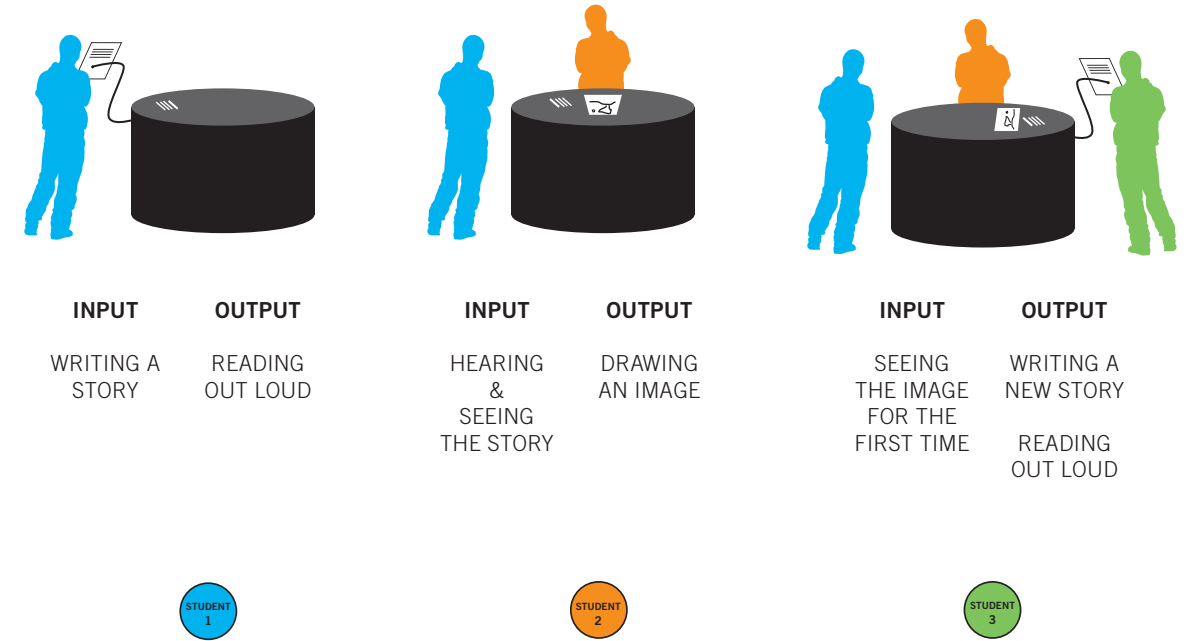
| INPUT | OUTPUT |
|----------------------------|------------------|
| HEARING & SEEING THE STORY | DRAWING AN IMAGE |

| INPUT | OUTPUT |
|-------------------------------------|---------------------|
| SEEING THE IMAGE FOR THE FIRST TIME | WRITING A NEW STORY |
| | READING OUT LOUD |



Graph showing the process of each student's task.

USER SCENARIO



MEASURE



WHY STUDENT DOES THIS?

READING FLUENCY
VERBAL EXPRESSION

TEACHER TO EXPECT

WRITTEN EXPRESSION
DECODING
PHONOLOGICAL AWARENESS

WHY STUDENT DOES THIS?

READING COMPREHENSION

TEACHER TO EXPECT

SEQUENCING OF THE STORY
(BEGINNING, MIDDLE, END)

WHY STUDENT DOES THIS?

INTERPRETS THE DRAWING

TEACHER TO EXPECT

VISUAL COMPREHENSION
WRITTEN EXPRESSION

STUDENT EVALUATION

SELF-ASSESSMENT
IN THE FORM OF REFLECTION

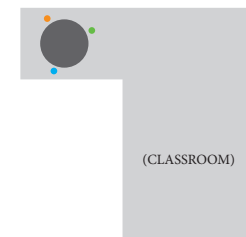
TEACHER EVALUATION

OBSERVATION

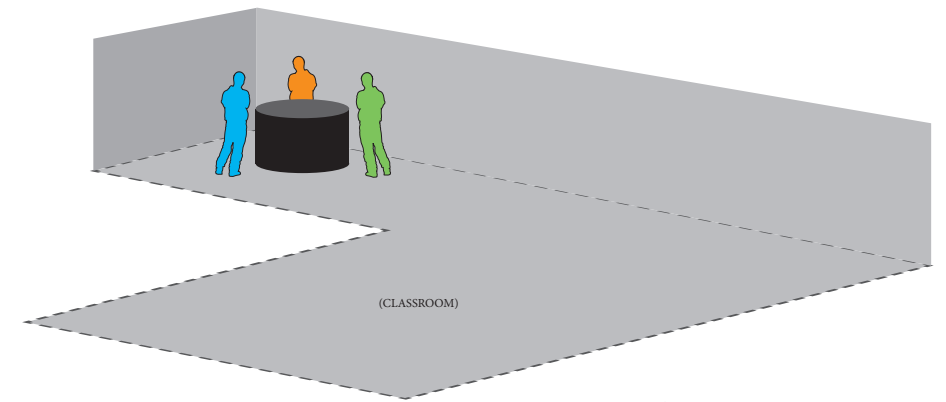
Patricia Mytkowicz, Professor at
Curry College, informed my research
for a multi-sensory approach
to vocabulary validation.



ENVIRONMENT



TOP VIEW



SIDE VIEW

Students are set back allowing them to focus and not be distracted.



Case Studies



INDIVIDUAL CASE STUDIES



CASE RESEARCH #1

In-Home Preliminary Experimentation

My first two studies with individual students were done with an analog prototype. I recruited two high school students, boys ages 16, who would participate. The students were supervised by their parents at home. In Studies #1 and #2 I asked the students one with ADHD, and the other with ADHD and dyslexia to write a story, read the story out loud, draw the story, and reinterpret and write a new story from the drawing.

My goals in these two case studies were to see if the process would help students discover their own learning styles and to assess the results in order to inform the digital tools I am developing for students with APD. Further explanation of these case studies are listed below.

Individual Case Study

Student #1 (ADHD)

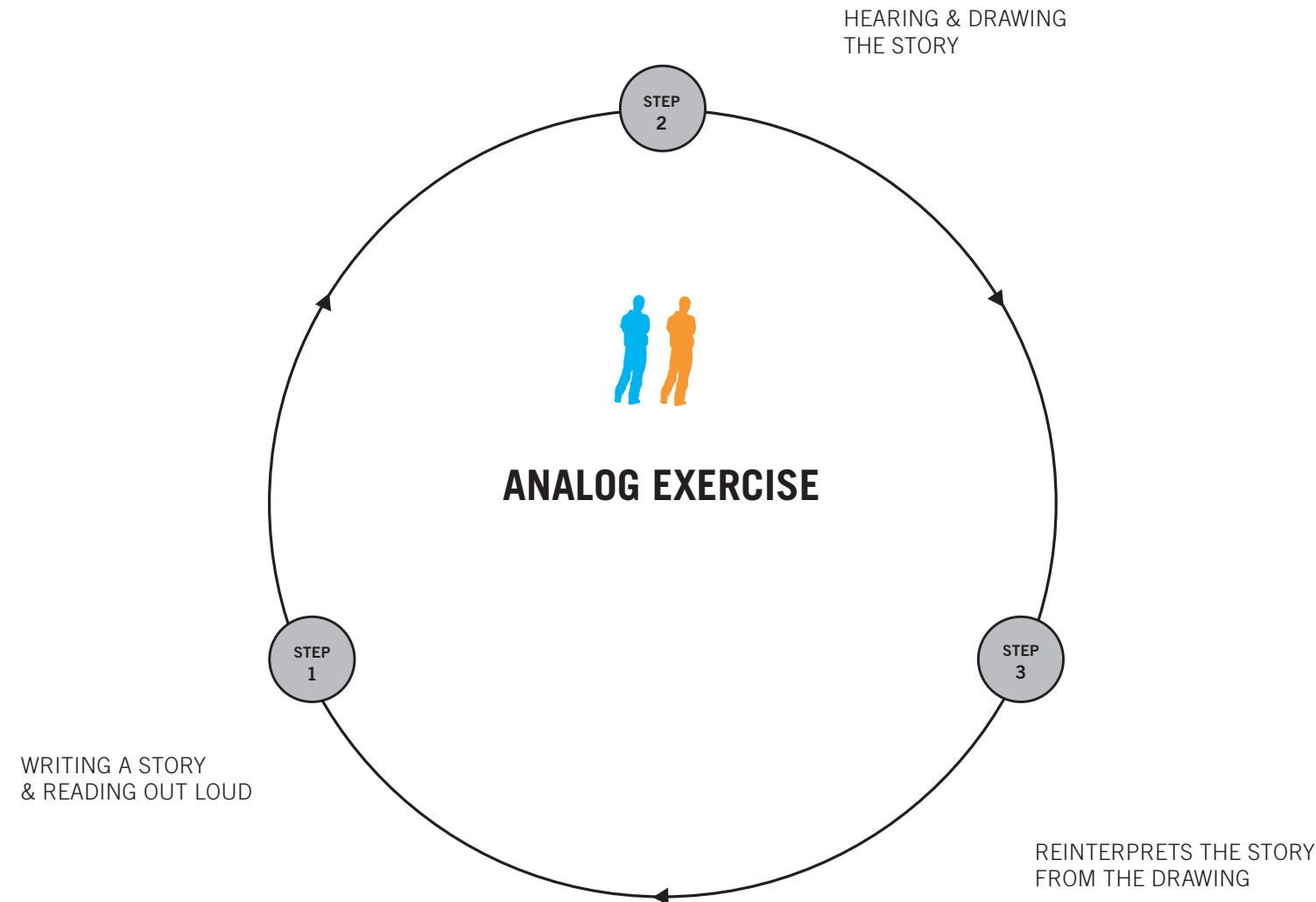
Individual Case Study

Student #2 (ADHD, Dyslexia)

Note: permission notes signed by students and parents

Research Hypothesis:

First, the step-by-step exercise enables the students to recognize their strengths. Second, the exercise can help the student realize how one task at a time can be interpreted, and how that in different ways it shows the student their learning process. Through experiencing a variety of learning styles (visual, kinesthetic, auditory, and social) the analog exercise helps the students to recognize and improve their weaknesses. Perhaps it's about recognizing their weaknesses, and devising a strategy with the teacher towards crafting a curriculum that focuses on these issues.



