Multi-Sensory Room Usage in Medium-Sized Elementary Schools in Western PA: A Case Study

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Belinda Nuth Sloboda

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Slippery Rock University of Pennsylvania

Department of Special Education

A Dissertation Written By

Belinda Nuth Sloboda

Bachelor of Science in Interior Design, Indiana University of Pennsylvania, 1995

Master of Science in Interior Architecture, Chatham University, 2007

Doctorate of Education in Special Education, Slippery Rock University of Pennsylvania

2022

Approved by

Robert Isherwood 4-13-22

Dr. Robert Isherwood, Dissertation Committee Chair Date

4/13/22

Dr. Anne Rose, Committee Member Date

Karen Scarton 4-13-22

Dr. Karen Scarton, Committee Member Date

Accepted by

A. Keith Dils 4/28/22

Dr. Keith Dils, College of Education, Slippery Rock University of Pennsylvania Date

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ABSTRACT

Are multi-sensory rooms the new fad or are they necessary spaces for special education students? This question frequently comes to mind when talking to people outside of the education system. Oftentimes, these rooms receive little consideration when space planning a new school. Instead, any extra room or space that has not already been allocated becomes the multi-sensory room. This often does not allow for proper space planning for the needed sensory aids. The multi-sensory room also may be situated in an undesired location within the school that may be distracting. These undesired adjacencies include the lunchroom, auditorium, and gymnasium.

Due to this uncertainty of room placement during the design phase of building, a mixed-methods study was conducted to analyze current multi-sensory rooms. This allowed the researcher to examine how well the rooms function for the students and teachers who use them. The mixed-methods study consisted of a Qualtrics survey and in-person interviews with special education teachers. These teachers were from five elementary schools within the same district in Western Pennsylvania.

Results of the study indicated that even though multi-sensory rooms were necessary for the special education students' daily schedule, teachers often supplemented their students' sensory needs with aids in the classroom. The rooms housing the multi-sensory rooms were generally located in unideal positions within the school; some were adjacent to high activity areas such as the cafeteria and gymnasium, whereas others were out of the way for convenience. These results, as well as their implications for future research and practice, are discussed.

DEDICATION

I would like to dedicate this dissertation to and thank my husband, Brian, and my children, Chiara, Santino, and Luciana, for their tireless support during this endeavor.

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I would like to acknowledge and thank my dissertation chair, Dr. Robert Isherwood, for giving me a chance to intertwine interior design with special education. It is amazing that the selection a proper wall color, ceiling material, or lighting can help children with special needs flourish in a classroom. This seldom touched area of design needs to become normalized so those with special needs can benefit from the entire space, not just the learning and sensory aids placed within it.

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CHAPTER 1 INTRODUCTION

Imagine attending school and struggling to concentrate. Instead, you are preoccupied with the subtle flickering of the fluorescent lights and the noisy children playing in the nearby gymnasium. You start to feel anxious and need something to soothe you but are unsure what will help. A short visit to the multi-sensory room, or MSR, could help neutralize these annoying distractions by allowing you to satisfy your sensory needs. An MSR is an artificially created area containing equipment and materials designed to stimulate the senses through light, sound, touch, and smell (John, 2017). Once the anxiety subsides and you are relaxed, you can return to class and continue with your learning. A well-designed multi-sensory room can help a student with special needs in many ways. Unfortunately, there has been little research conducted on the importance of space planning and design regarding helping people with autism spectrum disorder (ASD) or sensory processing disorder (SPD).

Multi-sensory rooms are an important part of a special needs student's day and should not be an afterthought once the school is built. Their placements should be carefully considered during the pre-planning phase of construction to limit the students' disruption and time spent outside of the classroom. According to D. Pry and C. Nichols (personal communication, May 4, 2021), these rooms unfortunately are placed in an unused classroom or space that is left over once the other needs are met.

Ideally, multi-sensory rooms should be located near all special education classrooms and any general education classrooms that may use them. Most schools separate multi-sensory rooms while others incorporate their essential elements into the existing classroom space. The existing classroom space is beneficial because students can satisfy their sensory needs without leaving the classroom, and they do not need a paraprofessional or aide to take them to a multi-sensory room

in another part of the school. They can still hear the teacher and be part of the learning by remaining in earshot.

Statement of the Problem

When designing spaces for individuals with various disabilities, specific design strategies can be employed to create optimal spaces that positively impact special learning and sensory needs. Since little research has been conducted on the importance of this special space planning, individuals who fall within the autism spectrum or have sensory issues are at a disadvantage compared to the general student body.

Current research shows an increase in multi-sensory rooms in almost every school, but little empirical knowledge exists to base the MSRs design upon. A spare room or extra-large closet is often used to house the multi-sensory room, which is an afterthought and not prudent to putting a student's needs first. Then the special education teachers and administrators outfit the room with affordable sensory aides that will fit within the space. Instead, the multi-sensory room should be part of the pre-planning phase and incorporated into the actual space planning of the school. Proper adjacencies should be adhered to as well as room placement and size constraints. This study examines how staff utilize multi-sensory rooms and their products to provide empirical research into the best practices for space planning multi-sensory rooms and incorporating them into all-inclusive classrooms.

Background of the Study

Interest in this area of design started with a case study about a child who had a difficult time functioning efficiently in his home. An interior designer helped situate his bedroom into certain task areas. The task areas included an area for dressing, for decompressing, for schoolwork, for sleeping, and more. The task areas helped bring order to his otherwise chaotic

life and his behavior changed for the better. He was able to function on a typical development scale and had less frequent outbursts. The child's parents attributed these positive changes to his physical environment (Paron-Wildes, 2013).

Interest was then piqued during a discussion with M. & B. Biskup (personal communication, June 15, 2021) about their special needs son who suffers from multiple disabilities, including gross physical and intellectual challenges. The parents use sensory devices to help bring him out of his otherwise coexistence with only himself. They credit the usage of these sensory aids in helping him advance cognitively further than they previously thought he was able.

Purpose of the Study

The purpose of this study is to determine the best layout for a multi-sensory room and to find ways to incorporate various sensory elements into general classrooms. It examines the effectiveness of multi-sensory rooms and whether the attributes can be designed into the standard classroom for truly integrated and inclusive education for all.

