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Autoethnographic Study in the Process of Applied Design: Creating Adaptive Clothing for a Child with Spinal Muscular Atrophy

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Citation	Rutledge, Brittany. "Autoethnographic Study in the Process of Applied Design: Creating Adaptive Clothing for a Child with Spinal Muscular Atrophy." 2017. Thesis, Georgia State University. https://doi.org/10.57709/10025817
DOI	https://doi.org/10.57709/10025817
Download date	2026-04-12 23:14:51
Link to Item	https://hdl.handle.net/20.500.14694/854

AUTOETHNOGRAPHIC STUDY IN THE PROCESS OF APPLIED DESIGN:
CREATING ADAPTIVE CLOTHING FOR A
CHILD WITH SPINAL MUSCULAR ATROPHY

by

BRITTANY RUTLEDGE

Under the Direction of Dr. Melody K. Milbrandt, PhD

ABSTRACT

The intent of this study is to reveal essential elements learned by reflecting and analyzing the applied design process in developing a specialized garment for a child with Spinal Muscular Atrophy (SMA). I researched and determined the clothing needs of one child with SMA, designed and created a pair of adaptive pants based on the needs of the child, tested the final product through a trial wear of the adaptive pants, and I evaluated and revised the adaptive pants. Through this study I also determined ways in which my design process can inform my teaching of applied design in my elementary art classroom.

INDEX WORDS: Adaptive Clothing, Spinal Muscular Atrophy, Applied Design

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A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of
Masters of Art Education
in the College of Arts and Sciences
Georgia State University
2017

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May 2017

DEDICATION

This thesis is dedicated to the memory of my beloved grandmother, Alyce Marie O'Neal. As an educator herself, she would have been so proud to witness this monumental moment. I also dedicate this thesis to Stephanie Rutledge and Miguel Patrick. I thank you two for being my rock during the entire process of earning my Master's degree.

ACKNOWLEDGEMENTS

I would like to express the deepest appreciation to my committee chair, Professor Melody Milbrandt, who gave me unequivocal support and guidance throughout the entire process of my thesis completion. Thank you so much for helping me to develop my ideas and to pursue something that I love.

I would like to thank Dr. Melanie Davenport and Dr. Kevin Hsieh for serving on my committee and providing indispensable advice and support.

I am extremely thankful for my Principal, Mrs. Angela Thomas-Bethea, who has offered endless support and patience as I worked to earn my Master's degree. The type of support that she has provided is extremely rare and I am forever grateful.

Thank you all for helping me to pursue my destiny.

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CHAPTER 1 INTRODUCTION

As a child, I would often go to work with my mother after school. My mother worked at a small clinic as an occupational therapist servicing children with mental and physical disabilities. I had the opportunity to get to know some of her clients very well; in fact, I became friends with one of her clients. Her client and I would talk on the phone and we also would socialize outside of the clinic. Most of the time we socialized, we had sleepovers at my house. I can vividly remember how things went during our sleepovers. My friend and I would have a blast together watching movies, playing with dolls, and playing board games. I also remember that my friend depended greatly on me to help her with dressing herself and preparing meals. My friend had cerebral palsy, a neuromuscular disability that manifest as left hemiplegia. Her left leg postured in a flexed position and her left arm postured in a tight fixed position. Her hemiplegia caused my friend great difficulty with bilateral task, such as dancing, walking, and getting dressed. She often required help from others. During the times that my friend needed help, she would often apologize, feel embarrassed or ashamed that she seemed to burden my life or anyone else's life from whom she received help. Ever since this childhood experience, I have always wanted to make a positive change in the lives of young, disabled individuals by attempting to increase their ownership of being able to complete simple tasks of the dressing process themselves; tasks that physically abled individuals often take for granted.

Need for the Study

After a long conversation with my mother who is now an occupational therapist at five public schools, it was clear to me that young disabled individuals still face the same issues that my dear friend faced as a child. The disabilities that her students have are mental and physical

disabilities while a few of her students possess both and are labeled as multiply disabled. My mother is one of millions of people who witness daily, the negative impact that a disability has on a young individual's life. The negative impacts that her students experience include the lack of self-sufficiency, low self-esteem, fear of making new friends, and the lack of encouragement to participate in anything that would require someone else's assistance. My mother also mentioned that getting dressed and undressed is a very common struggle amongst the individuals with physical disabilities. Usually, these students do not take any ownership with dressing and undressing, and require assistance from their parents, caregivers and paraprofessionals. These students also wear regular clothes that bring them additional physical discomfort and make the tasks for caregivers difficult to complete. I believe these students should wear clothing that works in concert with their disability instead of working against it. Such clothing is called adaptive clothing which is clothing that has been adapted to positively contribute to an individual's need. Adaptive clothing isn't just needed, for my mother's students, it's needed for everyone who has a physical disability.

During my conversation with my mother, one particular student caught my attention. To protect the identity of this child, I have assigned a pseudo name Hayden in which I will use this name in reference to the child. Hayden has Spinal Muscular Atrophy, (SMA) Type II, a spinal disability that inhibits walking and overtime, decreases the ability to use fine motor skills. My mother would always speak of Hayden stating how intelligent and outgoing Hayden is, and how Hayden overflows with joy and excitement. My mother mentioned that the only time when Hayden was not in good spirits was when he had to go to the nurse to change his undergarments due to urine leaks. Hayden wished that he could change his garments himself and retain his privacy. This was the perfect opportunity for me to step in and put my fashion design skills to

use. Fashion design is very dear to my heart and a true passion of mine. I graduated from Savannah College of Art and Design with a bachelor's degree in Fashion Design. In fashion design, the design of a garment and the functionality of a garment are equally important. I made a pair of adaptive pants for Hayden in hopes that this clothing would increase his ownership of dressing by making it easier to put on and remove garments. Additionally, I also made the garment appealing to the young crowd of Hayden's age group.

Purpose of the Study

The purpose of this study is trifurcated. First, I created a pair of adaptive pants for a physically disabled child in an attempt to increase his self-esteem and self-worth by increasing his ability to take ownership of self-dressing and undressing. My findings during this study assisted me with discovering the essentials of designing an effective pair of adaptive pants. Second, I discovered and used the essential elements learned from this study of applied design by applying the process of applied design into my elementary art classroom lessons. Third, in the future, I plan to perfect the adaptive pants and take them into production to allow the garment to have the same positive impacts on other young individuals across the world.

Research Questions: 1) What can I learn by reflecting and analyzing my applied design process in developing a specialized garment? 2) What can I learn from my design process that can inform my teaching of applied design in my classroom?

CHAPTER 2 LITERATURE REVIEW

Definitions of Terms

To provide clarity for the terms that are used in this study, I have included a list of defined terms related to garment construction (Johnson & Hopkinson, 2002).

Fabric finish- Various finishes may be applied by the manufacturer in order to change the performance, look, or feel of a fabric. The finish used may affect fabric care and is usually indicated on the fabric bolt label (p. 370).

Fastener- A device that is used to assist with fastening garments (p. 370).

Fiber- A thread or filament from which a textile is formed (p. 370).

Inseam- The seam inside the leg of a garment (p. 371).

Lining- A layer of fabric, sewn inside coats, jackets, dresses, skirts and pants. It covers construction details and makes garments easier to put on and take off (p. 371).

Outseam- The seam that falls along the outside of the leg (p. 372).

Pattern- The template from which the parts of a garment are traced onto fabric before being cut and assembled (p. 372).

Seam- Where two or more layers of fabric are held together with stitches (p. 372).

Tailor- A person who makes custom, fitted clothes (p. 373).

Twill- A type of woven, textile weave with diagonal parallel ribs (p. 373).

Wash- A type of bleached finishing added to garments after they have been constructed (p. 373).