Materials:

Lined paper, pencil, blank paper, thin and thick marker, ruler, eraser, iPhone — for using the program Dragon to talk into and convert voice into digital text. I experimented with the program Dragon on the iPhone as a digital assistive technology into the exercise. Although having this tool proved to be fun and engaging for the students, the main technical difficulty was that the rate of the student’s speech caused the program Dragon to run words together.

Process:

The exercise took place at a home environment in the presence of his parents. I gave the student an overview of the exercise and there were no time constraints on creative and exploration. The process of the exercise was to have each task, based on a step-by-step method (WRD³).

Qualitative Research Analysis:

Student #1

- Student became engaged while writing a personal story.
- Completed all tasks within an hour’s time.
- Reported what worked best for him, which was writing the story.
- Experienced difficulty with drawing the story.

Qualitative Research Analysis:

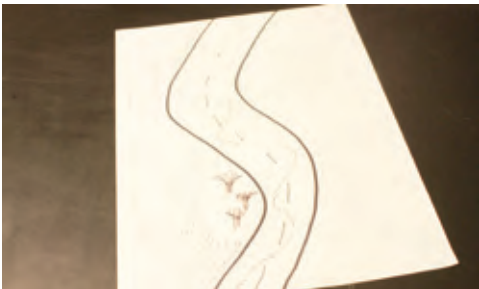
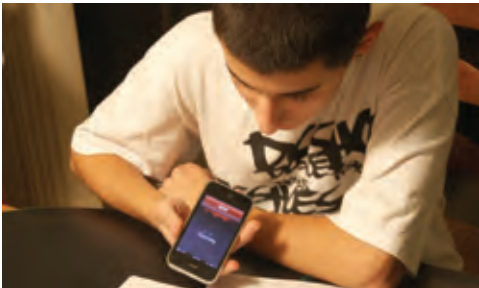
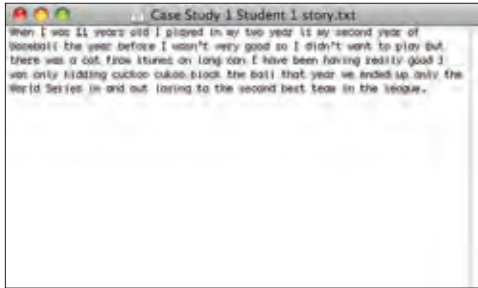
Student #2

In this case the student gravitated towards his strength, writing. Reading and hearing the story out loud helped the student make corrections if something did not sound right. He disliked the drawing exercise because he was worried about his draw-

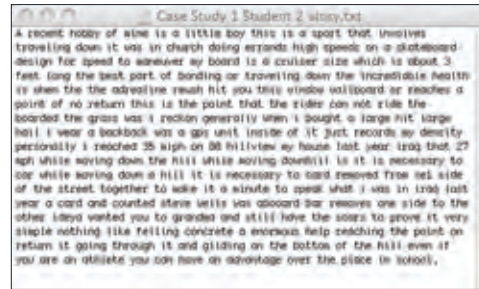
ing being “good or bad.” I also learned that by not providing a visual and verbal prompt for what to draw stymied his level of processing the story in a sequence for having a beginning, middle, and end.

Conclusion:

Did this exercise confirm my hypothesis? Did it send me in a new direction? I learned it is possible to develop a digital tool that engages students in many tasks and helps them recognize their learning style and processes. Testing revealed the student’s likes and dislikes in the process. The ambiguity of this task led the student to only draw one scene of the story instead of the whole story. The lack of visual prompts initiating a beginning, middle, and end led me to re-evaluate how to display the information. For instance, providing a storyboard with three designated areas for drawing.



Student writing a story, recording the story using the program Dragon on the iPhone, drawing the story, and reinterpreting the story.



Student writing a story, recording the story using the program Dragon on the iPhone, drawing the story, and reinterpreting the story.



CASE RESEARCH #2

**Shrewsbury High School, Shrewsbury MA
Public School Testing Round 1, Analog Exercise**

After my original trials with the two individual students, I was able to get permission to repeat this exercise with four students from Shrewsbury High School. The group included four girls ages 16-18. The instructor informed me that the group included those with APD, ADHD, and Dyslexia, although she could not reveal each student's particular diagnosis.

**Group Case Study, 4 Students
(APD, ADHD, Dyslexia)**

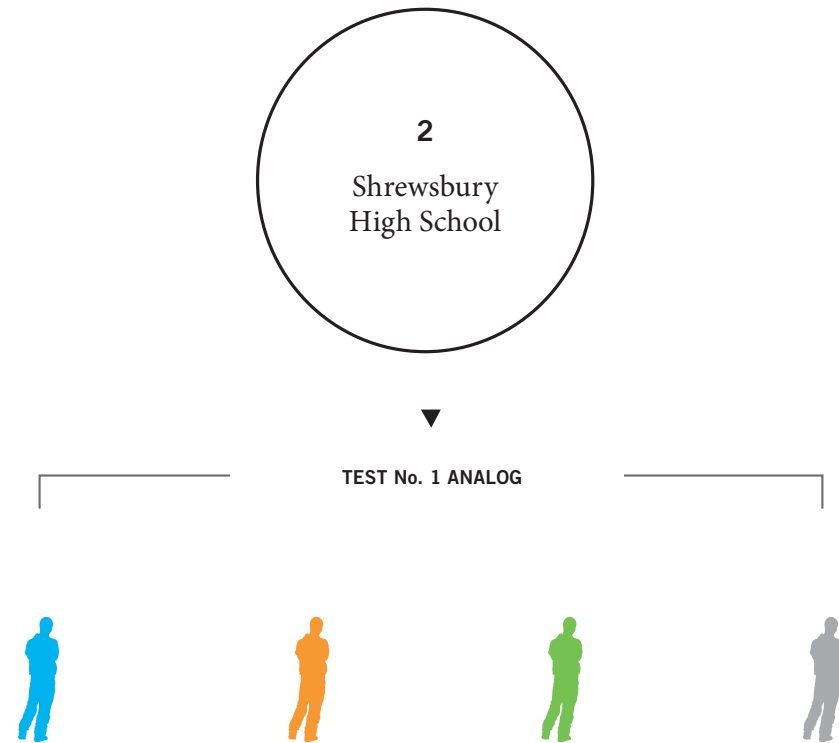
Note: permission notes signed by students and parents

Testing Original Assumptions of Exercise

Proposal and Permission Note:
Some current models use multiple-choice questions to identify learning styles, specific to students with learning disabilities and/or difficulties. My model uses a dynamic learning experience that shows students their strengths and weaknesses.

I began with an analog exercise that tested whether in fact students could recognize and identify their strengths and weaknesses in learning.

This analog exercise would be accomplished through self- authorship of content with one student writing and reading a story out loud, a second student listening to the story and drawing it visually, and the third student reinterpreting the story based on the drawing.



I needed permission to test the analog exercise with special education students at Shrewsbury High School in Shrewsbury, Massachusetts. After a long approval process with much paperwork, I was granted permission to work with four students. (See *permission note, CORI form, and proposal in appendix*).

Writing the permission note and proposal helped me to articulate the project scope:

- The objectives
- My role as a graduate student and instructor
- The special education teacher’s role
- The analog exercise
- The outcomes for students and teachers
- Summary of my thesis

This process made me realize how many stages one needs to go through in order to interview students at a high school level. (i.e.: user testing with

“live subjects”.) I needed to cover all the necessary legalities for myself, MassArt, Shrewsbury High School, and student/parent concerns in a written document. I also learned how to write a detailed curriculum proposal in order to test my pedagogy in relation to APD, which included: testing both an analog and digital model of my learning tool. I used the feedback from students and experts to suggest changes in the next version of WRD³.

This was my first draft at writing an assignment, so it forced me to really think about the expectations I was placing on the students. Time was a factor in considering my expectations. Version one of the proposal was estimated to run for 90 minutes. I learned that time would be my biggest problem due to class periods running for 40 minutes. I needed to reduce the exercise to 30 minutes, even though my research dictates that learning disabled students need more time to complete tasks.

Once the exercise was in full swing I later learned that I was given the allotted one-hour time slot I had envisioned for this to happen. This extra time proved to be very helpful in presenting the exercise, and eliminated the students anxiety.

Brief Description of Research Exercise:

In this exercise I wanted a group of students to experience what it would be like to write a story, read the story out loud, draw the story, and reinterpret and write a new story from the drawing.

Goal #1:

Students discover their own learning styles in the process.

Goal #2:

Use the research and analysis to develop digital interactive tools for students with APD.

Research Hypothesis:

First, the step-by-step exercise helps students to recognize their strengths. Second, the exercise helps the students realize how one task at a time can be interpreted in different ways. Third, it allows them to reflect on their learning processes. Forth, it allows them to experience a variety of learning styles (visual, kinesthetic, auditory, and social) that can helps the student to exercise and strengthen their weaknesses. Fifth, the process keeps students stay engaged and focused.

Materials:

Lined paper, pencil, blank paper, thin and thick marker, a pen, and eraser.