Research Questions

While empirical research is available concerning the benefits of multi-sensory rooms, it is limited (e.g., Ayer, 1998; Carter & Stephenson, 2012; William, 2011). Information on the best layouts of MSRs is mostly subjective and found on special needs products manufacturers' websites but is not reinforced with scholarly research (Experia, n.d.; Multi-sensory rooms, n.d.; Sensory university, n.d.). The research questions this study examines are:

1. *How are the multi-sensory rooms used?*
2. *What elements are most beneficial?*
3. *Which layout works best?*

The rationale behind these questions is to find what is working, and what is not, pertaining to functional multi-sensory rooms.

Description of Terms and Phrases

Vocabulary

Autism. Autism is a lifelong developmental disability that affects how a person communicates with and relates to other people. It also affects how they make sense of the world around them. People with autism may also experience over- or under-sensitivity to sounds, touch, tastes, smells, light, or colors (Martin, 2016).

Asperger's syndrome. A form of autism, people with Asperger's syndrome are often of average or above-average intelligence. They have fewer problems with speech but may still have difficulties understanding and processing language (American Psychiatric Association, 2013).

Autism Spectrum Disorder (ASD). Autism is sometimes referred to as autism spectrum disorder. The word 'spectrum' is used because, while all people with autism share three main areas of difficulty, their condition will affect them in very different ways (Martin, 2016).

Sensory Processing Disorder (SPD). A person with a sensory processing disorder finds it difficult to process and act upon information received through the senses, which creates challenges in performing everyday tasks (Kranowitz, 2006).

Attention Deficit Hyperactivity Disorder (ADHD). Attention deficit hyperactivity disorder is a behavioral disorder characterized by symptoms of inattention and/or impulsivity and hyperactivity.

Pervasive Developmental Disorders (PDD). Pervasive developmental disorders refer to a group of disorders characterized by delays in the development of socialization and

communication skills. Other types of PDD include Asperger's syndrome, childhood disintegrative disorder, and Rett's syndrome (American Psychiatric Association, 2013).

Profound and Multiple Learning Disabilities (PMLD). People with profound and multiple learning disabilities have more than one disability and are categorized mentally as having an IQ of less than 20 (Moir, 2010). People with PMLD will have:

- A profound learning disability
- Difficulty in communicating
- High levels of support
- Behaviors that challenge us

Severe Learning Disabilities (SLD). Severe learning disabilities are categorized mentally as having an IQ between 20 and 50 (Moir, 2010).

Moderate Learning Disabilities (MLD). Mild or moderate learning disabilities are categorized mentally as having an IQ between 50 and 70 (Moir, 2010).

Self-Stimulating Behavior (SSB). Abbreviated to "stimming." This is a means by which a person provides themselves with sensory stimulation characterized by maladaptive behavior, which features repetitive body movements or movement of objects to stimulate the senses. These may include head banging, hand flapping, skin scratching, or vocal sounds such as grunting, just to name a few (Smith, 2018).

Snoezelen. Rooms originally used to provide relaxation, often interchanged for multi-sensory rooms/environments (Snoezelen, n.d.).

Multi-Sensory Environment (MSE). Interchanged for multi-sensory room

Multi-Sensory Room (MSR). Interchanged for multi-sensory environment

Vestibular. This provides the physical sense of balance in our lives by providing information about movement, gravity, and changing head positions. It tells whether we are moving or still, as well as the direction and speed of our movement. We may even tell whether we are vertically or horizontally positioned, even with our eyes closed (Scott, 2009).

Proprioception. This is how your brain can sense your body, its position, and its movement through space. We often overlook this sense because it is only subtly distinguished from movement. Without sensory information coming in from our muscles, we would be unable to monitor and correct our paths of motion. Children who are clumsy, uncoordinated, and sensory seeking are often experiencing proprioceptive dysfunction. These children often self-regulate by engaging in behaviors that provide proprioceptive input such as toe walking, crashing, running, or flapping (Scott, 2009).

Sensory Integration (SI). The process by which your brain interprets the things you see, feel, smell, hear, or taste, and then instructs your body to respond. Sensory Integration treatment is rich in vestibular, proprioceptive, and tactile inputs (Ayres, 1979).

Hypersensitivity/Sensory Overload. This is the inability to process or manage the amount or intensity of sensory stimuli, frequently observed with autism spectrum disorders, dementia, and other mental health challenges. This can lead to "sensory avoiding" in which individuals avoid sensory input because it is too overwhelming (Kranowitz, 2006). Behaviors associated with Hypersensitivity/Sensory Overload include:

- Irritability, anxiety, restlessness
- Anger, aggression, violence
- Fatigue, sleeplessness
- Reduced abilities

- Hallucinations, illusions, disorientation
- Tension, stress, anxiety, frustration
- Coping behaviors

Hyposensitivity/Sensory Deprivation. The opposite of hypersensitivity, this undersensitivity can lead to "sensory seeking" behavior. Individuals may look for more sensory stimulation because their bodies lack this need (Kranowitz, 2006). Behaviors associated with Hyposensitivity/Sensory Deprivation include:

- Rough housing with others
- Being undersensitive to or having a high tolerance for pain
- Constant touching of objects
- Need for physical contact or pressure

Occupational Therapist (OT). The role of an occupational therapist is to work with a client to help them achieve a fulfilled and satisfied state in life using purposeful activity or interventions designed to achieve functional outcomes which promote health, prevent injury or disability and develop, improve, sustain or restore the highest possible level of independence.

Speech & Language Therapist (SLT). Speech and language therapists work with parents/caregivers and others to provide treatment, support, and care for children with speech and/or language difficulties, communication, or eating and drinking difficulties.

Significance of the Study

While researching this topic, information was continually found on multi-sensory rooms and the importance for children with ASD and SPD. Multi-sensory rooms (MSRs) have become the newest "fad" by creating exciting and invigorating environments for children with various disabilities to decompress and learn skills (Zarling, 2017). However, these rooms can be very

costly and are not inclusive of all students while providing isolation for disabled students. Ideally, a properly designed space should be able to incorporate specific considerations to help students with disabilities function efficiently in the space alongside their able-bodied peers. They should not have a reason to "escape" because their needs are being met (Cooper et al., 2007). These design attributes will not only benefit every student, but teachers and learning support staff as well. Improved acoustics, material selection, spatial layout, and the use of color psychology will provide educational benefits to everyone using the space (Sanchez, Vasquez, & Serrano, 2011). The best way to research this is to understand what works well in the MSRs to incorporate some elements into an all-inclusive classroom.

The following chapter is the literature review, which will delve into the research concerning the benefits, usage, and design elements of MSRs. In addition, the methodology chapter discusses the research design and methods used for data collection and analysis of this mixed-methods research design.