Adaptive Clothing

During the quest for literature on adaptive clothing, I noticed that resources were very limited. There also seemed to be a gap in literature resources from the late 1970's to 2013. In the late 1970's, there were literary resources that explained the fabrication of adaptive clothing, but not many on the importance and impact that adaptive clothing gives to one who is physically disabled. In the early 2010's, sources revealed the importance of adaptive clothing for individuals with physical disabilities, innovations in the fashion industry with adaptive clothing and studies with adaptive clothing but again, all of these sources were limited in number.

Langtree (2016) defines adaptive clothing as follows:

Clothing, garments and footwear specially designed for people with physical disabilities and post surgery patients who may have difficulties dressing themselves due to the inability to manipulate closures such as buttons, zippers, or due to a lack of a full range of motion required for self dressing (p. 1).

Although the need for adaptive clothing has existed as long as individuals with disabilities has existed, the first signs of adaptive clothing were noted in the 1850's with custom garments that were sewn by seamstresses based on the needs of the disabled individual. In the late 1800's, the wheelchair was invented, but was used as a part of the rich and lavish lifestyle of those who were wealthy. In the 1930's, the wheelchair was used for mobility for individuals who were disabled and unable to walk or stand. At this time, clothing that provided comfort and easy wear and removal for a wheelchair bound individuals was not a prominent concern. Custom garments constructed for easy wear and removal were very costly to produce and were often

worn by wealthy individuals (Kernaleguen, 1978). In the 1950's, apparel design companies started to produce clothing that would offer benefits for individuals with or without disabilities, but these garments were not specifically for individuals with disabilities. These types of garments included elasticized waistbands in pants and using stretch fabrics. In succession, seamstresses made and designed garments that provided comforts and ease in both wear and removal for disabled individuals by making the inseam in the back of pants longer which provided the wheelchair bound person with better coverage (Kernaleguen, 1978). In the late 1970's, small apparel companies offered their adaptive clothing lines for sale in medical supply stores, and these companies also started to offer more selections of adaptive clothing, as well as, providing patterns and adaptation descriptions on how to make adaptive apparel (Bowar, 1977).

Types of Adaptive Clothing

As of today, there are three things that go under the adaptive clothing category; adaptive garments, easy access clothes and adaptive mechanisms. Adaptive garments are made specifically for a disability with special seams, fabrics and closures (Downs, 2016). For example, a wheelchair bound individual might have a garment without any back pockets or seams along the center back of their garments due to the irritation or discomfort they could cause. This garment could also have a special seam behind the knee to prevent bunching, special seams by the front knee area to allow for comfort while the knee is in a flexed position, extra length to compensate for the wearer being postured in a seated position, and could be made from breathable fibers or vented fabrics such as cotton to prevent the wearer from perspiring while seated. Easy access clothes are not specifically made for disabled individuals, they are garments made for a particular fashion trend and are often easy to put on and remove; a trait that disabled

individuals usually like to see in their clothing (Fields, 2013). Although easy access clothes offer benefits to a handicapped individual, the garments may still present occasions for discomfort. For example, a knee-length wrap skirt would be considered to be an easy access garment. Although this garment is easy to put on and remove, the individual who is disabled could still experience discomfort if in a seated position. A wrap skirt that is knee length does not necessarily provide additional coverage to the back of the garment for an individual who is wheelchair bound. Once this individual sits down, the back of the skirt could rise which would cause the back of the individual's leg to be exposed to the seat of the wheelchair. This could cause discomforts considering that the individual might feel the seam where the coverage of the dress stops and where the skin is exposed to the wheelchair. Adaptive mechanisms are used in garments to assist the disabled individual with opening and closing a garment. This could include magnets placed in the front center seam on a shirt, Velcro panels used on the center back of a garment, or plastic zippers in the front of clothing (Langtree, 2016).

Traits of Adaptive Clothing

There are four main traits of adaptive clothing; 1) Breathable, natural fibers, 2) Fasteners and trims that are easy to manipulate, 3) Inclusion of adaptive mechanisms, and 4) Specialized garment pattern, seams and closures (Dimka, Kabel, & Mcbee-Black, 2016).

Natural and Manmade Fibers

Natural fibers are known for their breathability and comfort. Cotton fabric is often used to assist with perspiration while the fibers absorb sweat and allows it to evaporate into the air. On the other hand, cotton also tends to wrinkle very easily and shrink. Wool fabric is often used to

assist with thermal traits allowing the wearer to remain warm during cold weather. Wool usually resists wrinkling and soiling and it also is very durable and retains its shape. Wool usually requires delicate care and the cost of wool can become pricey as the fiber content of a fabric approaches 100% wool. Although natural fibers are desired for their traits of breathability and moisture absorption, natural fiber can be blended with manmade fibers for stretch or repellent qualities. Polyester and other manmade fibers can be desirable for their traits of long lasting color, ability to hold its shape, rapid drying, and decreased propensity to wrinkle. Perhaps a cotton blend with polyester may offer the best fabric traits of both worlds.

Fasteners and Trims

Fasteners that are easy to manipulate may include large buttons to promote a more facile grasp, snaps in various sizes, large hook and eyes and Velcro panels. A trim that is easy to manipulate may include plastic zippers with large tabs. The larger zipper tabs assist the wearer by providing ease of gripping. The plastic teeth on the plastic zipper are easier to close as compared to the teeth on a metal zipper.

Adaptive Mechanisms

A very common adaptive mechanism that is utilized in dress shirts is MagnaReady closures. Maura Horton created the MagnaReady line of dress shirts with hidden magnetic closures along the inside of the placket of dress shirts (Binkley, 2016). These shirts have decorative buttons on the outside to appear as a normal dress shirt (Binkley, 2016). Some other adaptive mechanisms include drawstrings at the waist of a garment or garment weights to keep particular areas of the garment weighted so that the areas do not rise or fold upward.

Specialized Garment Pattern, Seams, and Closures

In 2013, Jun Li, Yunyi Wang, Daiwei Wu and Mengmeng Zhao and designed a specialized garment pattern in which the crotch of a pair of pants is detachable from the legs of the pants. This specialized garment offers the benefits of ease with dressing and undressing. Li, Wang, Wu, and Zhao also utilized special seams and closures in which the elbows of their jacket consisted of a circular patch that provide comfort and support in an area that is prone to friction for a person who is wheelchair bound. The jacket has a zipper placed on the front and back around each armhole to make the sleeves of the jacket detachable. While both the jacket and pant have adaptive elements, the design of the garments has not been compromised.

Challenges Disabled People Face with Adaptive Clothing

According to the US Census Bureau (2012), nearly one in five people have a disability in the US. In opposition, very few retailers regard consumers with disabilities as a target market, thus limiting product offerings to a small number of specialized retailers, most of which are based online or who sell through catalogs. In addition, online shopping and catalog shopping may pose additional limitations based on how well people with disabilities can use the Internet and catalogs for adaptive clothing (Annett-Hitchcock & Xu, 2015). Many people with spinal abnormalities also face issues with sizing, as they do not often fit into the current size system (Li, Wang, Wu & Zhao, 2013). In addition, anatomical changes take place, which might cause their body heights to decrease, and their spines to curve forward (Li, Wang, Wu & Zhao, 2013). While visiting the retail stores that sell adaptive clothing, individuals with disabilities may face issues with transportation, parking, checkout lanes, reaching items, trying on clothes, and the attitudes of the sales representatives. Due to the lack of a large competitive market for adaptive clothing,

prices tend to be high to cover the cost of producing and marketing specialized garments. Lastly, if a person who is disabled decides to get custom garments tailored to their disabilities, they might experience difficulties finding a tailor who will purchase fabrics and create custom garments. Although having clothing tailored is the best route for a person who is disabled, it is also the most expensive which may be an unaffordable venture (Dimka, Kabel, & Mcbee-Black, 2016).