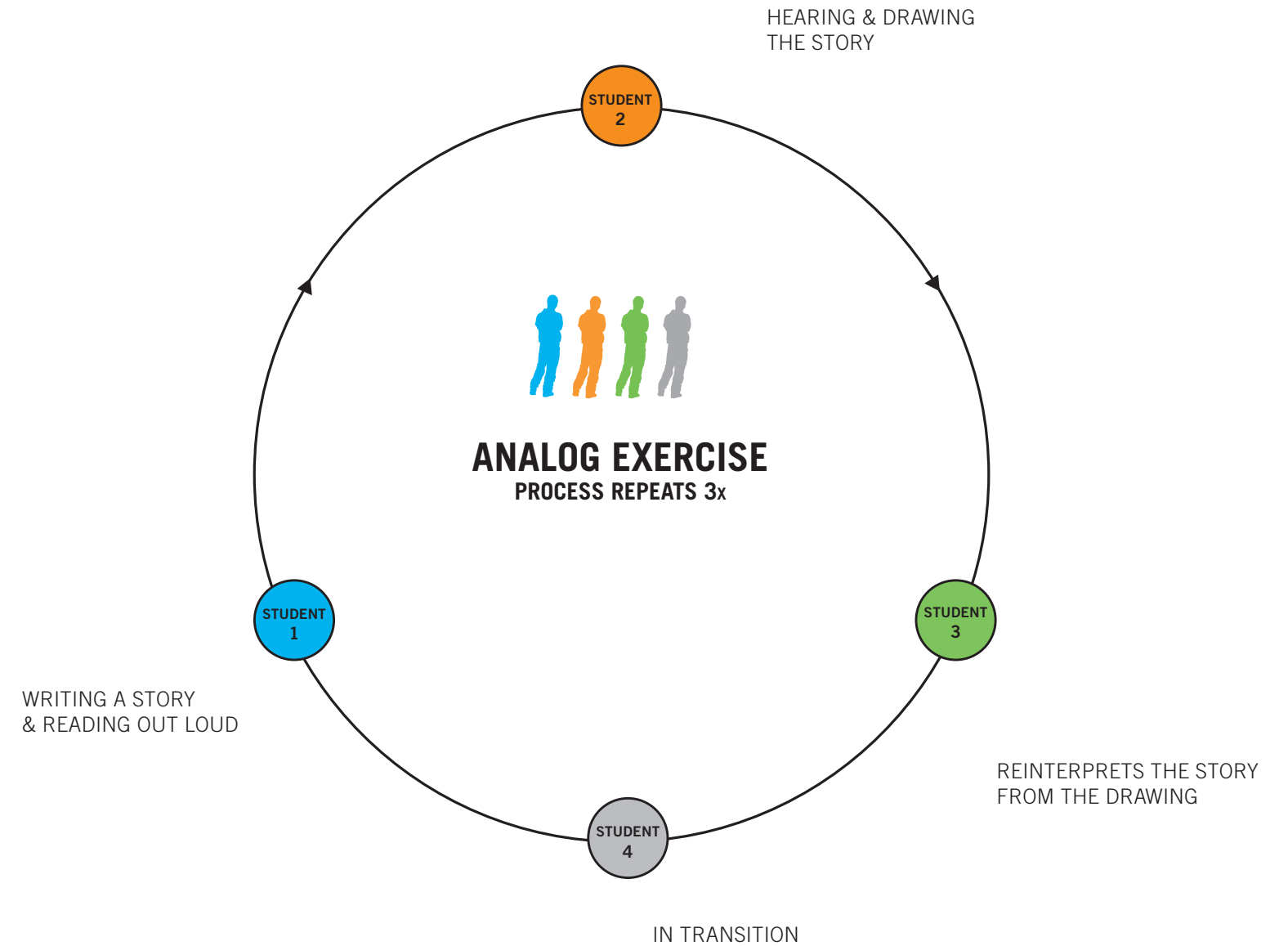
Process of Exercise:

I experimented with giving the writing assignment prior to meeting with the students. Students had a choice of two stories, and each story needed to have a beginning, middle, and an end. The first story asked the students to write about their favorite toy, stuffed animal, or game that once meant a lot to them. The second choice asked them to write about an experience with the worst or favorite food they ever ate. Having the writing portion of the exercise completed before meeting with the students allowed me to stay on track within the one-hour time constraint.

Each student came prepared with their personal story based on the two topics I had assigned before class.

- Student #1 read their story out loud
- Student #2 and #4 listen and draw student #1's story
- Student #3 listens the first story from students #1, and reinterprets the story from student #2 drawing
- Student #1 listens and draws students #3 story
- Student #4 listens student #3's story, and reinterprets students #1 drawing

I observed that there was some background noise in the room that could test students' frustration levels. I explained to the students my own frustrations and learning difficulties dealing with APD, what my role was and why I was doing this exercise. I realized that by telling my story while sitting in the same chairs as they did put me at their eye level. My story and proximity helped me connect with the students, and they in turn connected with my own experiences.



Write a story about your favorite toy, stuffed animal or pet.

(beginning)
 When I was younger I went to the mall with my mom. When we got there I saw a cute little stuffed animal puppy.

(middle)
 Since I didn't really know how to talk I cried and pointed at it. My mom realized what I was crying over and didn't get it. I was so upset and tired from crying I fell asleep.

(end)
 When I woke up from my nap in my stroller I found the cute little stuffed dog on me. I was so happy I named him Ruggles. I still eat today.

Write a story about your experience with the worst or favorite food you ever ate.

(beginning)
 My family and I took a trip to the beach for the day over the summer. When it was late we went out to eat.

(middle)
 We went to this restaurant that had mostly seafood, for me not liking seafood it was a bit of a problem. When the food got on the table I tried calamari. Probably the grossest I've ever eaten so I...



Student #1 reads their story out loud.



Student #2 and #4 listens and draws student #1's story.



reinterpreted
g: 11

- 1) on my way to the mall I saw a father and his son fighting, he wanted the stuffed panda but the father said 'no' because it was too expensive
- 2) when I got in I saw the same father & son but the son had fallen asleep on a mall stroller.
- 3) the father gave in and bought his son the panda bear.



reinterpreted
g: 11

- 1) I went to the mall and as I was walking in I saw a huge dog and a baby crying so loud because it was scared of the dog!
- 2) I went inside and saw that the same loud crying baby had fallen asleep finally.
- 3) then the baby had woken up with her own new dog her mom had gotten her.

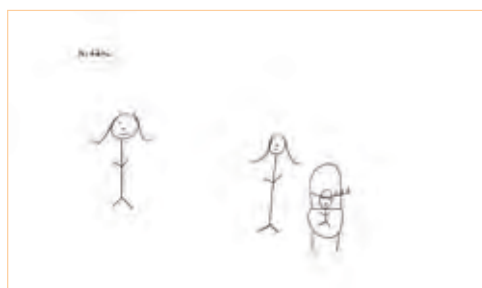


Student #3 listens to the first story from students #1, and reinterprets the story from student #2 and #3's drawing.

1) On my way to the mall I saw a father and his son fighting, the woman the stupid parent but the father said no because it was so expensive

2) When I got in I saw the same father & son but the son had fallen asleep at a mall trolley.

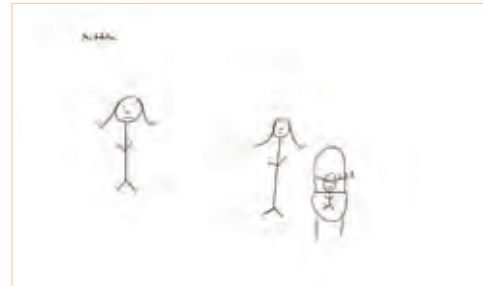
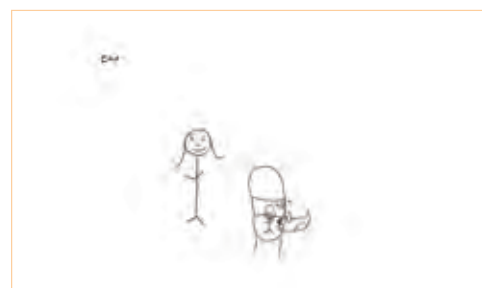
3) The father gave in and bought the son the panda coat.



1) I went to the mall and as I was walking in I saw a huge dog and a baby crying so loud because it was scared of the dog!

2) I went inside and saw that the same loud crying baby had fallen asleep on a trolley.

3) Then the baby had woken up with her own new dog but her mom had gotten her.



17 years old

Kelly, her babysister, & her mom went for a walk in the park but her baby sister started crying because a dog was barking at her & scaring her.

Kelly made the dog go away so her sister could sleep.

When her sister woke up ^{Kelly's} mom got them a little puppy so ~~she~~ her baby sister ~~no~~ could get over her fear of big dogs.



Student #4 listens student #3's story, and reinterprets student #1 drawing.



Student #1 and #2 listens and draws student #3 story.

“Yes, I can’t focus a lot, I fall behind, I don’t learn as fast. History is my worst subject.”

“Yes it does, it’s hard to focus and I can’t do math.”

DOES YOUR LD MAKE SCHOOL DIFFICULT FOR YOU?

“Yes, I can’t go as fast as others learning wise and I miss out on other things.”

“Well kind of because it’s a lot of writing and comprehension that is my problem so I have trouble in english and history.”

“It’s easy to break things down into beginning, middle, and end, helps me understand more.”

“It definitely helps to draw things out if you didn’t understand them.”

DID YOU LEARN ANYTHING ABOUT YOURSELF OR LEARNING STYLE IN THE PROCESS?

“When I was drawing the stories I learned that I don’t listen well.”

“Yes, that I use some of the same methods like writing things down.”

By easing the students' concerns I had won their trust. I continued to give an overview of what the exercise entailed and repeated the description of the exercise in a slow and calm manner. When I explained the exercise I asked for a volunteer to read their story out loud. I was able to break down each phase of the exercise within the allotted time. Having each task accomplished step-by-step gave the students the freedom to be creative without feeling rushed or pressured.

Qualitative Research Analysis:

- The students became engaged through writing, reading and drawing.
- The students were able to complete all tasks within an hour's time.
- Their feedback informed what worked best for them, whether it was writing or reading the story out loud.
- All students remarked that they learned something about themselves via the exercise:
- They didn't listen well.
- They understood the story better by writing and drawing.
- They enjoyed seeing each other's interpretations of the stories through the drawings.