CHAPTER 2 LITERATURE REVIEW

This literature review aims to analyze the research of several past studies and discover research also uncovers which layouts are most conducive for student improvement. It focuses on the benefits and usage of multi-sensory rooms to determine the best layout and find ways to incorporate some of these elements into general classrooms.

Everything we see, taste, hear, smell, and touch is regulated by our brain, which creates and regulates responses to these sensory experiences. This link is known as sensory integration (Stewart et al., 2009). For most people, this is a normal occurrence that happens during young childhood development. Conversely, for a child with a developmental disorder, such as autism, there could be feelings of distress and discomfort due to the way their brain processes these sensory experiences (Kranowitz, 2006).

Sometimes, the mentally challenged brain may overreact while other times it may underreact to these sensory stimuli. Since our sensory experiences expand past the five basic senses, this overreaction or underreaction can negatively invoke the little-known proprioceptive and vestibular sensory systems (Stewart et al., 2009). When a child cannot regulate sensory stimuli from any of these sensory systems, it is known as a sensory processing disorder. Oftentimes sensory processing disorders cause many negative behaviors, which could include rocking, acting out, meltdowns, and fighting, and information development and processing problems (Kranowitz, 2006).

One way to overcome sensory problems is using a multi-sensory room, which has become popular over the last decade. This is a safe space that offers a place for students to confront their sensory issues and decompress when needed. Ultimately, these students will be able to cope with ostensibly normal experiences (Haegele & Poretta, 2014).

A multi-sensory room is a space designed to help a child with sensory issues learn to cope with their brain's negative responses to external stimuli. The MSR may be an entire room, or a quiet corner of a more spacious room. Ideally, the design elements and products offered should be tailored to each child's sensory needs. Children have different sensory issues so a space that can incorporate materials to help with all their sensory needs will be beneficial to help them cope with the outside world.

This chapter will provide insight into existing research concerning MSRs. The literature analysis is broken into four main sections: a diagnosis, the history of multi-sensory rooms, effectiveness of usage, and integrated design solutions.

A Diagnosis

Autism Spectrum Disorder (ASD)

Autism and ASD have been around for years. As early as 1943, a doctor named Leo Kanner observed children with distinct behaviors, such as lower cognitive levels, trouble interacting with peers, repetitive behaviors, and difficulty developing speech (Historical perspective, n.d.). These are all characteristics of what we now call autism. However, back then the children were diagnosed with mental retardation. Around the same time, another doctor named Hans Asperger observed children with similar behaviors, but with much higher cognitive levels. These children could speak fluently and could function effectively in the community. This was the beginning of the diagnosis of Asperger's syndrome.

The American Psychiatric Association merged four different autism diagnoses under a single umbrella diagnosis of autism spectrum disorder (ASD) in 2013. ASD is a term covering the many subgroups within the spectrum of autism. These diagnoses include Asperger syndrome, autistic disorder, pervasive developmental disorder-not otherwise specified (PDD-NOS), and

childhood disintegrative disorder (American Psychiatric Association [APA], 2013). Since the range is quite large, some sufferers may be able to live mostly independently, whereas others may require lifelong care. According to the *Diagnostic and Statistical Manual of Mental Disorders*, 5th ed. (APA, 2013), people with ASD have certain characteristics that help to distinguish the diagnosis from other disabilities. These include repetitive behaviors, limited interests, communication difficulties, the inability to function properly in most areas of life, and difficulty interacting with other people. Autism is believed to be present at birth and is usually evident by three years of age. Prevalence is 4 to 5 times higher in boys than girls (Centers for Disease Control and Prevention [CDC], 2016).

Autism diagnosis has increased over the years. In 1992, the prevalence was 1 in 150 children and increased to 1 in 68 in 2012 (CDC, 2016). According to the Centers for Disease Control and Prevention (2016), autism affects an estimated 1 in 54 children in the United States today. This increase can be attributed to a broadened definition of autism, better diagnostic procedures, wider awareness of the disorder, or parental preference for the autism label over other disability labels. Conversely, some studies suggest that there are more children with the disability than in previous decades (Scheuermann et al., 2017). Autism diagnosis is continually evolving, and advancements are being made constantly. Ultimately, autism is a common disability amongst students and needs to be addressed fully.

Since no two cases of ASD are alike, it produces a challenge when designing shared interior spaces such as classrooms and MSRs. Everyone has different symptoms, sensitivities, and levels of functioning, thus being referred to as a spectrum disorder. McAllister (2010) states that environments for individuals on the spectrum should prepare them for the challenges and problems they will face in everyday life: “Cocooning the ASD pupil from all external factors

will not necessarily help them reach their full potential in life" (p. 3). Therefore, designers should not overly cater to users with ASD and create unrealistic environments that will leave them unprepared to face the standard environments of other classrooms (Gaines et al., 2016). Individuals with ASD are either hypo-sensitive or hyper-sensitive to certain information pertaining to smell, sight, taste, sound, or touch. There are also instances of hyper- or hypo-sensitivities in vestibular movement and proprioception, or the ability to sense the position of the body in space. Hypo-sensitive cases appear to be under-responsive, as if certain sensory information goes unnoticed or certain senses are impaired. Hypo-sensitive cases are often qualified as "sensory-seeking," meaning they often create or generate their own sensory experiences either for pleasure or to block out other unpleasant stimuli. Conversely, hyper-sensitive cases are over-responsive to sensory stimuli. Children with hyper-sensitivity can be easily overwhelmed by incoming sensory information. The environment can be terrifying at times because loud or sudden noises feel physically painful to hyper-sensitive individuals. Some experts believe that individuals with Asperger's syndrome experience this kind of sensory overload more than other individuals on the spectrum. Table 1 illustrates examples of symptoms that students with ASD may have.

One individual on the spectrum reported a similar dilemma in that he was unable to use more than one sense at a time - "Most people have a mind like a flashlight, with an area of high focus, and a larger area of partial awareness; my mind is more like a laser pointer, that highlights only a single small dot" (Jones et al., 2009, p. 116). Due to these idiosyncrasies, individuals with ASD have difficulty focusing in a general classroom. They often need a break to decompress and seek out their sensory needs (Oglesby et al., 2017). Multi-sensory rooms help fill this need and are a necessary attribute for schools with students with disabilities.