Impact Adaptive Clothing Provides for People with Disabilities

People with disabilities usually face three main issues, 1) Increased reliance on care givers, family and friends (Dimka, Kabel, & Mcbee-Black, 2016), 2) Posses a strong desire to want to look ‘normal’ and appear to be the same as other individuals in their age group and 3) Experience discomforts with clothing and medical equipment (Annett-Hitchcock & Xu, 2015). People gain great satisfaction emotionally when they are able to gain independence with self-dressing. The daily tasks that an abled person performs, such as removing a shirt or putting on a pair of pants, may be tasks that a disabled person is unable to perform. When disabled people gain the ability to take ownership in dressing themselves, this increases their confidence, and their dexterity and fine motors skills, which are not being utilized when their caregiver dresses them. Disabled individuals take great pleasure in wearing garments that mask their disability so that they feel more likely to be accepted by the general population (Dimka, Kabel, & Mcbee-Black, 2016). This acceptance increases their social engagement and heightens their desire to participate in socialized experiences. Fashionable clothing and garments for disabled people are comfortable and functional with discreet modifications and lightweight additions (Langtree, 2016). Research has shown that people with decreased social engagement could lead to further

disability or increased risk of death. Increased social participation amongst individuals with disabilities was associated with lower risk of later disability and death (Dimka, Kabel, & Mcbee-Black, 2016). According to Dimka, Kabel, and Mcbee-Black (2016), "...social engagement or meaningful involvement in society may modify or reduce negative consequences of health problems by providing individuals with a sense of purpose or control over one's life" (p. 2185). Adaptive clothing also increases both comfort and function for the disabled individual as opposed to wearing regular clothes. Fasteners in regular clothing may cause undue pressure applied to tender areas of the body that could produce sores. Regular clothes could also be too long and hang near the wheels or brakes of a wheelchair, which could be very hazardous. The use of regular clothing could bring several disadvantages to a disabled individual (Langtree, 2016). In summary, adaptive clothing has a positive impact emotionally, socially and physically on disabled individuals.

Spinal Muscular Atrophy Type I

Spinal Muscular Atrophy (SMA) is a neuromuscular, recessive genetic disease that is passed to children by both of their parents. SMA is caused by deletion or mutation of the Survival Motor Neuron 1 gene, which decreases one's ability to walk, eat or breath. SMA is characterized by erosion of neurons in the spinal cord, resulting in progressive muscular weakness (Henne et al., 2015). SMA affects approximately 1 in 10,000 live births and is the leading genetic cause of death for infants. One in 50 Americans is a genetic carrier of SMA (Prior, 2008). SMA is classified into four primary types; I, II, III, and IV. The most severe form of SMA, Type I is seen earlier during birth to six month of age. The severity of SMA types decreases and shows up later in life from Type I to Type IV with type IV being the least severe

and becomes more prevalent around adulthood (Arnold, Kassar, & Kissel, 2015). SMA Type I represents 60% of the SMA cases and its afflicted generally experience severe muscle weakness and difficulties with swallowing. Ventilator support is usually required. Eighty percent die by age one and the majority of the rest die before the age of two (Henne et al., 2015). SMA Type II represents 30% of the SMA cases and children are diagnosed by 18 months of age. The muscle weakness is not as profound as it is in SMA Type I, but muscle weakness is prevalent. These patients can sit without being supported but they never gain the ability to walk. They also experience difficulties with breathing and swallowing and they often develop scoliosis. These patients are wheelchair bound and the life span varies greatly with many surviving into adulthood. Compared to general population, life expectancy is shortened considering the severity of SMA increases with age and they often experience respiratory failure from lung disease (Henne et al., 2015). SMA Type III represents about nine percent of SMA cases and symptoms tend to be milder than Types I and II. The symptoms appear anytime between 18 months of age and early adolescence and these patients usually have a normal life span. As a child, patients with SMA Type III are usually able to walk or stand unaided. These patients begin to experience frequent falls and fatigue after age two and their motor abilities usually diminish over time as the patient's muscular strength becomes weaker (Arnold, Kassar, & Kissel, 2015). SMA Type IV is very rare and represents about two percent of SMA cases. These patients have a normal lifespan and their symptoms tend to become prevalent in adulthood around age 35. These patients also exhibit muscle weakness and respiratory complications.

Life Experiences and Needs of People with SMA Type II

Patients with SMA Type II usually depend very heavily on a caregiver. Based on a study of 29 participants living with SMA Type II, patients identified their quality of life being as fine and that they were able to do what they wanted to do. These patients received government funded personal assistance about 83% of the day. Ninety percent of these individuals had plenty of energy and strength but 33% of the individuals reported daily pain due to problems associated with being in the seated position (Jeppesen, Madsen, Marquardt, & Rahbek, 2009). These patients also had issues with their fine motor skills of their fingers and hands. These problems increased with age and intensified as the weather became cooler. The majority of the individuals were not able to perform personal care tasks such as bathing, using the restroom, shaving, and applying makeup. About 98% of the individuals were unable to cook, clean or do laundry, but the individuals did take an active role in assisting their caregivers. Some of the individuals had loss of functionality, a reduced ability to write, and needed assistance with eating and breathing. During primary and secondary education, these individuals experienced exclusions from classmates and required assistance from a paraprofessional. About 40% of individuals with SMA complete high school while about 10% of other individuals complete a specialized program (Jeppesen, Madsen, Marquardt, & Rahbek, 2009). Most of these individuals completed high school and were financially supported by public pensions while others supplemented their income with part-time jobs (Jeppesen, Madsen, Marquardt, & Rahbek, 2009). Most of these individuals have a small, close group of friends but 33% found it difficult to make new friends. Leisure time activities usually consist of socializing with friends or playing games on a computer or through a game device. The majority of the individuals stated that they worry about their disease and are fearful of the impact that their disease will make on their life.

Challenges People with SMA Type II Experience with Clothing

Patients with SMA Type II usually face difficulties with dressing themselves and require assistance from their caregivers. Although most patients with SMA Type II can use their fingers and hands, they are very limited in function. With general clothing, these disabled individuals do not dress themselves, and often experience discomfort due to the lack of proper fitting clothing. With adaptive garments, they fare better chance at manipulating the garment for dressing themselves such as a shirt with a magnet closure or a pair of pants with snaps along the sides. At the least, adaptive clothing provides more comfort to the disabled individual, and the caregiver has increased accessibility with removing and putting on clothes (Henne et al., 2015).

Applied Design

Applied design is defined as a design that is applied in an artistic form with purposeful application and functionality (Hanley, 1905). In applied design, every design decision works hand in hand with the design functionality while possessing appealing visual traits. Vande Zande (2014) has compiled a list of essential steps to take when implementing applied design, 1) Define the problem, 2) Investigate and research, 3) Generate ideas, 4) Make the prototype, 5) Present, and 6) Evaluate and Revise. In order to implement applied design, a problem must be identified. Solving the problem gives the applied design purpose. Investigating and researching information associated with the design challenge can be completed through interviews, observations, discussions, articles, etc. This step allows the designer to become informed with the problem and it positions the designer to make purposeful design decisions (Vande Zande, 2014). In the third step, the designer generates ideas by considering possible concepts and allowing ideas to flow freely without any deterrents. At this point, it is crucial to allow as many options as possible and

not settle for a final solution. These ideas can be organized through sketches, mind maps, and brainstorming. In step four, the potential solution is chosen based on the generation of ideas presented in step three. A prototype is designed and made in three-dimensional form (Vande Zande, 2014). In step five, the prototype is presented to the focus group or customer. In this step, the focus group puts the prototype to use and begins to form reactions, opinions and feedback about the applied design. The designer takes notes on all experiences that their focus group or customer exhibited. In the last step, the designer evaluates and revises their applied design. The designer will reflect on how well they met the needs of their focus group or customer and establish and implement new solutions to improve their applied design (Vande Zande, 2014).

CHAPTER 3 METHODOLOGY

For this study, I implemented a qualitative methodology. I utilized one-on-one interviews and followed the applied design method created by Vande Zande (2014). I decided to make this study an autoethnographic study to afford myself the opportunity to focus on my experience as a fashion designer utilizing the applied design process to better prepare myself with encouraging my students to become better designers by focusing on meeting the needs of their clients.

Autoethnography is defined as “an approach to research and writing that seeks to describe and systematically analyze personal experience in order to understand cultural experience” (Adams, Bochner, & Ellis, 2011).