Quantitative Research Analysis:

Students were asked to fill out a brief questionnaire explaining their experiences with the exercise. Each question was based on a scale of:

- Best to worst
- Distracting to very distracting
- Ability, to focus / not focus
- Ability to do the task / not do the task

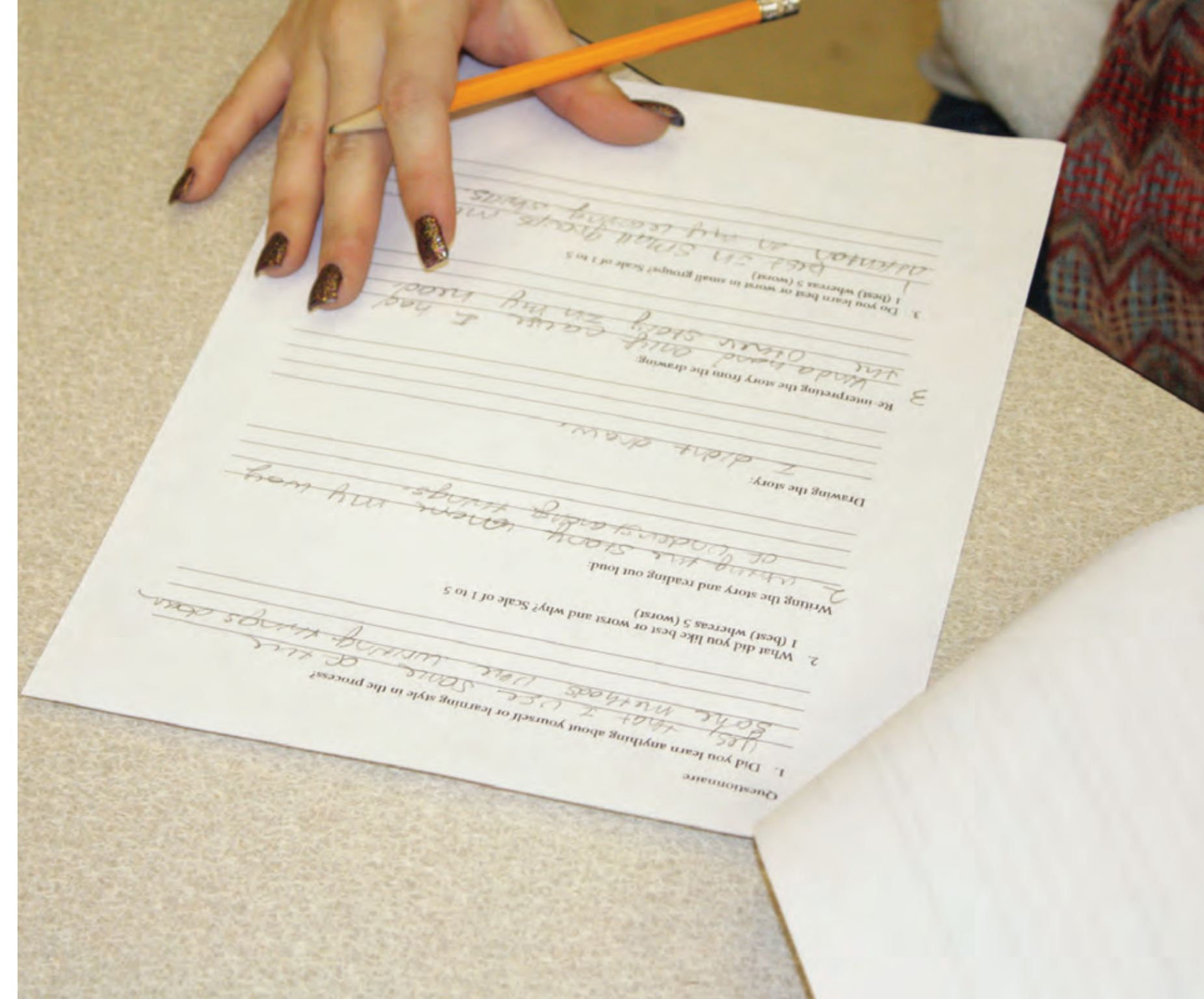
I learned that the majority of the students enjoyed the exercise because it allowed them to focus on one task at a time. The step-by-step process enabled them to block out background noise without distraction.

Conclusion:

I learned it is possible to develop an analog exercise that engages students in a sequential set of tasks that helps them recognize their learning styles and processes. Testing provided information about the students' likes and dislikes. Each student felt empowered to explore one of the tasks they felt comfortable with at that time. I took an ethnographic approach and observed that:

- Reading the story out loud was student #1's strength.
- Listening and drawing was student #3's strength.

All the students said they did not like to draw, but I reassured them that they were not being evaluated on their drawing skills. After they completed the exercise once, they all wanted to draw. They thought it was funny how the drawing could change the story, and how the story could change the drawing. I also learned that if the students had nothing to do, they would talk amongst themselves and became less focused while the other students worked. If I do this again, then idle time could be spent having the students observing and documenting the process of their peers. In doing this, they would learn about the other students learning styles and could help each other through difficult tasks in the future.



Question 2 (Part I) What did you like best or worst?
Writing the story and reading out loud:



Qualitative

No Data

“Because I am not good with writing stories and reading it out loud.”

“It was fun reading them out loud.”

“Writing the story, more my way of understanding things.”

Question 2 (Part II) What did you like best or worst?
Drawing the story:



Qualitative

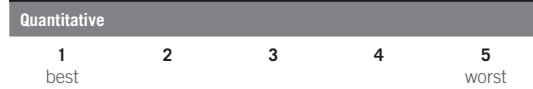
“I think it help give a visual of the story.”

“Because it was easy to listen then draw out the picture.”

“I liked drawing the stories because the pictures came out funny.”

“I did not draw.”

Question 2 (Part III) What did you like best or worst?
Reinterpreting the story from the drawing:



Qualitative

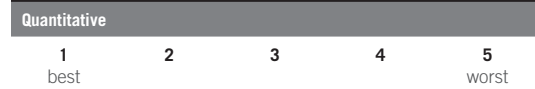
“I think it’s funny/interesting how a story can change kind of a lot just because of the drawing.”

“Because all you had to do was write a different story from the drawing.”

“It was funny to see how other people could create a story with your words.”

“Kind of hard only because I had the other story in my head.”

Question 3
Do you learn best or worst in small groups?



Qualitative

“I work better in groups then on my own.”

“Because it’s easier if I discuss what’s going on with the group and they help make more sense of everything.”

“I learn better when it usually a group discussion.”

“Best in small groups more attention on my learning skills.”

Question 4
Do you learn best or worst in lectures?



Qualitative

“I can’t stand lectures, it goes in one ear out the other.”

“Because I can’t pay attention for a long time, so by the time they are done talking I forget what they say at the beginning.”

“I learn good in lectures, but sometimes my mind drifts off.”

“It goes in one ear and out the other.”

Question 5
Did the background noise distract you?



Qualitative

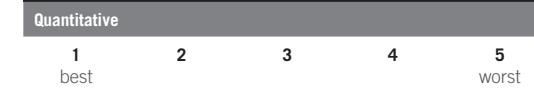
“I didn’t notice the background noise.”

“Because it doesn’t visually distract me, unless they are talking about something interesting or screaming.”

“Yes, it distracted me because I couldn’t focus on what we were doing.”

“I am use to it and no one was talking, everyone was participating.”

Question 6
Were you able to focus on each task at hand?



Qualitative

“I could focus on what we were doing because it was fun and interesting.”

“Because I get off topic very easily.”

“Yes, I could focus on what we were doing.”

“We were in smaller group and all focused on the same thing.”

Question 7
Was it helpful to you to do one task at a time?



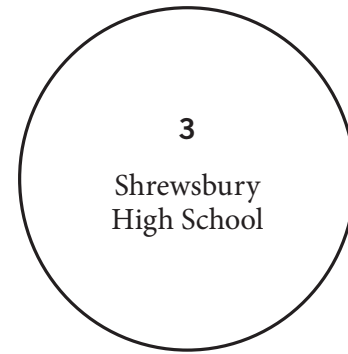
Qualitative

“Yes, I think it would have been harder if we didn’t.”

“Yes, it was because it was easy to pay attention and do each step.”

“Very helpful because I could focus better.”

“Yes, I can understand things better when they are broken down.”



TEST No. 2 DIGITAL



CASE RESEARCH #3

Shrewsbury High School, Shrewsbury MA Public School Testing Round 2, Digital Exercise

The next step of my research involved two girls ages 16-18. The instructor informed me that the group included those with APD, ADHD, and Dyslexia, although she could not reveal each student's particular diagnosis. I brought in a computer with my digital application (WRD³) for the students to interact with.

Group Case Study, 2 Students (APD, ADHD, Dyslexia)