Table 1

Hypo- and Hyper-Sensitive Symptoms of ASD

Sense	Hypo-Sensitive	Hyper-Sensitive
Auditory (Sound)	Does not respond when name is called; Enjoys strange noises	Overly sensitive to loud noises; Appears to hear noises before others
Tactile (Touch)	Touches people and objects unnecessarily; Has abnormally high pain threshold	Avoids wearing certain fabrics; Does not like being wet or going barefoot
Visual (Sight)	Disregards people or objects in environment; Sees only outlines of objects	Bothered by bright lights; Stares at certain people or objects; Easily distracted by movement
Vestibular (Motion)	Moves around unnecessarily; Enjoys spinning in circles	Seems unbalanced; Distressed when upside-down
Olfactory (Smell/Taste)	Some aspects of Pica, or eating non-food substances	Picky eater; Will only eat foods with certain textures
Proprioception (Sense of body's location)	Unaware of body position in space (leans against people) and body sensations like hunger	Odd bodily posture; Difficulty manipulating small objects

Note. Adapted from the *Designing for Autism Spectrum Disorders* book (Author: K. Gaines et al., 2016, p. 5).

Sensory Integration and Sensory Processing Disorder (SPD)

Sensory integration originated with Dr. A. Jean Ayres in 1972. Ayres was an occupational therapist who examined the connection between the sensory processing systems and their impact on a child's ability to learn and perform (Ayres, 1979). She defines sensory integration as "the neurological process that organizes sensations from one's body and from the environment and makes it possible to use the body effectively within the environment" (Ayres, 1979). In layman's terms, sometimes one or more senses are either over- or under-reactive to

stimulation. This could result in behaviors such as spinning, rocking, and hand-flapping. Temple Grandin relates the distress and relief of her sensory experiences in her article, "My Experiences as an Autistic Child" (1984). The following excerpt explains her tactile issues and how she overcame them:

> When I was 5 years old, I craved deep pressure and would daydream about mechanical devices which I could get into and be held by them. I liked wrapping myself in a blanket or getting under sofa cushions, but that did not apply enough pressure. I wanted more pressure. At the age of 8 I liked to wear cardboard posters like a sandwich because I enjoyed the pressure of the boards against my body…At the age of 18 I built a squeezing machine. It took a long time to learn to accept the feeling of being held and not try to pull away from the squeezing machine. I could barely tolerate being touched, and I would stiffen up, flinch, and jerk away. One day about twelve years ago, Siamese cat's reaction to me changed after I had used the squeeze machine. This cat used to run from me, but after using the machine I learned to pet the cat more gently and he decided to stay with me. I had to be comforted myself before I could give comfort to the cat. (Grandin, 1984, p. 151)

Contrary to popular belief, there are seven sensory systems in our bodies, not just the five commonly known. They include auditory (sound/hearing), visual (sight), olfactory (smell), gustatory (taste), tactile (touch), vestibular (movement), and proprioception (input from muscles and joints). Sensory Processing Disorder (SPD) is a neurological disorder that causes information processing difficulties from these senses (Kranowitz, 2006). For those with SPD, sensory information is sensed, but abnormally perceived. That can cause distress and confusion in the way the brain inadequately processes the information. These seldom discussed sensory

systems are critical for our body to relate to the world around us. For example, a child suffering from proprioceptive overresponsitivity may have trouble using the stairs, does not like being touched, and is picky about certain foods. They would benefit from being squeezed tightly, receiving massages, and doing heavy work (such as lifting boxes). Conversely, a child who suffers from proprioceptive underresponsitivity may have trouble chewing on objects, using too much force in everyday activities, walking loudly, and body unawareness. They would benefit from stretching, chewing gum, kneading dough, or squeezing stress balls.

When considering vestibular input, it is slightly different from the proprioceptive input just discussed. For example, when a child is suffering from vestibular overresponsivity, they may be scared to move their body, afraid of the stairs, appear clumsy, and not liked being picked up. Some activities to combat that would be swinging, spinning, dancing, and focusing on games that move their bodies. On the contrary, vestibular underresponsivity causes children to constantly be moving; they may be excellent at movement activities such as gymnastics, impulsive by taking risky chances, and found to be running or hanging upside down. Activities to balance this would include jumping on a trampoline, swimming, and riding a bike.

Unfortunately, SPD is not listed in the *Diagnostic and Statistical Manual of Mental Disorders*, 5th ed. (APA, 2013) so sufferers have issues with insurance covering treatments for this disability. However, it is noted that SPD is usually found in conjunction with other disabilities, such as ADHD or ASD so treatment can be covered along with the other disability (Kranowitz, 2020).

Autism and Sensory Issues

In 2016, the STAR Institute for Sensory Processing Disorder was formed from two organizations that merged: SPD Foundation and STAR Center. STAR Institute for SPD provides

"premier treatment, education, and research for children, adolescents, and adults with SPD" (STAR Institute, 2020). It is estimated that 75% of children with autism have significant symptoms of sensory processing disorder. However, most children with SPD do not have autism. ASD and SPD are not the same, but they are very similar. Both are brain-based differences, neurological conditions that affect a child's development. Moreover, SPD is like ASD in that it does not suggest a reduced level of cognitive ability. It merely means that the brain is misinterpreting some sensory signals. Even those with high levels of functioning deal with sensory difficulties.

Children with autism can have sensory processing dysfunction manifest in many ways. Some of these include language delays, fine and gross motor delays, strong sensory interests and aversions, an inability to interact with people and stay within an interaction, and repetitive sensory stereotypes. There is also evidence that social engagement is made even more difficult by sensory processing deficits. Some individuals with ASD show that a sensory distraction in the environment can cause them to miss a social cue, making the current situation more confusing and stressful (Gaines et al., 2016). Often, children may avoid social interaction, especially in larger groups, because they fear unwanted tactile contact or want to avoid uncomfortable volume levels if they have auditory sensitivities.