Timeline

The study of the implementation of adaptive pants for a child took place from November 2016 to March 2017, and I finalized my thesis at the end of March 2017. I submitted and received the initial completed questionnaires on November 6, 2016. Based on the questionnaires, I started the design of pants by creating three options of sketches. I also selected 2 fabric options. On January 22, 2017, I decided on the final garment design and fabrication. On January 29, 2017, I finished a pair of pants and gave them to the child to try on and test out the functionality of the pants. I asked the participant to complete in an informal interview after wearing the pants for three times. After conducting the interviews based on the evaluation questionnaires, I determined the findings of the study and completed the research study in March 2017.

Interview Program

I believe that adaptive clothing designs should meet the needs of the user by providing comfort, protection, and easy removal. The adaptive clothing should also offer values such as self-esteem, respectability, status and confidence. To ensure that the adaptive clothing meets the needs previously listed, I composed a list of essential questions that guided the interview (see Appendix A. for interview questions). The questionnaire was composed of questions that helped me determine Hayden's current experiences with his clothing. These questions were read to Hayden and explained in a way comprehensible to a child. These questions helped to identify areas of comfort or discomfort, favorable fabric traits and fit of a garment, which are all essential traits of an effective adaptive garment. It was important that these questions were answered so that the design of the adaptive garment suited Hayden's needs as best as possible. This questionnaire also provided a starting place for the design of adaptive pants.

Based on the interview, I identified the following undesirable traits of current clothing worn by Hayden: 1) Discomfort from back pockets and additional seams in back of pants, 2) Difficulty with dressing, undressing and going to the toilet, 3) Inability to take ownership of dressing. The fit of the pants rated very important while the trend and color of the pants rated at average importance. Desirable fits included a normal fit around the waist and ankle and a slightly loose fit around the knee, buttock, and crotch. The three most important clothing properties were abrasion resistance, soft and comfortable fabric, and warmth.

After all of the questions were answered, I allowed the floor to be open to Hayden so he could freely identify any specific concerns or desires that were not mentioned in the questionnaire. This qualitative information provided additional insight required to truly meet his needs. The concerns that were identified are as follows: 1) Current clothing did not tend to the

need of Hayden's sensitive skin and would irritate his skin, sometimes causing sores from the abrasive contact with dressing and undressing, 2) Waist is too low in the back and too high in the front because he is in the seated position. This fit causes discomfort in the front and inadequate coverage in the back. 3) Length of the pants were usually too short because they would not accommodate Hayden sustaining a seated position the majority of the day.

Limitations

This study is limited to my personal experience with adaptive clothing. The design concept for the adaptive pants derived from my personal choices. Other designers and personnel in the medical field may view the process of creating adaptive clothing differently. In this study, I worked with one child. Perhaps the use of a larger clinical study with more participants would yield more expansive results for creating adaptive pants as opposed to a personal study with one child. Although this study may reveal traits that could increase the suitability of adaptive clothing needs of one who is physically disabled, it may not be suitable for many physically disabled wheelchair bound individuals. Based on my experience and research on people with physical disabilities, it is difficult to generalize everyone. The needs of individuals who are physically disabled could vary greatly, although there are some common traits for those who are wheelchair bound.

Based on my experience and research, the consumer in the market to purchase adaptive pants for a youth child would be their parent. Parents in this market generally spend \$10.00 to \$30.00 for a pair of youth pants. Considering that the cost of my adaptive pants could range from \$132.00 to \$182.00, cost could be a deterrent. Adaptive pants would be considered to be a luxury

item and most likely would not be covered by the client's insurance. Potential solutions to cut cost could be to mass produce items and find inexpensive fabric alternatives.

CHAPTER 4 IMPLEMENTING THE DESIGN PROCESS

Based on the results of the interview, I designed a pair of pants that will meet Hayden's most important clothing needs. I implemented the following applied design process created by Vande Zande (2014): 1) Define the problem, 2) Investigate and research, 3) Generate ideas, 4) Make the prototype, 5) Present, and 6) Evaluate and Revise.

Define the Problem

The results from the interview allowed me to identify six essential problems that Hayden experiences with his current clothing: 1) Discomfort from additional seams and pockets in the back of pants, 2) Difficulty with getting dressed and undressed, 3) Front waist of pants were too high, back waist of pants were too low, 4) Length of pants were too short, 5) Fabrics of clothing irritated skin, and 6) Inability to take ownership of dressing. These essential problems may also be similar to other children that are wheelchair bound with SMA.

I learned that although Hayden is unable to take ownership of dressing himself in part because of his SMA disability, the lack of convenience with dressing and undressing due to clothing restrictions eliminates possible opportunities for him to be able to take ownership with dressing and undressing. Difficulty with getting dressed and undressed occurred because of the following: 1) the fitted waist of the pants were difficult to maneuver up starting from the feet and working upwards toward the waist. 2) Due to SMA, Hayden lacked lower body strength to assist with dressing, 3) Also due to SMA, Hayden has leg contractures in which his leg is postured in a fixed flexed position, due to prolonged improper positioning causing abnormal shortening of ligaments and tendons. Trying to accommodate a fixed, flexed extremity while getting dressed

creates discomfort for the Hayden, as the leg may get stretched while maneuvering pants past the legs.

Pant waists that are too high press against the armrest of the wheelchair causing irritation and abrasion. Pant waists that are too low, expose the lower back and can also create undesirable pressure points while seated in the wheelchair. Fabrics that are not soft, and that are thick and rough to touch, can cause abrasion and sores. This occurs often with blue jeans that have a stiffening finish and do not have a bleaching wash to soften the feel of the jeans.

Investigate and Research

During my interview with Hayden, I was shown two pair of his favorite pants. Two prominent styles that were shown are in Figure 1. and Figure 2.



Figure 1. Cargo Pants
Image from OldNavy.com



Figure 2. Polyester Snap Pants
Image from Adidas.com

I learned that Figure 1. was favorable because of its soft, elastic, stretchy waist and comfortable, 100% cotton fabric. The elastic waistband made it easier to pull the pants on the waist. The pants were also favorable because of their versatility and because they could be worn with almost any casual shirt and even button down dress shirt and penny loafers. The unfavorable traits of these pants were their back pockets, high front waist and low back waist, and the pant legs. Although the back pockets were thin because of the fabric, the back pockets could still be felt while seated which caused some discomfort. High socks also had to be worn with these pants to ensure that the lower leg portion would not be exposed while seated in the wheelchair.

Figure 2. was favorable because of its ease with dressing and undressing, soft polyester tricot fabric, and its elastic waist. The side seam of the pants has snap closures from the waist to the hem of the pants. With dressing, the pants are opened and unsnapped, Hayden is laid on top

of the pants, and then the pants are snapped on the sides. The side snap closures eliminate the discomforts from trying to pull the pants up from the feet to the waist. Some unfavorable traits of these pants were their athletic, sporty look. These pants can only be worn with an athletic shirt and athletic shoes. These pants are not as versatile as the pants in Figure 1.

Additional traits that were prevalent through researching adaptive pants for wheelchair bound users were the use of elastic waistbands, larger fit, zippered crotch openings, adjusted waist to accommodate the seated position, longer length, designs only in the front of pants with no yoke seams or pockets on the back of the pants, use of natural fibers such as cotton and wool, and no front zipper.