Note: permission notes signed by students and parents

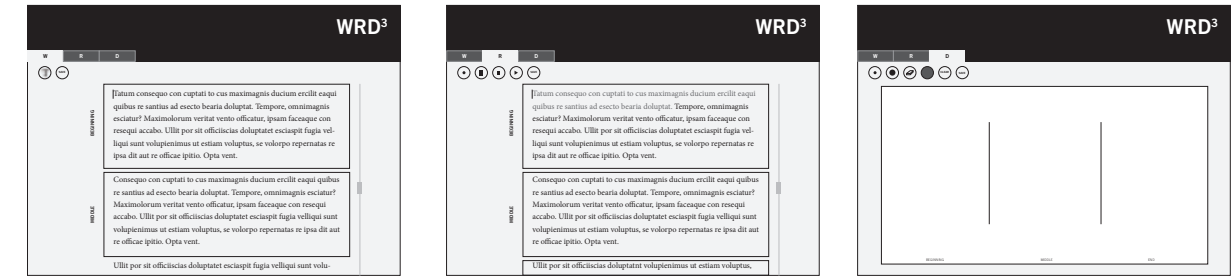
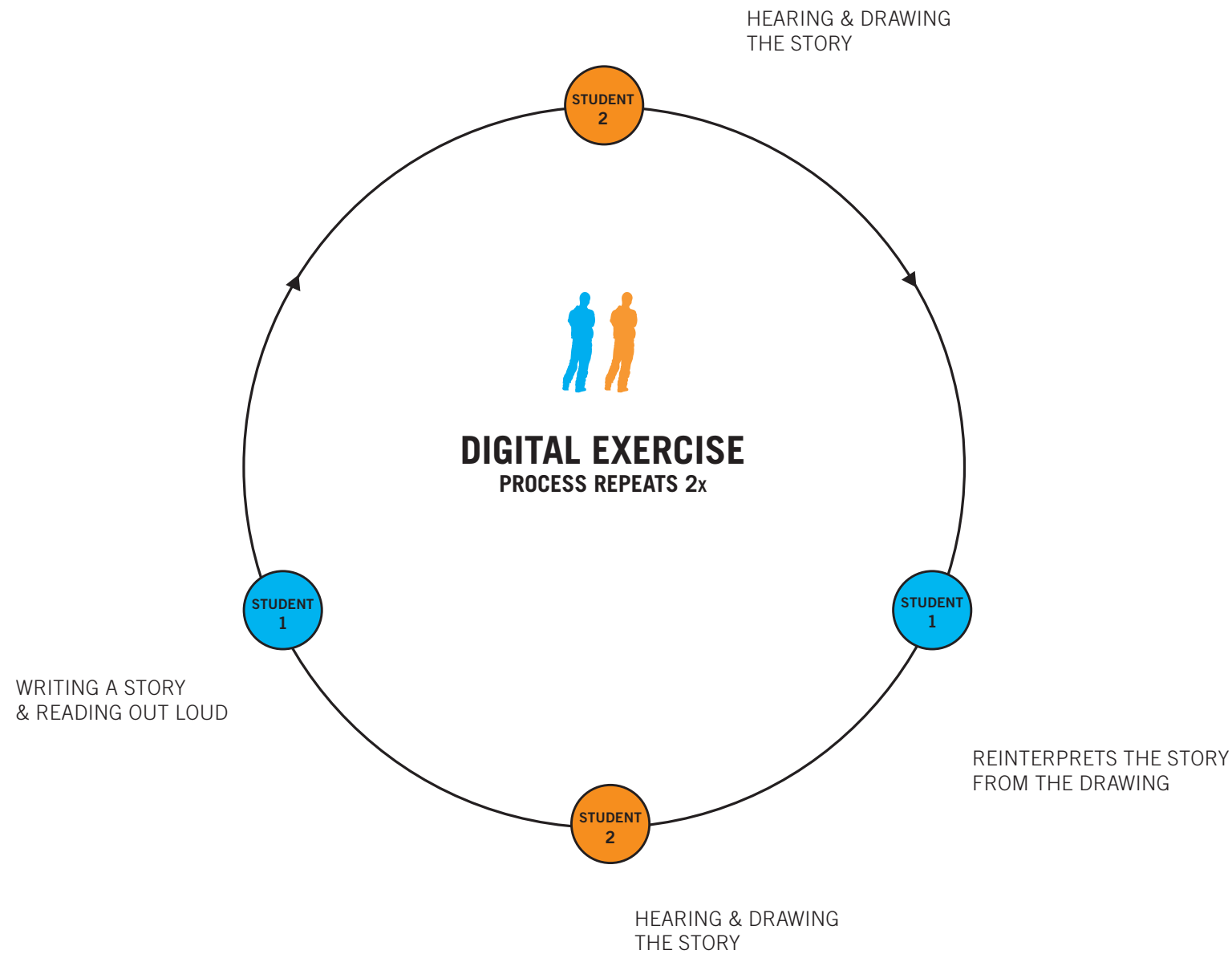
My tool cues students to write the beginning, middle, and end of the story; read the story out loud with voice playback; and draw the story to sketch out the beginning, middle, and end of the story. Now that I had a writing exercise developed and tested it was time to experiment with introducing the digital tools I had been developing. Why the use of digital tools?

Hypothesis:

- Would the technology be additive to the exercise or integrative?
- Will the digital tool make it easier for students to move step-by-step through the process?
- Will the digital experience help students identify their learning style, and will moving through the steps more quickly help them integrate the experience as a whole?

Interactive Writing Tool

I decided to use TextEdit, an application that is supplied on all Mac computers. The students writes their personal story (beginning, middle, and end) into TextEdit and save their document. Once they have completed their task, then they would open the reading tool application, which gives students a prompt that asks them to find and upload their TextEdit file. This would be a nice transition to experiencing the reading tool.



Wire frames for writing, reading, and drawing

The process of designing the interactive prototype tools (Reading and Drawing) was done with the collaboration of Professor Brian Lucid.

Interactive Reading Tool

The interactive reading tool incorporates the TextEdit file into Processing. The tool enables students to see their story, and read it out loud. The recording can play back their voice one sentence at a time. In doing this the students can hear what they would be able to play back and what they had read. This would give them the audio feedback that they needed to understand what they had missed or added in writing their story.

Interactive Drawing Tool

The interactive drawing tool is used after a student has written, read, and recorded the story out loud. The drawing tool is designed to be simple and navigated with ease. It provides drawing options ranging from line thickness, the ability to erase, clear the

stage for a blank canvas, and save the sketch as a jpeg image. The main stage has the same visual prompts as the reading tool: a beginning, middle and end. Having three visual prompts on the main canvas allows the students to see the whole story on one page.

Brief Description of Research Exercise:

In this exercise, two students experience what it would be like to read the story out loud and record their voices, draw the story, and reinterpret and write a new story from the drawing using digital tools.

Goal #1:

I will use this information to see if the digital tools would help students who have APD realize and learn from their weakness.

Materials:

Digital tools developed with the program called Processing (www.processing.org), laptop.

Hypothesis/Research Question:

What is the purpose of the digital version of the analog tool?

1. Does it enhance the process?
2. Does it engage more senses?
3. Is it more fun for students?
4. Is it more natural for the students?
5. Did it help them learn anything about themselves in the process?
6. Do the tools help slow the process so that they can understand what they are doing in a particular moment?

Process Summary:

I took what the student learned from analog lesson plan and using digital tools to integrate their knowledge into a digital environment.

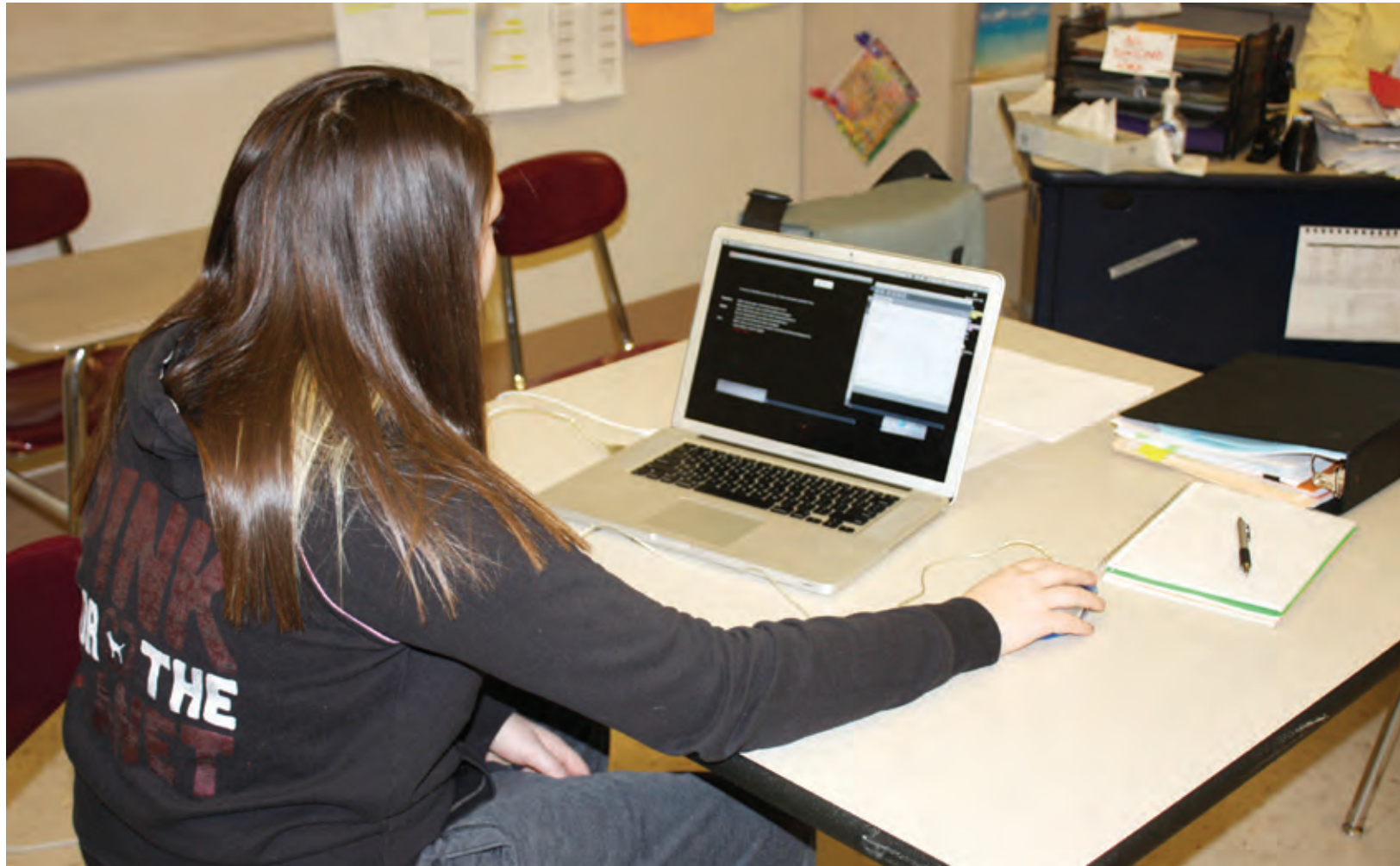
Introduction for Students:

- The students’ stories were entered digitally, with distinct beginning, middle, end (2 sentences per section),
- I explained to students the process of creating the text file:
- Save the text file, and then open the “reading out loud” tool.
- A prompt would signal them to “find the text file”. Locate and select the text file, import text file into the “reading out loud” tool. Here, “record” and “save” buttons.
- The text would come in as a beginning, middle and end. The start of the text would be outlined in red.