Stewart's (2009) study focuses on sensory characteristics in ASD and finds that participants with ASD notice sensory combination difficulties. The study provides "personal vignettes that include examples of difficulty in the reception and processing of information from vision, sound, taste, and smell, and difficulties processing information from more than one modality concurrently" (Stewart, 2009, p. 109). One participant's description makes a stark realization on the severity of these cases:

> I have a definite problem. When I am concentrated on the sound, I felt my eyes and nose shutting off. I could never do everything together at the same time. That is, I could not see you and at the same time hear you. The result was knowledge of a fragmented world perceived through isolated sense organs. (Stewart, 2009, p. 109)

Self-Stimulating Behavior (SSB), a.k.a. "Stimming"

Self-stimulating behavior can be found in most individuals, not just the mentally impaired. Many people fidget during long meetings, tap a pencil on their desk, pace while waiting, or hum to themselves. These stimming behaviors can be seen daily and usually arise when people are nervous, anxious, or bored. However, it becomes an issue when these behaviors are self-injurious or interrupt others. Research has not found a specific reason for stimming behavior. Some think the pleasure received by this behavior results from beta-endorphins being released from the brain, which produces dopamine in the central nervous system (Sandman, 1988). Another theory suggests that stimming counteracts a lack of sensitivity by stimulating the sensory system, as seen in sensory processing disorder. Lastly, Smith (2018) suggests that stimming simply has a calming effect by focusing attention away from an overwhelming experience. These behaviors can provide comfort to people, specifically those with autism, and vary in type and intensity (Smith, 2018).

Stimming can include the use of all senses, not just vestibular, which most people think of when discussing maladaptive behaviors such as head banging. Some examples of stimming (Sandman, 1988) include:

Auditory. The sense of hearing and sound which could consist of humming, shrieking, or grunting.

Olfactory. The sense of smell and taste which could be comprised of sniffing or smelling objects and/or people, licking, and placing items in the mouth.

Tactile. The sense of touch, which could involve skin-scratching with hands and/or objects, finger tapping, and hand movements such as clenching fists.

Visual. The sense of sight, which could include staring at objects, object placement, hand flapping, and repetitive blinking.

Vestibular. The sense of movement and balance, which could incorporate rocking, pacing, and spinning.

Stimming itself is not dangerous behavior, but can have adverse social, emotional, or physical effects among individuals. It can interfere with learning by diverting attention away from the teacher or discouraging positive social interaction due to other students' unfamiliarity with these coping skills. People often misunderstand the reason for these behaviors and can feel upset, distracted, or even frightened when in the presence of a person employing them. Unfortunately, this can result in social isolation for the affected individual or lead to other maladaptive behaviors if suppressed (Shapiro et al., 1997).

When stimming is used as a coping mechanism, it is best to find a positive replacement behavior instead of abruptly removing it. For example, instead of biting or chewing a finger, replace it with chewing gum or biting a safe object (Smith, 2018). Another example for reducing fist clenching or scratching could be using a squeeze toy to mimic the feeling. Reducing these negative behaviors can also be achieved by using a multi-sensory room and its various objects. For example, if a student needs vestibular input, instead of rocking in his or her desk chair, a short trip to the MSR could fulfill that need. They may be able to rock in a chair, swing, or move

freely without interfering with the other students' learning. Then they can return to the classroom focused and ready to learn.

History of Multi-Sensory Rooms (MSR)

MSRs were first used in the 1970s by Jan Hulsegge and Ad Verheul. They helped develop the concept of "Snoezelen Rooms" while working at De Hartenberg Institute in the Netherlands (Haegele & Poretta, 2014). One summer they created an experimental sensory tent for one of the institute's yearly summer fairs. The tent was filled with basic equipment and objects that would essentially produce some sort of effect. For example, they had a fan that blew small pieces of paper into the air and bottles filled with scented liquids. The experimental tent was an immense success and it appeared that individuals with intellectual disabilities were demonstrating positive verbal and non-verbal reactions and feedback while visiting the tent. The word SNOEZELEN originates from the Dutch words Snuffllen (to seek out) & Doezelen (to relax). These rooms were originally used to provide people with intellectual disabilities a recreation option as well as relaxation. This type of room is now widely used in schools and health care environments.

The Snoezelen rooms continue to grow and develop over the years and become more extensive in both design and cost. What started as a relatively dark room with low level lighting, white, soft materials and padding, and fragrant smells morphed into what is commonly known as a multi-sensory room. In 1987, Whittington Hall became the first premier Snoezelen environment in the UK. This institution serves adults with intellectual disabilities and the room is very beneficial. Further growth of the concept continued in 1992 with a Snoezelen room at Bloorview Kids Rehab opening in Toronto, Canada, and another in the United States in 1992 at Lifespire in New York City (Snoezelen, 2021). Depending on how they are outfitted, these

rooms can be used for a multitude of people, not just those with disabilities. For example, a Snoezelen room can help relax an agitated person or it can help increase the functional performance of a person with dementia (Snoezelen, 2021). These rooms are outfitted in hospitals, dementia facilities, and in the Kaplan study (2006), a Day Habilitation program. They can vary in complexity, with multiple objects and materials available for use.

Key Elements Used in a Typical Snoezelen Room/MSR

Regardless of the space or location, there are similar types of items used in MSRs. They are aimed at the senses – visual, tactile, olfactory, auditory, vestibular, and proprioception.

Senses

The main purpose of the MSR is to provide needed sensory stimulation, or de-stimulation, for individuals. This can only be achieved with proper sensory aids for the children to use. Some of the most popular sensory aids are listed below, sorted by sense (Sensory university, n.d.).

Visual. While taken for granted by most people, this sense is a simple way to engage someone, as the line of vision can vary in distance. The following examples appeal to the sense of sight

Bubble Tubes. Used for sensory-regulatory activities or to encourage visual tracking, physical movement, color recognition, and hand/eye coordination.

Fiber Optics. Fiber optics are ideal for those who have difficulty enjoying the normal range of lighting effects. They can be used as a luminaire or within carpet and cloth materials. This provides texture, ambiance, and visual interest simultaneously.

Projectors. They project various light shows as well as black lights for special effects.

Interactive Panels. These panels encourage interaction, visual tracking, hand-eye

coordination and an understanding of cause and effect.

Light Chase. Students can chase a light beam around, either visually or physically, while trying to "catch" it.

Tactile. The sense of touch helps to keep us in touch with our environment. The following examples appeal to this sense:

Weighted Blankets and Vests. These provide constant, deep pressure input, which helps with calming and organizing.

Cushions and Pillows. These provide relaxation along with softness.

Carpets. Carpets can include LED lights to incorporate the visual sense.

Tactile Panels. Panels that have various textures applied to them, i.e., silky, soft, rough, furry, etc.

Olfactory. The sense of smell, or olfaction, is the special sense through which smells are perceived. The sense of smell has many functions, including detecting hazards, and pheromones, and plays a role in taste. The following examples appeal to the sense of smell:

Aromatherapy Kits. These kits provide bottled smells for students to open and enjoy.

Aroma Switch Box. This is similar to an aromatherapy kit, but the student can operate a switch to release various aromas versus opening and closing separate bottles.