Generate Ideas

My goal in designing the adaptive pants was to combine the favorable traits of both pants in Figure 1. and Figure 2. as well as providing a solution to all of the problems. The essential traits that I decided to include in the pants are as follows: 1) A soft elastic waistband, 2) A natural fabric that is soft and durable with stretch, 3) A side seam opening from the waist to the hem, 4) Lower front waist, higher back waist, 5) Longer length and a slightly loose fit around the knees and buttock, 6) Versatile wear and 6) Design in the front of pants. The soft, elastic waistband covered by a ribbed knit cotton fabric will provide comfort and stretch around the waist. The natural, 100% cotton, woven, stretch fabric will provide comfort to the skin, and the stretch will help the fabric comfortably conform around the body in the seated position. I decided to go with khaki, a neutral color fabric with twill weaved pattern. The color and twill of the fabric provides desirable versatility allowing the pants to be worn with a button down dress shirt, a polo shirt, or a t-shirt. A lowered front waist and higher back waist accommodate being in the

seated position as well as longer length and a slightly loose fit around the knees and buttocks. A separating zipper on the side seam of each pant leg will provide ease to put on and remove the pants. A pocket design on the front of the pants adds a visual, desirable fashion element to the pants to fit in and be up-to-date with current clothing trends. Figure 3. is a technical illustration of the pant design.

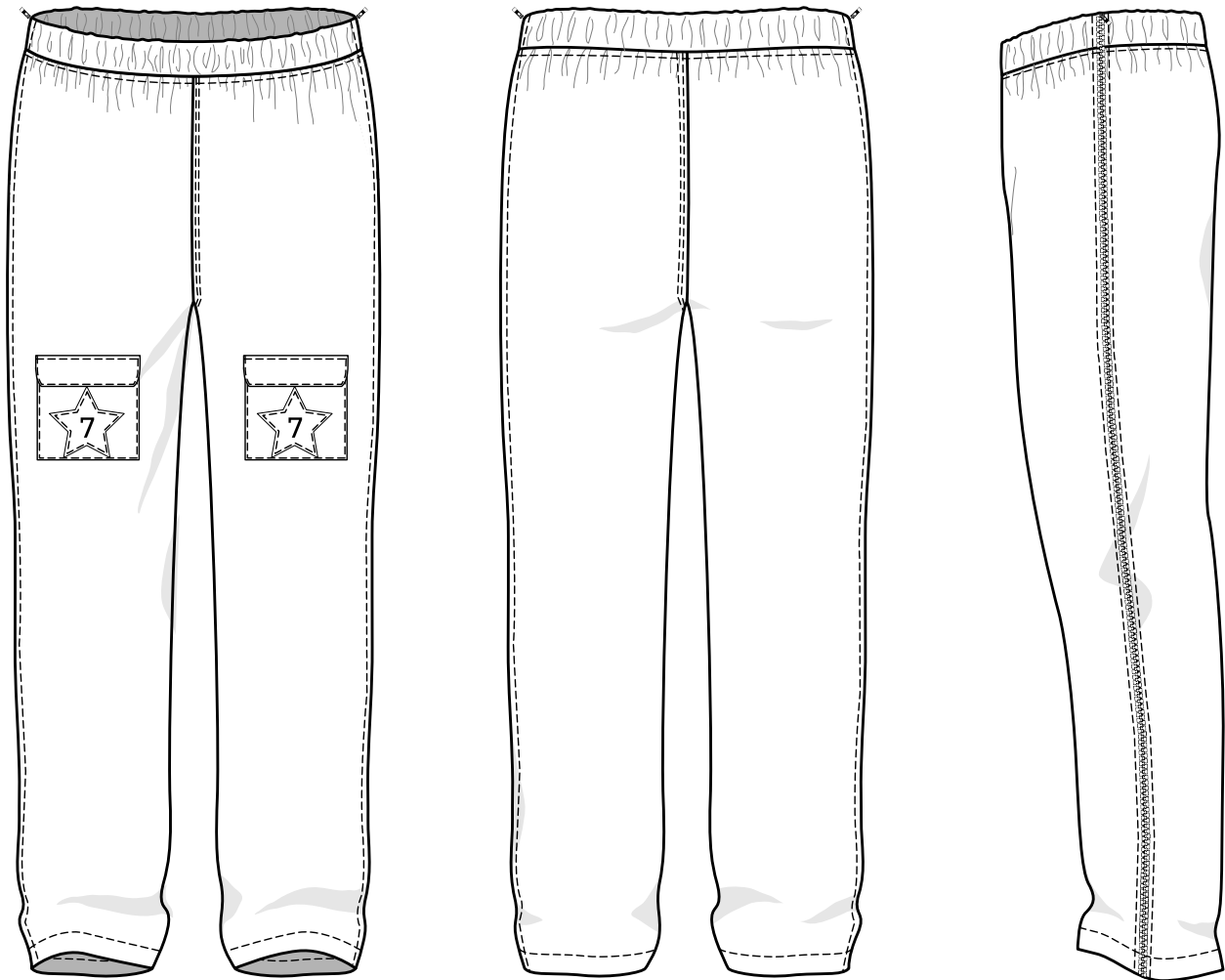


Figure 3. Technical Illustrations of Adaptive Pants

Make the Prototype

To make the prototype, I purchased a simple boy's pant pattern from Simplicity Patterns. I made adjustments to the waist, side seams, length, and fit of the garment. I also created a pocket design to be attached to the front of the pants. The following is a list of all things that were purchased to make the pants: 1) Simplicity Pattern \$2.00, 2) Brown and tan thread \$3.00, 3) One yard of khaki cotton, stretch fabric \$10.00, 4) One half yard of brown ribbed knit cotton \$3.00, 5) Two inch wide elastic \$3.00, 6) Two iron-on star appliques \$2.00, 7) Two brown 36 inch separating zippers, \$3.00, and 8) Bias tape \$6.00. The total cost for these items were \$32.00. It took two hours to adjust the Simplicity pattern to meet the adaptive needs and it took a total of eight hours to cut the fabric and sew the garment. Labor cost could range from \$100.00 to \$150.00 for seamstress who charge \$10.00-\$15.00 an hour. The total cost for these pants based on my fees as a seamstress and the cost of the materials totaled to \$132.00. The adaptive pants were gifted to Hayden as a token of thanks for his participation. The total cost for these adaptive pants could range from \$132.00-\$182.00. The following figures are images of the adaptive pant prototype.



Figure 4. Pant Front



Figure 5. Pant Back



Figure 6. Pant Side Zipped



Figure 7. Pant Side Unzipped



Figure 8. Pant Side Unzipped



Figure 9. Waist Details



Figure 10. Pocket Details



Figure 11. Garment on a Child

Present

After the pants were completed, I took them to Hayden and instructed him to wear the pants for a total of 3 days. I also explained in detail the best way to don the pants. The first step would be to lay the pants down with the backside of the pants facing the bed (or any other surface in which the wearer will be positioned for dressing). Next, the pants should be completely unzipped on both sides as shown in Figure 12.



Figure 12. Step One



Figure 13. Step Two

After the pants are unzipped and separated on both sides, each front pant leg should be rolled towards the inseam of the pants, creating one roll in the front center of the pants. This step is shown in Figure 13. Lastly, the top front of the pants should be folded down towards the center of the pants. This step is shown in Figure 14.



Figure 14. Step Three

At this step, Hayden can now lie down on top of the pants and his caregiver can easily lift the front waist of the pants, and unroll each pant leg on top of Hayden's legs and proceed to zipping the sides of the pants.

Evaluate and Revise

I evaluated the success of the adaptive pants based on conducting interviews with Hayden. I also utilized a list of questions to guide the interview between Hayden and I, but the interview was not limited to the questions on the questionnaire (see Appendix B. for interview questions). The interview process allowed Hayden to address pleasures and concerns that were not mentioned in the questionnaire. I hosted this interview after Hayden had worn the adaptive pants for three days. Based on my personal experiences with clothes, I am able to identify favorable and unfavorable traits the first time the garment is worn. I decided that three days would be sufficient for a child to become fully aware of favorable and unfavorable traits of a garment.