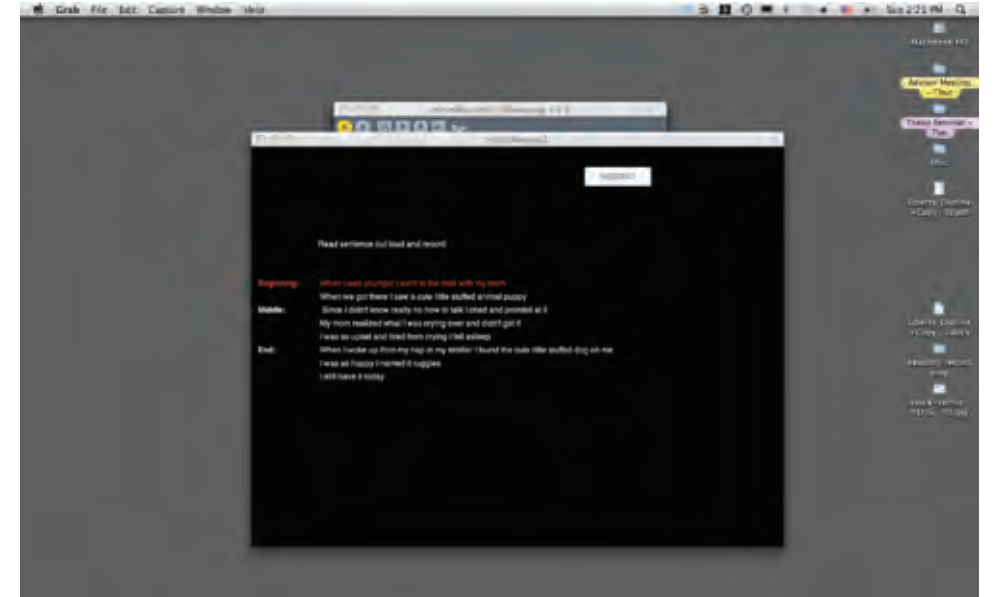
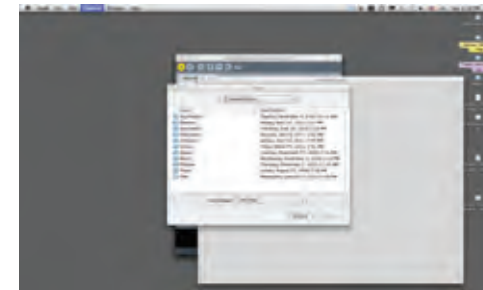
Process:

1. Press record.
2. Read out loud.
3. Hit “save.”
4. Red highlighted text would go to next line.
5. Press record.
6. Read 2nd sentence out loud.
7. Repeat through end of story.
8. Move the screen to the side, so that you can engage the “drawing tool”.
9. The split-screen allows you to see the drawing on the side. Student 2 is taught about the interactive tools on the left side that can be used to augment line thickness, erase, and select “save” or “clear”.
10. View the drawing.
11. A line is visible on the screen in the “drawing tool” that divides beginning, middle and end. This is a visual prompt for students to see that there are separate sections of the story.

12. Student 1 would reinterpret story from the drawing.
13. Student 1 brings up a new text file, with visual prompts of beginning, middle, end, and she will fills in the story, describing what would happen from the drawing.



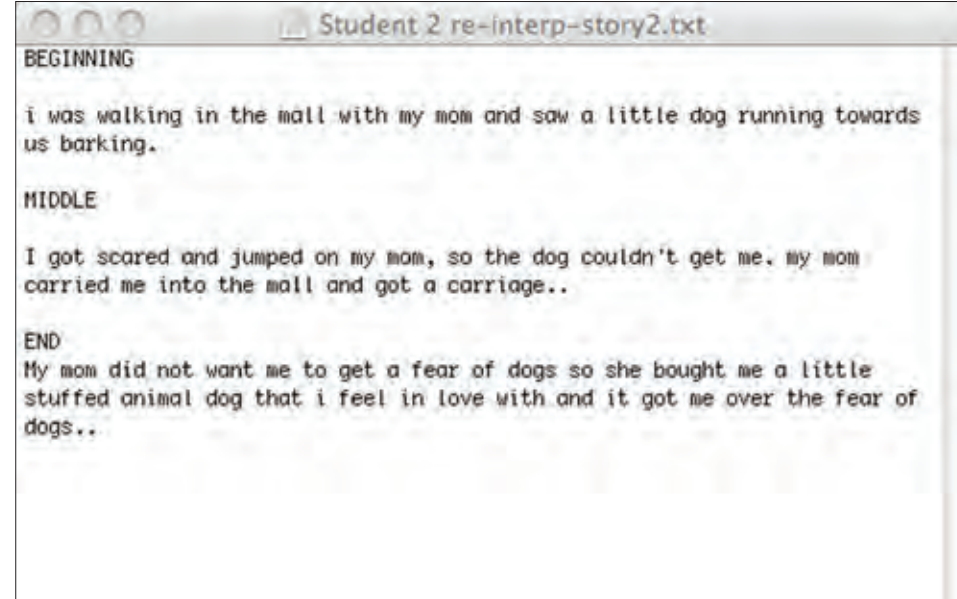
```
minimRecord2 | Processing 1.0.9  
import ddf.minim.*;  
import javax.sound.sampled.*;  
float record;  
float wave1;  
float playOne;  
export java.swing.*;  
int playcounter = 0;  
  
// setup  
Minim minim;  
AudioInput in;  
AudioRecorder recorder;  
  
void setup {
```



```
Student 1 story.txt  
BEGINNING  
When I was younger I went to the mall with my mom. When we got there I saw a cute little stuffed animal puppy.  
MIDDLE  
Since I didn't know really no how to talk I cried and pointed at it, my mom realized what I was crying over and didn't get it. I was so upset and tired from crying I fell asleep.  
END  
When I woke up from my nap in my stroller I found the cute little stuffed dog on me. I was so happy I named it suggie. I still have it today.
```



Student #1 reading and recording with digital tool.



Student #2 listen the first story from students #1, and draws story.



Student #1 reinterprets the story from student #2 drawing.

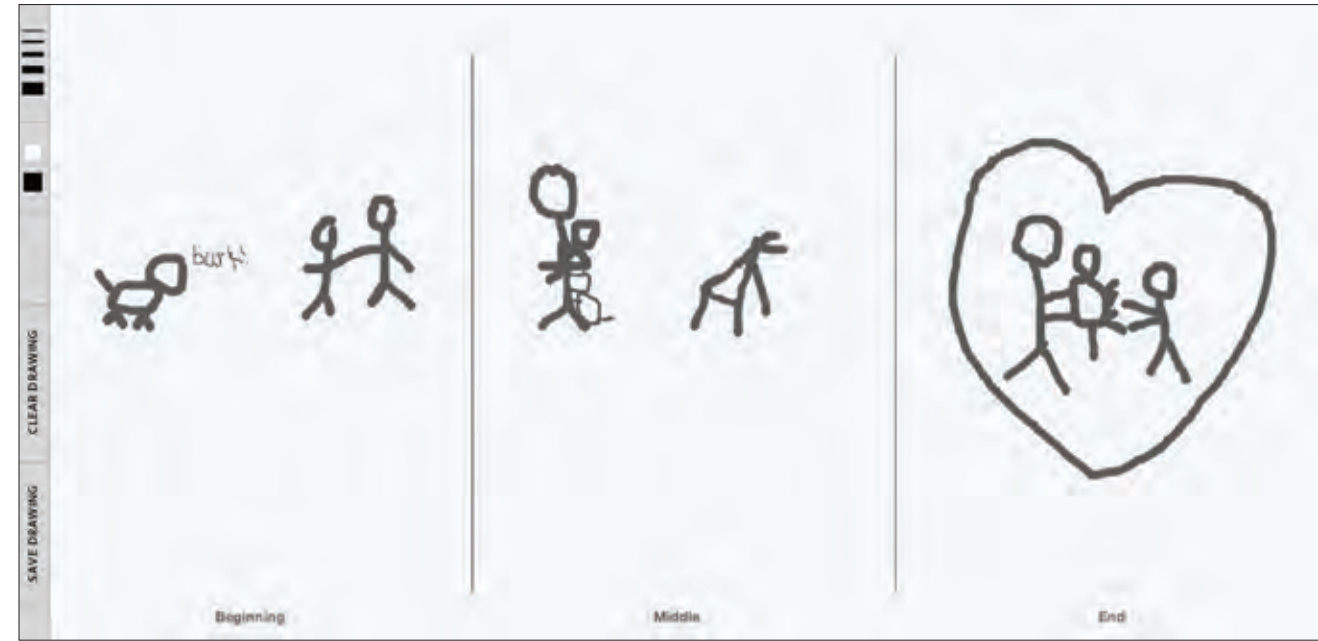


Student 2 re-interp-story2.txt

BEGINNING
I was walking in the mall with my mom and saw a little dog running towards us barking.

MIDDLE
I got scared and jumped on my mom, so the dog couldn't get me. my mom carried me into the mall and got a carriage..

END
My mom did not want me to get a fear of dogs so she bought me a little stuffed animal dog that I feel in love with and it got me over the fear of dogs..



Student #2 listens to the second story from students #1, and draws story.

Qualitative Research Analysis:

The students agreed they liked the digital version better because one student found it more straight-forward, meaning that she felt more comfortable drawing on the computer as opposed to using a pencil. “It’s helpful to read out loud,” remarked one student, because she was able to hear noticeable pauses in her reading. Because this trial involved only students, more definitive analysis will require further testing with a larger population.

Conclusion:

Additional assessment would be needed to prove that the students learned or understood better. The tasks/tools focused on one component of the entire process: students can make corrections and understand what skills are lacking, so that they can better assess their own work (specific to reading tool, because it was designed to target APD). After they had finished the digital exercise I asked students to fill out a questionnaire including the following prompts:

- Did you learn anything about yourself or learning style in the process?
- What digital tool did you like best or worst and why?
- Reading out loud
- Drawing the story
- Reinterpreting the story from the drawing
- What did you like better the digital tool or the analog exercise?