Aroma Dough. Although tactile in nature, the various smells can provide relaxation (lavender) or common smells.

Auditory. The auditory sense can be simply described as the ability to hear. Appealing to this sense can occur using headphones, as not to interrupt others. The following examples appeal to the sense of hearing:

Calming Music. This type of music helps with de-escalation and relaxation.

Musical Instruments. A variety of instruments will provide a range from low- to high-pitch sounds.

Musical Tactile Panel. In addition to being a tactile panel, it adds an additional element by allowing the student to choose from nature, animal, classical music sounds.

Vestibular. This sense puts balance into our lives. It provides information about movement, gravity, and changing head positions. It tells whether we are moving or still, as well as the direction and speed of our movement. Examples of these products include:

Rockers. Rocking in a hammock or on a yoga ball can provide soothing feelings and relaxation.

Ramps/Scooters. Rolling down a ramp gives kids vestibular stimulation and pulling their body weight up a ramp gives them proprioceptive feedback.

Swings. Swings provide vestibular stimulation in multiple planes, and some even spin or bounce. Swings can provide stimulation to help relax or even stimulate the individual depending on the level of input.

Ball Pools. This can encourage relaxation and can build confidence and strengthen sensorimotor skills.

Proprioception. This is how your brain can sense your body, as well as its position and movement through space. Examples of these products include:

Climbing. This is a great way to become aware of your body and its position in space. A child's weight combined with gravity offers proprioceptive feedback.

Puppets. Using your hand to move a puppet the way you want helps with proprioception.

Gloves. Putting gloves on and placing your fingers in the correct holes utilizes proprioceptive skills.

Threading. Without you having to look, your brain can direct your fingers to help thread.

Balls. A child can roll and push a ball. A weighted ball can be used for more intensity.

Effectiveness of Usage

There has been a lot of research on the effectiveness of MSRs for various disabilities. Advocates claim multiple benefits are derived from multi-sensory room usage such as calming effects, stimulation, socialization, improved focus, as well as motor skills, cognitive, and sensory development.

Calming Effects

A multi-sensory room may have an aromatherapy diffuser, a white noise machine, or an assortment of other calming items designed to aid them in controlling their emotions.

Stimulation

Oftentimes additional sensory stimulation to promote feelings of awareness and well-being is needed. The sensory space may contain specially designed objects or toys that allow children to explore their senses and become more aware of how these interact with the world around them.

Socialization

Whereas some children prefer using the multi-sensory room alone, the room can also be utilized as a place for them to practice interacting with others. This space should be stress-free and a safe place where children can explore and interact together if they choose to do so. It allows them to become cognizant of their body movements and how they can affect others.

Improved Focus

Students with ASD or other developmental disorders are often distracted, so they struggle to pay attention to what is happening around them. A sensory room can help them increase

cognizance of their surroundings and learn to cope with real-life situations where concentration is mandated.

Motor Skills, Cognitive, and Sensory Development

Exposing students to the brain's intricate responses to things they touch or hear, as well as muscle functions including motor skills, allows them to learn how to control and process those experiences when they are not in the room.

Research Versus Reality

Opponents claim MSRs are an expensive bandage for poorly planned classrooms and are often used as an escape and avoidance contingency (Grace, 2019). However, empirical research suggests that future research is still needed in justifying the effectiveness of the rooms. In the Ayer (1998) study, they reviewed the caregiver's use of the equipment installed in the MSRs to ensure they met the needs of the children in their care. While they found that it provided scope for relaxation and discovery, it also raised some important questions, such as could alternative everyday curriculum or community experiences be offered which would generate similar responses and have similar appeals, and could the money spent be allocated to other ways of improving the experiences of children with learning difficulties. The study concluded that more rigorous research is needed to assess and evaluate the impact these environments have on the short- and long-term lives of children who use them.

Another study (Oglesby, 2017) demonstrates that there is a positive effect in balancing the sensory functions of auditory, visual, movement, touch, and behavior variables from the use of the sensory room. This study explores the utilization of sensory integration rooms on classroom behaviors with sensory function. The increasing prevalence of Sensory Processing Disorder (SPD) raises alarms for rehabilitation counselors, mental health professionals, school

counselors, teachers, parents, and other helping professions to develop strategies to improve behaviors within the classroom setting, home, and work environments. These contributions helped to reduce misdiagnosis and promoted more effective treatment among rehabilitation counselors, counselor educators, and other professionals. The sample site locations were selected from students of four elementary educational facilities within two school districts that provide sensory integration rooms on campus. The quantitative analysis of the data found that occasional use of a sensory room has a positive effect on the child's behavior in the classroom. The Oglesby (2017) study concludes that frequent use of the sensory room also has a positive effect on behavior in the classroom. Overall, the findings demonstrate that there is a positive effect in balancing the sensory functions of auditory, visual, movement, touch, and behavior variables and use of the sensory room. The qualitative data substantiated the quantitative findings and concluded that frequent use of the sensory room also had a positive effect on behavior in the classroom.

Interestingly, a study by Shapiro et al (1997) sought to determine if a true Snoezelen room worked better than a conventional playroom in reducing self-stimulating behavior in children. The study includes 20 children between the ages of 5 and 10 that are observed pre- and post-treatment using a traditional Snoezlen room and a typical playroom. Below, the Snoezelen room is described:

> A partially lit room with special curtaining which does not allow the sunlight in. The walls and floor are padded with soft white mattresses. There are visual stimuli projecting coloured lights onto the walls of the room, moving in a predictable sequence. It includes sensory integration equipment in a free-play approach, which is child initiated, and provides both sensory and motor stimulation. The setting for this approach was in a

> regular room with no special lighting effects: neither music, aromas nor vibrating equipment. The treatment includes: deep pressure, tactile stimuli (including vibration), aromas and soft music. (Shapiro et al., 1997, p. 27)

The study sought to find out whether the Snoezelen increased or decreased the number and duration of SSBs as compared to the playroom, in addition to changes in ambulatory heart rate among the children from pre- to post-treatment while in the rooms. Findings demonstrate that the Snoezelen room shows a significant decrease in both SSBs and in negative behaviors. The study also finds a nominal heart rate change ranging from pre-treatment to treatment to post-treatment when compared to the playroom. Some important points were noted from the study:

> In the Snoezelen room, the stimuli always include a harmonious combination of all the senses. The child receives vestibular, tactile, and proprioceptive stimuli at the same time as he/she is smelling aromas, seeing contrasting visual stimuli, and hearing relaxing music. (Shapiro et al., 1997 p. 35)

They found that when the children feel "safe" in the Snoezelen room, they do not "need" maladaptive behaviors to cope. Instead, they are replaced with adaptive behaviors which lead to the initiation of learning skills (Shapiro et al., 1997).