Based on the interview questions I learned the following about the adaptive pants garment traits: 1) Style, fit and comfort were all favorable, 2) The ability to dress and undress were very favorable, 3) The ability to boost confidence level rated as somewhat favorable, and 4) The ability to take ownership of dressing was somewhat favorable. Each category on the interview questions was of great importance to me and it was my goal to excel in every category. From my personal experiences, I have noticed that children from ages 8 to 17 often like to wear trendy clothes to fit in with their peers. This age group really takes value in being the most stylish and enjoys compliments on their clothing. Based on my research, the adaptive pants that I've seen were very basic in style and resembled clothes made for the elderly handicapped with a loose fit and simple elastic waistbands. Children aged from 8-17 don't usually wear plain elastic band pants. They tend to wear jeans or even cargo pants. Hence, this is why jeans and cargo pants are a popular pant styles for both boys and girls. Hayden really enjoyed how the pants looked with the pocket design on the front of the pants.

When I examined the first trial of Hayden wearing the pants, I immediately noticed that the waist was too big and it came up too high in the front. Although the waist was too big, the fit was good in the legs and buttock area, and the length was good as well. I will make the adjustments to the pattern by dropping the waist 1½ inches and taking the waist in on the sides a total of 3 inches. The back waist of the pants provided adequate coverage and the fit worked well in the seated position.

Considering that the waist of the pants were too high, the waistband of the pants being pressed against the armrest of the wheelchair, which caused some discomfort. Once the waist is adjusted, this discomfort should be eliminated. I learned that the pants felt comfortable while seated, without any additional seams or pockets on the back. Also, the fit was comfortable and loose around the knees and ankles. I decided to go with a looser fit for these pants to accommodate space for the side zipper.

The fabric had a high rating based on how it felt against the skin and for its stretch qualities. Considering that Hayden remains in the seated position the majority of his day, a soft, stretchy fabric that conforms to the body is a desirable trait for adaptive pants. In addition, the stretch of the pants helped work with moving around while in a bent position. The thickness of the fabric also provided warmth, but the pants remained dry and breathable while he remained seated. The ability to dress and undress was very favorable due to the ease of donning the pants. Putting these pants on was much more convenient than typical pants that must be pulled up from the feet to the waist.

When Hayden first saw the pants, he was immediately pleased with the style of the pants and couldn't wait to try them on. I noticed an immediate boost to his confidence level once the pants were on. Although Hayden has very weak upper body strength and fine motor skills, he

was able to help zip the top of the pants. This is the first time in a while that he was been able to assist with self-dressing. I noticed how it was a struggle to try to move the zipper due to weakness of fine motor strength. Based on these experiences, perhaps I could increase the ability to take more ownership with self dressing if the pants had side magnetic closures or if the pants had a larger zipper tab.

Throughout my conversation with Hayden and his caregiver, two additional important attributes were noted: 1) The front waist of the pants can be unzipped for an easy catheter change, and 2) The waist of the pants can be unzipped for easy trips to the restroom. With regular pants, discomfort arises from removing the pants down to the ankle as well as pulling the pants back up once he had finished using the restroom.

Overall, I will make the appropriate revisions to the waist of the pants and I will explore options with magnetic closures along the sides of the pants to help increase the ability to take ownership of self-dressing.

CHAPTER 5 REFLECTIONS, CONCLUSIONS AND IMPLICATIONS

Before Designing Adaptive Pants

On September 27, 2014, I was presented with the question, “What do you want to write your thesis on?” First thing that came to mind was that whatever I chose, it had to be something interesting and something in which I would sustain a continued interest. While brainstorming for ideas, I landed on the idea of somehow creating empathy for children with special needs. This idea stemmed from what I would witness quite often at work. During my first year of teaching, I had the honor to teach art to an early childhood special education (ECSE) class. Anytime my ECSE classes were aligned outside my class waiting to enter into my classroom, I would notice other elementary students laughing and making jokes about the students who were in ECSE. I believe one of the reasons the non-ECSE students responded this way was because they were neither informed about students in the ECSE class, nor did they possess empathy for ECSE students. I wanted to bring light to this situation and find a way for our students to learn to respond in love regardless of one’s disability. Considering that my young elementary students really take a strong interest in fashion, I decided to make a line of t-shirts. I believed that creating a line of ‘Empathy Inspired T-Shirts’ would be a great way to inform others about the feelings of people with disabilities. The t-shirts would have examples of empathy on the front such as arms hugging the shirt or holding hands, and the back of the shirts would have quotes given by students with disabilities such as “We are all the same” or “We deserve to be loved too.” Towards the end of designing and producing the t-shirts, I still was not pleased with what I accomplished. Although creating empathy was great, I wanted to make a greater, more significant impact on people with disabilities, something that would change their daily lives. I wanted to use my artistic and fashion design skills to better the quality of life for a disabled

child. Then it all came to me and I asked myself, “What about making adaptive clothing?” Knowing that my mother had daily contact with children with disabilities, I asked her, “Have you noticed any of your students wearing adaptive clothing?” She stated that she didn’t notice any of her students wearing adaptive clothes. In fact, she asked them and they all responded with a resounding, “no”. She told them that I was considering designing something specifically for children with physical disabilities that are wheelchair bound, and her two students were thrilled. They immediately described what they would want to wear and how they believed their design should be.

On January 12, 2015, I met with Hayden, a student that my mother suggested me to work with. During my visit, I was informed a great deal about Hayden’s disability with SMA. Although my mother briefly described the general facets of SMA was, I had a better understanding of SMA and its symptoms by conversing with Hayden and his mother. I remember keenly when I walked into their home, he was so thrilled that I had come over to design a pair of pants with him. In fact, he had already created his own design and even attempted to draw a picture of a pair of pants despite his struggles with fine motor skills. It was this feeling alone, brightening up someone’s day and making a positive impact on their lives and potentially the lives of other children just like him, that was the driving force for me to move forward with designing a pair of adaptive pants. At this point my thesis topic was final. Throughout the next year, I continued to complete the required courses for my master’s degree, but I would find myself still thinking about ideas for the adaptive pants. I kept in touch with Hayden and his mother and informed them that things were still scheduled to move forward with me designing a pair of adaptive pants. In fact, my mother mentioned that Hayden wouldn’t stop

taking about how he had a designer that was going to make him a pair of pants. The idea completely thrilled him, and he enjoyed telling anyone who would listen.

On August 29, 2016, I asked my mother how Hayden was doing. She informed me that he had been out of school due to surgeries and complications with SMA. This day I reached out to Hayden and his mother to extend my wishes of a speedy recovery and to uplift Hayden's spirits. When Hayden learned that I would be coming back to his home in two weeks, he was delighted. Since so much time had lapsed, both Hayden and his mother wondered if things were still going to proceed forward. I informed them that things were good to go, and I met up with them on October 15, 2016. It was so nice to see the two of them since it had been over a year since the last time we met. I noticed that Hayden had grown so much. I enjoyed socializing with him about school, toys, games and even his two girl crushes. I was a companion to him, something in which he takes great value considering that he had been homebound for a few months and didn't have much of a social life with his classmates that he would see at school. Just being with him uplifted my spirits. I witnessed so much joy and wit coming from such a small human being.

During the Design Process

On November 6, 2016, I met with Hayden again to start the design process of the adaptive pants. During this meeting, I asked questions regarding the survey. I noticed that he struggled to understand some of the questions and his mother had to intervene with responses. I really liked how he would interject and mention particular traits that he wanted or did not want to be included in the pants design. He made sure his voice was still heard.

After gathering information from the questionnaire and conversation that I had with Hayden and his mother, the design idea for the adaptive pants became quite easy for me. I knew that I wanted to mimic traits that Hayden had mentioned about his favorite pair of pants so I decided to make the sides of the pants have side zipper openings. While reflecting on the sketch that Hayden had drawn, I wanted the pants to have a cargo style with pockets. I noticed how Hayden loved the camouflage material so I wanted to incorporate that fabric design in the pants as well. I also like the camouflage print because it matches virtually anything that was paired with it. Only downfall to the camouflage print is that it is very casual and could not be worn with a dressy shirt or shoes.