Some of the Responses Were:

- “Yes, now I know how I can improve my reading.”
- “The reading out loud tool-it’s better to hear your recording, instead of having people tell you.”
- “I liked reinterpretation because it was fun and neat to see how different stories come from just looking at a picture”.

- “It was much easier learning and remembering something when I read and draw it, but I didn’t think it would work”.
- “Reading out loud, because reading out loud helps me process the story better.”
- “Drawing the story, because I could remember what went on in the story by drawing it.”
- “Reinterpreting the story from the drawing, because it helps me get a better understanding of the story.”

How Could I Train Teachers to Use My Model

My pedagogy is in the form of a flexible model of two parts, analog and digital. This flexible model could allow the teacher to exercise interhemispheric transfer training to make the necessary choices based on the students’ needs and lesson objectives.

- Teachers would be instructed on how to use the analog model by going through the process.
- They would then experiment with the digital model.

- Finally, they would be asked to complete the same questionnaire as the students (See 141) to see the measurable results.

The students would be asked to write, read out loud, draw, and re- interpret a story about a specific topic given by the teacher. Each of these tasks would be assigned to one student who would pass on their version of the story to the next. This would be a step-by-step process that uses visual prompts during each task. Student #1 is prompted to compose the story in three parts: beginning, middle, and end. The Drawer uses a three block storyboard to draw the beginning, middle, and end of the story. Student #3 reinterprets the story by looking at Student #2’s drawing. Student #3 will then write his/her own story with a beginning, middle, and end.

“Yes, my reading, now I know how I can improve my reading.”

DID YOU LEARN ANYTHING ABOUT YOURSELF OR LEARNING STYLE IN THE PROCESS?

“It is much easier learning and remembering something when I read it and draw it, but I didn’t think that would work.”

Question 2 (Part I) What digital tool did you like best?
Writing the story and reading out loud:

Quantitative

1 2 3 4 5
best worst

Qualitative

“It better to hear your recording so you can hear what you can fix, rather than having people tell you, you can understand better.”

“Because by reading it out loud helps me process the story better.”

Question 2 (Part II) What digital tool did you like best?
Drawing the story:

Quantitative

1 2 3 4 5
best worst

Qualitative

“It’s cool how close you can get the pictures to the story.”

“Because I could remember what went on in the story by drawing it.”

Question 2 (Part III) What digital tool did you like best?
Reinterpreting the story from the drawing:

Quantitative

1 2 3 4 5
best worst

Qualitative

“I liked it because it was fun & neat to see how different a story can be from just looking at a picture.”

“Because It kind of helps me get a better understanding of the story.”

Question 3 What digital tool did you like best?
Digital tools or the analog exercise:

Quantitative

1 2 3 4 5
best worst

Qualitative

“I liked the digital process better, because I thought it helped me more to read out loud and hear my own voice, and could help me in the future.”

“I liked the digital better because it was very straight forward and it personally works better for me to draw on the computer.”



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April 5, 2011

To Whom It May Concern,

This is a review summary of what I observed as a result of Joseph Liberty providing a lesson and extension of his work needed to meet graduate school requirements. Mr. Liberty presented the first part of the in-class exercise and use of his interactive learning tool, WRD³, his thesis proposal, as part of the Dynamic Media Institute program at Massachusetts College of Art and Design. This Learning Center Skills class, is a class designed for students with learning disabilities, providing them additional time to receive academic support, review material, and to develop/practice strategies and self-advocacy skills so that they may better access information presented in the general curriculum.

The lesson took place during first period from 7:35-8:25am on Tuesday March 15, 2011. There were 4 out of the original class of 6 students who took part in the actual lesson, one student did not take part due to unsigned permission slip, and another was missing due to absence. Prior to this lesson, students were assigned a prompt. The students were given space in which to write a short story. The reason for this was the time constraints given for students to begin/complete the lesson with a positive outcome, limiting feelings of stress, while providing support if needed from me as their Learning Skills teacher. As Joe was setting up materials, I took attendance and prepped the students on what was going to be presented, as well as giving some background on Joe's experiences in school as a student with learning disabilities. Even though there was an instructional assistant present in the room, both of us remained observers to the lesson rather than participants. I did need to simplify/breakdown some instructions for a student that has difficulty in following oral instruction due to attention and comprehension, however for the most part, students took instruction and responded to Mr. Liberty only.

From what I could hear and observe, I did make note that Joe had made an incredible connection with the four students that participated, in a very short period of time. He spoke clearly and simply with discussion that related solely to the lesson. He was able to hold onto and maintain their attention so as to adhere to the lesson. They seemed to be captivated by learning and trying something new. The students were also very candid about their learning styles, and whether or not they thought this trial of a new strategy would actually work within their own content classes. In an after class discussion, students also revealed to me that they enjoyed the way the lesson was presented, but wasn't sure if it was something that would actually work within general education classes, and whether or not general education teachers would look at alternative ways to assess student knowledge.

In the many conversations I have had with Joe since the beginning of this project, he knows that any individual with a specific learning disability, whether it is in written expression or auditory processing, is never "cured". The difficulty in accessing and demonstrating knowledge through traditional means is the fact that it doesn't always work for all students. As educators it is best to provide additional outlets through whatever means necessary, in order to allow students to demonstrate their knowledge in the best way possible.

On April 5, 2011 Mr. Liberty presented the actual digital tool for use with the students who had participated originally. Students came to class ready and willing to participate. In the beginning

Letter written by
Carolyn Sherman.

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there was certainly some hesitation, due to the technical portion and using the computer program, but in the end everything came together with students being genuinely interested in the assignment completion. One student in particular was truly interested and invested in the way this digital tool recorded her information, and she was able to hear it back. She legitimately has difficulty in processing and attention, so the fact that she could ideally use something like this was great for her to experience. As noted before, Mr. Liberty's interactions with the students were very positive. He took time to work with each student, was very patient and approachable when asked questions, and provided students complete attention as they manipulated the information being presented.

It was both an honor and privilege to have Joseph Liberty present his thesis and digital for trial in my Learning Center skills class. Students appeared focused and intent on learning, and seemed to be in agreement that this tool could be best used in a small class or group, rather than a typical classroom size. This collaboration among students seemed to provide a sense of support and understanding around content material presented in the general curriculum, without singling out particular students based on ability level.

I wish Mr. Liberty the best of luck as he moves forward in his graduate studies and further development of his thesis project WRD³ Digital tool. I wish him nothing but success as he pursues this new endeavor. Please feel free to contact me should you have any questions.

Sincerely,

Carolyn Sherman
Special Educator
Shrewsbury High School
(508) 841-8300 x2106
csherman@shrewsbury.k12.ma.us

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CONCLUSION

What I Learned Here at DMI

My Learning Process

Analyzing my own learning process gives me the opportunity to understanding how other people learn. As an interactive designer I have to try to go beyond myself and imagine how the user learns and thinks. Having a sense of empathy for the user should be a part of the design process.

After exploring my own patterns of thinking, I was able to create a model for dynamic learning that gives me insight into how others with my disability learn best. Trusting my instincts is something I had lost while working as a graphic designer. I enrolled in the DMI program to reestablish my connections, both to my own creative and learning processes and those I was designing for.

My studies in the DMI program have sharpened my conceptual thinking, my prototyping, and my ability to present my ideas to others. Applying interdisciplinary methods of learning and designing has transformed my visual design skills. My awareness of the audience has helped to become a better writer. In order to create my model for dynamic learning I not only had to reflect on my own learning process, but also learn more about those for whom I was designing my tool. This involved ethnographic research. I began by consulting with specialists: an

audiologist, a speech pathologist, special education teachers, and learning coach. This experience has led me to believe that there are two parts to ethnographic research. One, the industry to inform your opinions about the topic of interest, (specialists) and two the users, (students). For the specialists I kept it simple and asked lots of questions, who, why, how, etc. This process proved to be valuable because it allowed me to set up the boundaries needed to bounce my ideas off of. If I did not do this step I would have been lost in the development of my project. For the students, it was all about observing how they interact with and to each other, the body language, loud or soft spoken, what technology are they using, how do they write. Seeing and hearing what they are doing provides a perspective that is at their level. This process proved to be valuable to me because by knowing and interacting with the user first hand help create an interactive experience.

Dynamic Media to Inspire Dynamic Learning

Dynamic learning is especially important for those with APD because it provides interhemispheric transfer training; that is, moving from one task to another helps them connect concepts with multi-sensory stimuli. Many who do not approve of digital tools in the classroom speak of getting back to the basics, but my WRD³ project does, in fact, bring students back to the basics of reading, writing, and drawing. It uses simple tools to strip away the complexities of

the students' interactions with the content. It is a step-by-step, multi-sensory, kinesthetic, and collaborative process, which slows down the learning process and creates a holistic experience.

Future Project Development

My plans for future development of my tool include; moving from a laptop platform to a multi-touchable so students have a better sense of collaborative learning. I also imagine a community website that students and teachers would be able to access at home to interact with students in their school or even other schools. I plan to explore adding an time management system to track an individual students time in completing each step. This would allow the student to recognize the time they need to complete something. Other thoughts include, having students use a stylus to write rather than type the story which slows down the learning process. Finally, I want to create a way for students to review past work so they can chart their own progress and be active participants in their learning process.

Once WRD³ is tested in the classroom I plan to distribute it to assistive technology specialists who can modify the reading out loud tool to serve the particular needs of their own students. I would also like to test this tool with students who have other types of learning disabilities such as: Visual Processing Disorder — a sensory disability related to processing images; Dysphasia — a language disability

related to difficulty with reading comprehension; and Dysgraphia — a writing disability related to difficulty with forming letters and legibility. In the future I will consult with audiologists to see if my WRD³ project could be modified as a diagnostic tool.