While most existing studies focus on young children with ASD, the Novakovic et al. (2019) study researches a slightly older population, ages 15-35, with ASD. The findings are like the studies focusing on young children. Snoezelen room usage is found to improve the CARS (Childhood Autism Rating Scale) scores in many participants. They find that continual sessions in the rooms affected the severity of ASD on CARS scale while the adaptation level in everyday activities increases.

Another perceived benefit is that having an MSR in a school can reduce the need to send students out for additional services (Carter & Stephenson, 2012). Occupational and physical therapists can work with students directly in the school rather than have them leave during the day for these appointments. School counselors and psychologists can also include set time periods for students to use the MSR as part of their daily IEP.

Incidental Learning Benefits

Incidental learning tends to observe and remember things not directly pertinent to the activity at hand. It is often described as inadvertent and latent since it takes place without awareness. The information acquired remains concealed until an occasion for its use arises. Research suggests improvements in concentration are evident after sessions in the Snoezelen room (Ashby et al., 1995).

The Broadbent, White, Mareschal, and Kirkham (2017) study found that incidental learning was evident after exposure to an MSR. The results indicate a significant improvement in incidental learning from 6 to 10 years of age. This study proves that children demonstrate greater performance on an incidental categorization task following exposure to multisensory (audiovisual) cues compared to unisensory information (visual or auditory alone).

Interestingly, a study by Kaplan et al. (2006) conducts experiments that explore engagement with three participants during functional tasks immediately following the treatment sessions. The study also notes changes in the daily frequencies of challenging behaviors on days following occupational therapy. It consists of participants with varying levels of mental impairments, from moderately severe to severe. The researchers measure the number of prompts to complete a task after having a session in the Snoezelen room. The study “found carryover for

two of the three participants to both post-session engagement as well as to the daily frequency of challenging behaviors on days following the occupational therapy sessions" (Kaplan et al, 2006).

Conversely, a study by Carter & Stephenson (2012) finds that students improving attention to tasks after an MSR session receive quite a low rating (36.8%) by staff, while the reduction of challenging behavior outside the MSR is seen as a benefit by almost half of respondents. Despite these findings, the benefits of utilizing the MSR are still evident and important to note. While there is not an improvement in attention to tasks, the reduction of challenging behavior is a benefit to all involved.

Integrated Design Solutions

Since the advent of the Americans with Disabilities Act (ADA) guidelines, students with physical disabilities have made strides in being part of an inclusive classroom. However, with developmental disabilities, this sought-out inclusion can be undesirable due to a lack of sensory aids and/or safe spaces for students to utilize in the classroom. When designing educational environments, we cannot forget to include these frequently forgotten students and ensure they are supported in the design. Autism is one of the most challenging developmental disorders but is neglected by architects and designers when determining building design. There are no guidelines nor building codes that must be adhered to. A study by Khare and Mullick (2009), sought to answer the following questions:

a) What kind of limitations do the pupils with autism face in the physical environment due to their deficits and associated conditions?

b) What are the environmental design implications of teaching strategies used for children with autism in educational spaces?

c) What are the enabling aspects of environment that might improve functional performance of children with autism in educational spaces?

d) How can this enabling environment for children with autism be validated for evidence-based future reference?

e) Are the environmental design aspects that are important for children with autism also significant for able-bodied children?

This study results in several emerging design concepts. The first concept is to design a physical space that sets clear visual and physical boundaries for each activity, so it is segmented within the environment (Stokes, 2001). The space can also provide visual clues to help understand where activities should occur (Figure 1) and instruction using a sequence of steps to follow an activity or task (Figure 2). In addition, since students have varying senses of personal space, known as proxemics, allowing a generous space standard can allow them to deal with social stimuli comfortably. Interestingly, due to the COVID pandemic, this has shown to be of the utmost importance when considering social distancing. Consequently, for the student that needs a break from the social demands of a classroom, designing a withdrawal space is beneficial by allowing them a space to unwind and regain composure (Figure 3). Another concept is to provide opportunities for community participation. This allows students to learn to interact within the community in ways such as shopping, using public transport, etc. This can be achieved by locating the school in an urban area with proximity to public services. An important concept that is often overlooked is providing a space that supports self-help and independent living skills. This could occur on the school lawn (gardening), cafeteria (preparing food), and in classrooms (Figure 4). Since most developmentally disabled students have an aide of some sort with them throughout the day, allowing extra space for assistance is beneficial so the aide is not

encroaching on anyone's space in the classroom. Lastly, well-designed furniture and materials with no sharp edges or corners that can take a lot of abuse while being easy to clean and replace is sought after due to the behaviors exhibited by these students (Khare & Mullick, 2009). After data collection from various teachers, therapists, and autistic experts, the study concludes that these concepts were found to be equally beneficial to both developmentally impaired and able-bodied students.

Figure 1

Segmented Activities

Note. Activities are segmented by furniture placement (Source: Author).

Figure 2

Task Schedule

Note. Washing hands task schedule (Source: Author).

Figure 3

Calming Space

Note. Calming corner within the classroom (Source: Author).

Figure 4

Self-Help Area

Note. Space provided in self-help area to teach sorting skills (Source: Author).

Another study by Mostafa (2008) finds that autistic behavior can be influenced favorably by altering the sensory environment, i.e., the stimulatory input, resulting from the physical architectural surroundings (color, texture, ventilation, sense of closure, orientation, acoustics, etc.) before the sensory malfunction occurs rather than after. They sought to find out if behavior may be improved by altering this sensory input in a manner designed to accommodate specific

autistic needs, or if at least a more conducive environment for efficient skill development could be created. Along with observation in phase one, participants are asked to rank five architectural factors: acoustics, visual (colors & patterns), visual (lighting), texture, olfactory, and spatial sequencing of functions, from the most influential to the least. The results of this phase show that according to the sample surveyed, the acoustics are the most influential architectural factor on autistic behavior, followed by spatial sequencing.