On December 15, 2016, I drew out a simple sketch of the adaptive pants and made a list of all materials that were needed and I went shopping at 2 local fabric stores. At the first fabric store, I intended on buying as much as I could, then I would get the remaining items at the second store. While at the first store, I was disappointed that I was unable to find a cotton or cotton blend fabric with a camouflage print. I came across a khaki, stretch cotton twill in a section that housed fabrics used for suiting and dress pants. I chose to go down this aisle because it had wool and cotton fabrics that were suitable for pants. For the waistband of the pants, I wanted to include some visual contrast to make the pants visually appealing, so I decided to get a brown ribbed knit which perfectly matched the brown separating zipper that I had also found at the store. The zippers were just the perfect length for the pants. I noted that if I were making these pants for an older person or one who has longer legs, I would have had to order custom separating zippers or I would have had to use a regular zipper that did not separate. The length of the separating zippers at the fabric store stopped at 36 inches, and I needed 32 inches. While roaming through the aisles of the fabric store, I came across some camouflage appliques that I

believed would work well on the front pockets of the pants. This worked out great because I was able to include the camouflage print. In fact, not finding the camouflage worked better because the khaki cotton twill fabric could be worn casually or dressy. After purchasing these items, I then went to the second fabric store to buy thread, bias tape, elastic, and a pattern.

On January 7th, 2017, I began to adapt the purchased pattern to match the design of the adaptive pants. I decided to purchase a simple pants pattern and use this as a starting point because it saved time instead of drafting a pattern from scratch. The only downfall that I encountered with this pattern was that it did not show in detail how the pants would fit on a model. The fit includes the length of the pants, the width of the pant leg, and placement on the waist (lower waist, natural waist, high waisted). I decided to not make any adjustments to the fit of the pants before I adapted the pants to meet Hayden's needs. I dropped the front waist, lowered the back waist, added length to the pants, created a 2-inch waistband and designed a pocket pattern. After the pattern was adapted, I proceeded to lay the patterns on the fabric and cut out the pattern pieces.

On January 21, 2017 I started to sew the pants. All of the pattern pieces worked well with each other and the sewing process was smooth and easy. I noticed that the time to construct the pants took much longer than I originally anticipated. I had to consider finishing techniques throughout the entire process, which prolonged the construction of the adaptive pants. Altogether, I enjoyed the process as I saw my vision coming together in 3-dimensional form.

After the Design Process

As soon as the pants were finished, I noticed that the waist appeared to be much higher and wider than I wanted it to be. I decided to leave the pants as they were, and to make final

revisions based on the trial fit that I would have with Hayden. On February 4, 2017, I took the pants to Hayden for the 1st trial. He was elated to see his own custom pair of pants. He couldn't believe that I had really made them. He was so thrilled that he mentioned other things that he wanted to be made and also wanted me to teach him how to draw a few things as well. Once, he tried on the pants he was so happy with how easy it was to put the pants on. The only thing that he had an issue with was with the waist being too high in the front. I then realized that the waist of the original pant pattern was designed to sit at the natural waist of the wearer which is considerably higher than how young boys wear their pants low on their waist. I should have dropped the waist all together and then made the appropriate adaptive changes. Other than the issue with the waist, Hayden enjoyed the pants. He could finally help with dressing himself, and getting dressed was so much easier. To see that smile on his face and to witness a pair of pants positively changing someone's life made me feel like my main goal was accomplished. All that was left was to perfect the pants and seek out ways to get production started to make this type of impact to children like Hayden across the world.

Conclusions and Implications

Before I started this study, my intent was to determine what could be gleaned from my two research questions. In reference to my first research question, what can I learn by reflecting and analyzing my applied design process in developing a specialized garment? I have learned two essential components: 1) Reflection enables learning and thinking that helps to yield the best product and 2) Examining carefully in a methodical way, organizes the design process to best meet the goal. Reflection during this process enables me to consider things that that I might have normally overlooked. During this process, I reflected on my thinking, my decisions, my client's

thinking, actions, and decisions. All of these things were taken under consideration and applied to the process of developing the specialized garment. To best meet any goal, one must first organize their preliminary strategies. Utilizing the applied design process not only organized preliminary strategies, but it also gave a meaningful and organized step-by-step process to meet the main goal of designing a pair of adaptive pants for a child with SMA. In addition, the applied design process can be repeated during revisions to better meet the needs of the client.

In reference to my second research question, 2) What can I learn from my design process that can inform my teaching of applied design in my classroom? I have learned that applied design steps are so simple that they can be infused into my elementary art classroom. The idea of applied design brings purpose and meaning to a work of art instead of just enjoying a product for its aesthetically pleasing traits. At the elementary level, the art classroom is usually geared towards making artwork based on visual traits. Design is a great trait to help to develop within our students, but who says they can't develop those design skills by also making functional things? From my experience, it is rare that elementary art students are taught to create works of art that have a physical function. At the same time, we live in a world that craves visually pleasing works of art that function such as a cellphone, Nintendo, flat screen television, etc. I believe that our students should be taught in a way that allows them to both imitate and stimulate the growth of the world in which we live today that is filled with functional design.

Considering that this study is limited to my personal experience with one child, perhaps the inclusion of a larger number of participants of different sex would increase the outcome of making the concept of my adaptive better into one that might be more suitable for a larger array of children with SMA or other children that are wheelchair bound. Each child's disability may vary in which specialized inclusions could be considered for the adaptive pants. In addition, this

garment should be made available to others who are wheelchair bound and experience similar symptoms of patients with SMA.

Another implication designed to facilitate an increased positive outcome of adaptive pants would be to include medical personnel that specialize in working with clients who have SMA. Medical personnel's perspective and experience could provide critical insight on those less visible necessities that a designer or child participant might overlook. Based on my research, the in-depth research studies on adaptive clothing have been done by protective clothing research centers, fashion designers, and doctors. It is questionable whether large conglomerates such as clothing research centers, and fashion design houses would engage in the one-to-one contact (implicated in this study) needed to get a more microscopic view of the specific needs and desires of the wheelchair bound population.

Based on this study, I have identified two ways that applied design can be utilized in the classroom: 1) Applied design can be utilized as a means of creating empathy for children with disabilities by designing a functional product and 2) Applied design can be utilized to create a solution to a problem. I believe one of the best ways for students to be empathetic and informed about students with disabilities would be to give them an opportunity to see what it would be like if they had a disability. Students would first need to be around others with disabilities to begin to understand the daily life of a student with disabilities. Based on that experience, I would then have students to complete the first step of Vande Zande's (2014) applied design process, "define the problem". For example, an art student (Student A) may identify that another student (Student B) with Down Syndrome may throw tantrums. I would then have the Student A to investigate why Student B throws tantrums. Based on Student A's research, the student may learn that Student B throws fits because they struggle with communication. I would then have Student A to

research ways that people with Down Syndrome communicate. Student A would then need to move to step three of the applied design process and “generate ideas” on how they could help Student B enhance communication. Ideas could range from picture cards to audio recording sounds. For example, Student B could utilize picture cards as a way to communicate or Student B could press a button that plays an audio sound corresponding to their desires. Audio sounds could be the restroom, a laugh, a sad sound, a clapping sound, etc. Once Student A has generated ideas, they would need to finalize their thoughts and proceed to step four of Vande Zande’s (2014) applied design process, make the prototype. Perhaps Student A’s prototype would consist of five separate buttons that communicate a sound. Next, Student A would need to present the product to the teacher and to Student B. A trial period should be determined to ensure that the prototype is obtaining its proper use. Lastly, Student A would proceed to the final step, evaluate and revise the prototype. The example that I have given can be broken down into very simple forms with varying forms of assistance provided by the teachers. For example, a kindergarten would need a lot of teacher assistance and the entire class could act as Student A and create the same prototype. A fifth grade class would be more capable of greater independence and would probably simply need additional questions to guide them through the applied design process.

In addition, applied design can be utilized to create a solution to a problem. For example, a way to help generate ideas could be to ask students the following questions, 1) Is there something that you’ve wanted that has not been created? 2) Are there any problems you face or problems that you witness other people facing that you want to change? Identified problems could be as simple as markers drying out over time, not being able to erase a marker mistake, or backpack straps becoming detached because of wear and tear. Identifying the problem would be

the first step of the applied design process. Students would then proceed to the other steps of the applied design process and finalize their product.