My Future as an Interactive Designer

I hope in the future to find a position with a design firm that puts emphasis on an interdisciplinary approach to the creative process. My goal is to find a firm that specializes in the development of research-driven interactive tools for students and adults with learning disabilities. I would also like to work directly with students to inspire them with my own story.

Advice for Designers and Students

I would advise students entering the DMI program to begin by understanding their own learning styles and thinking process. They need to realize both their strengths and weaknesses to imagine the scope and limitations of their designs. I would suggest they begin by creating mind maps and graphics to visually represent their creative and learning processes. By first interacting with our own thoughts and feelings, we can better understand how to interact with others.

BIBLIOGRAPHY

“(Central) Auditory Processing Disorders [Technical Report].” American Speech-Language-Hearing Association | ASHA. March 2011. <<http://www.asha.org/docs/html/tr2005-00043.html#sec1.10>>

Dictionary.com. 2011. March 2011 <<http://dictionary.reference.com/browse/dynamic>>

Bellis, Teri James. “When the Brain Can’t Hear:” *Unraveling the Mystery of Auditory Processing Disorder*. New York: Pocket, 2002. Print.

Bellis, Teri. “Understanding Auditory Processing Disorders in Children.” American Speech-Language-Hearing Association, Nov. 2010. <<http://asha.org/public/hearing/disorders/understand-apd-child.htm>>

“Kurzeil 3000.” March. 2011. <<http://www.kurzweiledu.com/kurz3000.html>>

Dragon. March. 2011. <http://www.nuance.com/dragon/index.htm>.

LibriVox. March. 2011. <http://librivox.org/>.

Interactive whiteboard. March. 2011. http://en.wikipedia.org/wiki/Interactive_whiteboard

“Assistive Technology For Learning Disabilities.” March. 2011. <<http://www.rehabtool.com/forum/discussions/93.html>>

“*Designing Flexible Curricula*.” March. 2011. <<http://www.ncsu.edu/graphicdesign/newcontexts/>>

Resnick, Mitchel and Rosenbaum, Eric. “Jots.” March. 2011. <<http://llk.media.mit.edu/projects.php?id=2646>>

2009 Eric Rosenbaum *Jots: Reflective learning in Scratch Interaction Design and Children Conference*

Project Zero. March. 2011. <<http://www.pz.harvard.edu/>>

“Orchestra Outreach.” March 2011. <<http://loveofmusic.net/OrchestraOutreachMap/OrchestraOutreach-Map-119.htm>>

FFFBI Home. March. 2011. <<http://www.fffbi.com/>>

Bruner, J. “Theories of Learning in Educational Psychology” March. 2001. <<http://www.lifecircles inc.com/Learningtheories/constructivism/bruner.html>>

Wurman, Richard Saul et al. “Education Is to Learning as Tour Groups Are to Adventure.” *Information Anxiety 2*. Indianapolis, IN: Que, 2001.

Appendix

PERMISSION NOTE (February 8, 2011)

I give permission for Joseph Liberty (MFA Graduate candidate in the Dynamic Media Institute program at Massachusetts College of Art and Design) to run an in-class exercise, with documentation that could include: written assessment, photography, and video (if permissible) to capture a learning process. All content is for ethnographic observations gathered in this exercise to complete his thesis project. I understand that Joseph will change the names of each student and keep their information confidential. This is an independent research project and Mass Art and Shrewsbury High School will not be held responsible.

For documentation + research purposes only, I _____

Hereby authorize Joseph Liberty to utilize the following media to document his research (Please Circle Yes or No):

(Photography: Yes / No) (Video: Yes / No)

Student Name Date

Special Education Date

Teacher Name

Parent Signature Date

Permission note for analog exercise.

1. MY ROLE:

Joseph Liberty – MFA Graduate candidate in the Dynamic Media Institute program at Massachusetts College of Art and Design

I will be taking an ethnographic approach to the collection of information, done through:

- In-class Assignment
- Participation and Observation
- Group Discussion

2. THESIS SUMMARY:

This thesis proposes the creation of an interactive learning tool for students – specifically adolescents ages 14-18, with Auditory Processing Disorder (APD). The tool will provide a multi-sensory, collaborative, and kinesthetic learning experience through writing, reading, and drawing. This thesis utilizes an ethnographic process involving high school students with (APD) in a controlled setting, through an participatory and collaborative assignment, to acquire quantitative and qualitative research to inform my thesis project.

3. THE ASSIGNMENT SCHEDULE:

The time allotted for this particular project would be a half hour, which will be broken into three student tasks with guidance in between. This includes:

- A 5 minutes brief introduction of the assignment.
- 5 minutes = (15 minutes) for each students task.
- 10 minutes for discussion.

Proposal for analog exercise.

4. THESIS PROJECT:

Some current models use multiple choice questions to identify learning styles, specific to students with learning disabilities and/or difficulties.

My thesis project (WRD³) stands for Writing, Reading, and Drawing repeated three times.

WRD³ is an assignment for students to recognize their learning style through an experience. It is accomplished through self-authorship of content with writing a story, reading aloud, and drawing it. (Details below)

THE ASSIGNMENT AND HOW IT WILL WORK: (Experiential Learning)

I am hoping to engage three students in the following exercises specific to (APD) learning:

Assignment Part One, Student #1: Authorship

- Student #1 writes a short story about a childhood toy (Sequencing of the story: beginning, middle, and end) (Written communication)
- Student #1 reads the story out loud to Student #2 (Reading/verbal skills)

Assignment Part Two, Student #2: Observation and Participation

- Student #2 hears the written story (read out loud by Student #1) (Auditory Processing skills)
- Student #2 draws the story for Student #3 (Sequencing of the story: beginning, middle, and end)

Assignment Part Three, Student #3: Re-Interpretation, Observation and Participation

- Student #3 views the drawing for the first time

- Student #3 Re-interprets and writes a short story based on Student #2 drawings (Sequencing of the story: beginning, middle, and end)
- Student #3 reads their story out loud to Student #1 and Student #2 (which brings the process full circle)

5. LEARNING OBJECTIVES:

- Student authorship of content and ideas through story telling, drawing, and re-interpretation of content.
- Enable students to identify their strengths and weaknesses through an assignment.
- Create a collaborative, experimental learning environment.
- Engages students as creators, participants and observers.

6. PROJECTED OUTCOMES:

- Recognition of strengths and weaknesses, and see how working together in small groups allows each one to use their abilities to help complete the task in front of them and to contribute to the group.

STUDENTS: Synthesizing ideas through story telling, sequencing, visual, conceptual, oral, and intellectual skills. Exposed to various learning styles through a multi-sensory, collaborative, and kinesthetic learning experience involving writing, reading, and drawing.

Assignment Part One: (Student #1)

- Reading Fluency
- Verbal Expression

Assignment Part Two: (Student #2)

- Reading Comprehension

Assignment Part Three: (Student #3)

- Interprets the Drawing

EDUCATORS: Facilitate a learning experience through a passive role

Assignment Part One: (Student #1)

- Written Expression
- Decoding
- Phonological Awareness

Assignment Part Two: (Student #2)

- Sequencing of the story: beginning, middle, and end

Assignment Part Three: (Student #3)

- Visual Comprehension
- Written Expression

7. THIS ASSIGNMENT SEEMS TO INFORM THE FOLLOWING QUESTIONS FOR MY THESIS RESEARCH:

- How can an educator facilitate a learning experience through a passive role?
- How can this assignment measure students' understanding of their own learning styles (strengths/weaknesses)?
- What are the advantages/disadvantages of developing a similar assignment for a digital learning environment?
- How can an interactive learning tool for students with (APD) provide an alternate approach to writing, reading, and drawing?
- How can the tool be simple enough to implement, without exceeding the student's and educator's comfort levels with technology?

PERMISSION NOTE (April 1, 2011)

I give permission for Joseph Liberty (MFA Graduate candidate in the Dynamic Media Institute program at Massachusetts College of Art and Design) to follow-up with the 1st exercise that was previously discussed to specifically "use" reading, listening and drawing digital tools. All content is for ethnographic observations gathered in this exercise to complete his thesis project. I understand that Joseph will change the names of each student and keep their information confidential. This is an independent research project and Mass Art and Shrewsbury High School will not be held responsible.

*For documentation + research purposes only, I _____

Hereby authorize Joseph Liberty to utilize the following media to document his research (Please Circle Yes or No):

(Photography: Yes / No) (Video: Yes / No)

Student Name Date

Special Education Date

Teacher Name

Parent Signature Date

* Note: Parents have signed previously (See PDF)

PROPOSAL: (April 1, 2011)

Shrewsbury High School – Special Education

1. MY ROLE:

Joseph Liberty – MFA Graduate candidate in the Dynamic Media Institute program at Massachusetts College of Art and Design

I will be taking an ethnographic approach to the collection of information, done through:

- Participation and Observation with digital reading, listening, and drawing tool
- Group Discussion

2. THESIS SUMMARY:

This thesis proposes the creation of an interactive learning tool for students – specifically adolescents ages 14-18, with Auditory Processing Disorder (APD). The tool will provide a multi-sensory, collaborative, and kinesthetic learning experience through writing, reading, and drawing. This thesis utilizes an ethnographic process involving high school students with APD in a classroom setting. Students engage in an analog exercise enabling me to observe and document their experiences to inform my interactive prototype.

3. THE EXERCISE SCHEDULE:

To follow-up with the 1st exercise that was previously discussed to specifically “use” reading, listening and drawing digital tools. The time allotted for this particular project would be a half hour, which will be broken into three student tasks with guidance in between. This includes:

- A 5 minutes brief introduction of the assignment.
- 5 minutes = (15 minutes) for each students task.
- 10 minutes for discussion.

4. THIS EXERCISE SEEKS TO INFORM THE FOLLOWING QUESTIONS FOR MY THESIS RESEARCH:

- What are the advantages/disadvantages of developing a similar assignment for a digital learning environment?
- How can an interactive learning tool for students with (APD) provide an alternate approach to writing, reading, and drawing?
- How can the tool be simple enough to implement, without exceeding the student's and educator's comfort levels with technology?