To ensure that this lesson meets the needs of all students, I have determined ways in which students with intellectual disabilities can learn about empathy and apply what they've learned through applied design. For students with SID (severe intellectual disabilities) and PID (profound intellectual disabilities), empathy should be an experience brought to life. Students could participate in making an empathy shirt. On the shirt, there can be an image that visually represents empathy such as a hug, holding hands, or a handshake. These images can be printed or drawn on the shirts. A scent of musk can be added to the shirt to make it have a human smell. Each student and their paraprofessional should be assigned to work on a section of the shirt. For students with MOID (moderate intellectual disabilities), empathy can also be experiential by first discussing empathy. The teacher can discuss attributes about empathy such as how hugs really make people feel better when they're sad. Students could make a 'hug shirt' that would have their drawn or painted images of a hug on the front. The garment assemble steps should be broken down into small components as follows: 1) Sew the left side of the garment, 2) Sew the right side of the garment, 3) Turn the garment right side out, and 4) Paint or draw an image of a hug. Additional support will be needed from teachers with sewing techniques and cutting the shirt fronts and backs so student can sew them together. For students with MID (mild intellectual disabilities), empathy should be experiential by first playing a beach ball game with words written on it that tells what one can do to show empathy. Words such as hug, listen, etc. should be written on the ball and when students catch the ball, whatever the ball lands on, that person would build and empathy shirt reflecting their word. Applied design and the design thinking process is an essential part of any art education curriculum. Utilizing applied design in the art

classroom familiarizes students with the essentials of product design and it better equips them to become future designers, scientist and engineers and best of all, empathetic to the global diversities of the world at large.

REFERENCES

- Adams, T., Bochner, A., & Ellis, C. (2011). Autoethnography: An overview. *Forum: Qualitative Social Research, 12*(1), Retrieved February 19, 2017, from <http://www.qualitative-research.net/index.php/fqs/article/view/1589/3095>
- Annett-Hitchcock, K., & Xu, Y. (2015). Shopping and virtual communities for consumers with physical disabilities. *International Journal of Consumer Studies, 39*(2), 136-144.
- Arnold, W. D., Kassar, D., & Kissel, J. T. (2014, June 16). Spinal muscular atrophy: Diagnosis and management in a new therapeutic era. *Muscle & Nerve, 51*(2), 157-167.
- Binkley, C. (2016, July 6). A new range of clothing for people with disabilities; More inventors and designers, including Tommy Hilfiger, create 'adaptive' apparel that is easier to put on and take off. *Wall Street Journal*. Retrieved September 27, 2016, from <http://ezproxy.gsu.edu/login?url=http://search.proquest.com.ezproxy.gsu.edu/docview/1801943261?accountid=11226>
- Bowar, M. T. (1977). *Clothing for the handicapped: Fashion adaptations for adults and children*. Minneapolis: Sister Kenny Institute.
- Dimka, J., Kabel, A., & Mcbee-Black, K. (2016, March 05). Apparel-related participation barriers: Ability, adaptation and engagement. *Disability and Rehabilitation, 38*(22), 2184-2192.
- Downs, F. (2016, January). Veteran advisor: clothing change. *PN Online for Better Wheelchair Living, 50-51*. Retrieved October, 2016, from http://pvamag.com/pn/article/7282/veteran_advisor_clothing_change

- Fields, D. (2013, October/November). Adaptive apparel. *PN Online for Better Wheelchair Living*, 67(1), 8-13. Retrieved October, 2016, from <http://occupational-therapy.advanceweb.com/Features/Articles/AdaptiveApparel>
- Haney, J. P. (1905, December). The teaching of applied design. *PsycEXTRA Dataset*, 6(4), 179-191.
- Henne, J., Hobby, K., Jarecki, J., Y., McGraw, S., & Yeh, W. (2015). Understanding the experiences and needs of individuals with Spinal Muscular Atrophy and their parents: A qualitative study. *BMC Neurology BMC Neurol*, 15(1), 2-12.
- Jeppesen, J., Madsen, A., Marquardt, J., & Rahbek, J. (2010, February). Living and ageing with spinal muscular atrophy type 2: Observations among an unexplored patient population. *Developmental Neurorehabilitation*, 13(1), 10-18.
- Johnson, P., & Hopkinson, B. (Eds.). (2002). *New complete guide to sewing: Step-by-step techniques for making clothes and home accessories*. Pleasantville, NY: Reader's Digest Association.
- Kernaleguen, A. (1978). *Clothing designs for the handicapped*. Edmonton: University of Alberta Press.
- Langtree, I. (2016, February). *Adaptive Clothing: Adapted Clothes Information and Suppliers*. Retrieved October 9, 2016, from <http://www.disabled-world.com/assistivedevices/adaptive-clothing>
- Li, J., Wang, Y., Wu, D. & Zhao, M. (2013, July). Evaluation on an ergonomic design of functional clothing for wheelchair users. *Applied Ergonomics*, 45(3), 550-555.
- Prior, T. (2010, August). Spinal muscular atrophy: A time for screening. *Current Opinions in Pediatrics*, 10(6), 696-702. doi:10.1097

Rosenblad-Wallin, E. (1985, September). User-oriented product development applied to functional clothing design. *Applied Ergonomics*, 16(4), 279-287. doi:10.1016/0003-6870(85)90092-4

US Census Bureau. (2012, August). Disability. Retrieved November 16, 2016, from <http://www.census.gov/people/disability/>

Vande Zande, R. (2014, November). The design process in the art classroom: building problem solving skills for life and careers. *Art Education*, 72(4), 20-27. Retrieved December, 2016, from <http://www.jstor.org/stable/pdf/9929964.pdf>

APPENDIX A. AND APPENDIX B.

Appendix A. Interview Questions Before Adaptive Garment Design

1. How old are you?
2. How often do you use a wheelchair?
3. How long have you used a wheelchair?
4. Can you use the wheelchair independently?
5. What are some discomforts you experience with your clothing?
6. What are some traits that you enjoy about your clothing?
7. If you could design you own pair of pant, what would be the most important part of your pants?
8. According to the clothing you wear daily, rate the following on a scale from 1 to 5 with 1 being very inconvenient, 3 normal, and 5 very convenient.

Dressing and undressing	1	2	3	4	5
Going to the toilet	1	2	3	4	5
Bathing	1	2	3	4	5

9. According to the clothing you wear daily, rate the following qualities on a scale from 1 to 5 with 1 being very unimportant, 3 average, and 5 very important.

Trendy	1	2	3	4	5
Fit	1	2	3	4	5
Color	1	2	3	4	5

10. According to the clothing you wear daily, rate the clothing fit for your particular body parts on a scale from 1 to 5 with 1 being very loose, 3 normal, and 5 very tight.

Torso	1	2	3	4	5
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Waist	1	2	3	4	5
Knee	1	2	3	4	5
Ankle	1	2	3	4	5
Buttocks	1	2	3	4	5
Crotch	1	2	3	4	5

11. According to the clothing you wear daily, please choose the three most important clothing properties and rate them from 1 to 3 with 1 being the most important and 3 being the 3rd most important property.

Soft and comfortable _____

Water absorbent and air permeable_____

Easy cleaning and quick drying_____

Abrasion resistant_____

Able to keep warm_____

Bacterial resistant_____

Wrinkle resistant_____

Appendix B. Interview Questions After Adaptive Garment Design

1. According to the adaptive pants, rate the following clothing qualities on a scale from 1 to 5 with 1 being very unfavorable, 3 average, and 5 very favorable.

Style	1	2	3	4	5
Fit	1	2	3	4	5
Comfort	1	2	3	4	5
Fabric	1	2	3	4	5
Ability to dress and undress	1	2	3	4	5
Ability to boost confidence level	1	2	3	4	5
Ability to take ownership of dressing	1	2	3	4	5

2. According to the adaptive pants, what do you like the most?
3. According to the adaptive pants, what do you like the least?