In phase two of the study, Mostafa works on modifying spaces while focusing on acoustics and spatial sequencing. While observing students during this phase, researchers note that an escape space was sought out often. An example was given about a girl who would distance herself throughout the day by sitting against a wall with her legs stretched out, banging her head on them for several minutes. Then she would sit quietly for a few minutes and continue back with her class. Mostafa wrote:

> The child was apparently escaping the maladjusted sensory stimulation of the session at hand and re-calibrating her inner sensory mechanism. She first removed herself from the situation and then provided herself with the sensory input required: auditory reduction by distancing herself, tactile by inflicting pain, and proprioceptive through the rhythmic movement and physical boundary of the wall. It seems best to design a baseline neutral sensory environment, as if designing for the hyper-sensitive across the entire spectrum. It is also easier to add stimulation from an external temporary source, like a piece of sandpaper for the hypo-tactile, or a moving mobile for the hypo-visual, or music for the hypo-auditory, than to remove stimulation from the environment, like soundproofing for the hyper-auditory, or changing textures for the hyper-tactile. (Mostafa, 2008, p.201)

There are many factors to consider when integrating these elements into the design of a space, such as: What are the students' needs and what products will help meet their needs? Where can the sensory space be placed? And how should it be set-up?

When considering the students' needs, one must look at the type of impairments the students have. Some schools may tailor their curriculum for certain disabilities, such as therapeutic support, whereas other schools may be focused on autism support. The MSR in one school may have different needs than another based upon the students' needs (Sanchez et al., 2011). An important building design element that is overlooked is the lighting of the space. It has been found that seizures can be induced by the subtle flickering of fluorescent lighting (McAllister, 2010) and yet this type of lighting is still specified in most school designs. Switching the light fixture to an LED source would eliminate this problem and provide an electrical use cost-savings to the district over the life of the fixture.

Another question that arises is where can the sensory room be placed? Unfortunately, it is often an afterthought and not designed properly into the space planning of the building during the design phase. Oftentimes the multi-sensory room will be in an empty office space, but unfortunately, sometimes only a large closet space is available by the time the required classrooms and office spaces are accounted for (Deline et al., 2017). If space constraints are an issue, a multi-sensory "area" can be placed in a corner of a classroom that is out-of-the-way of the general learning. Access to views of nature is another attribute that should not be overlooked. The McAllister study (2010) finds that individuals have a better demeanor and are more conducive to learning if they have natural lighting and a view of the outside. However, a higher view is preferred so students are not distracted by traffic and outdoor activities. In addition,

window treatments need to be specified to control the amount of natural light into the space to reduce glare and unwelcome brightness.

Lastly, how should the space be set-up? The MSR is a space for the children to explore on their own, with some guidance by their caregivers. It should be open and uncluttered while allowing students to relax and explore at their leisure. Objects should be within easy reach and able to be operated while in a wheelchair (Stephenson & Carter, 2011).

A properly designed space should be able to incorporate specific design considerations to help students with disabilities function efficiently in the space alongside their able-bodied peers. The Tufvesson & Tufvesson (2009) study finds that it is possible to increase the accessibility of education for as many children as possible and to make advances towards an all-inclusive school by designing it appropriately. This can be accomplished by avoiding disturbing factors affecting the concentration ability among extra sensitive children who have defined concentration difficulties, such as children with autism, ADHD, or Down's syndrome. However, an integrated design process must be utilized instead of the commonly used traditional model of design, build, and facilitate. As stated in the study:

> In practice there are two aspects to be considered in the building process in order to increase the accessibility of the school. Firstly, in order to address these issues with respect to the design of the school environment, expert knowledge is required. Secondly, it should be acknowledged that every space is unique and involves different conditions depending on the project content, design, character, etc. Therefore, in each school project there is a need for specific data for decision making during the pre-project decision stage, the design, and preparation processes. (Tufvesson & Tufvesson, 2009, p. 62)

In addition, the McAllister (2010) article goes into detail about certain design considerations to create an ASD-friendly classroom. This would be a room with additional areas for both storage and for a quiet withdrawal space for students when needed. He also notes that under-floor heating would help to minimize sound distractions as well as multiple lighting options for flexibility. Lastly, room placement away from auditory distractions, such as playgrounds, gymnasiums, and auditoriums would be favorable.

"Autism for the Built Environment" is a chapter in the book *Autism Spectrum Disorder: From Genes to Environment* (Sanchez, Vazquez, & Serrano, 2011). The researchers delve into how to make a space beneficial to an individual with ASD. Designers and architects are concerned with designing accessible spaces but mainly focus on physical impairments. Unfortunately, a lot of impairments, or disabilities, are not "visible" so they tend to be overlooked and forgotten. This usually is not an issue for general education students but can be detrimental for special education students. As stated in Scott (2009), "Mainstream children are probably more 'able to cope' with badly designed spaces than an autistic child would be. So the responsibility to create a 'good' environment is brought into sharp relief" (p. 41).

Costs Involved

It can be very costly to set-up one of these rooms, not including the cost of taking physical space away from the school. Schools can spend up to $10,000 per room to equip while equipment costs vary from $20 for exercise bands to $8,000 for heavy-duty swings (Zarling, 2017). One of the most prominent websites for sensory items is FlagHouse, which both specifies and supplies multiple items for the Magnetic Hill School in New Brunswick, Canada. The cost for this was about $30,000 and included all the suggested items. It was funded by the Ronald McDonald Children's Charities (Snoezelen rooms, 2021).

Consequently, multiple studies (Carter & Stephenson, 2012; Martin, 2016) find that "a primary justification for their use in the schools examined appears to be a belief in the inherent benefit of providing sensory stimulation, despite the absence of a plausible theoretical mechanism and weak supporting empirical evidence. It appears that schools rely on the views of other professionals and information from equipment suppliers in their decisions to install the rooms with very little examination of research" (Carter & Stephenson, 2012). In addition, they encourage the funding of studies intended to provide quantifiable outcomes that prove evidence-based design criteria.

Designing an MSR could be achieved inexpensively by simply painting a room a relaxing color, adding some equipment for sensory needs, and providing soft rugs or carpeting. A large closet in a standard classroom could also work as a small MSR by allowing students a break from their standard classroom. The main benefit of this would be the student could still be engaged in the learning while on break and an aide does not have to leave the room to take them to an MSR in a different area of the school.

In summary, there is a need for continued research as evidenced by this literature review. The benefits of the multi-sensory room integrated into best design layouts have not been empirically studied thus far. Information needs to be researched and utilized for future classroom space planning and design. The following section will discuss the research involved to help provide empirical data on the best practices for space planning in a multi-sensory room.

CHAPTER 3 METHODOLOGY

This study examines the way staff utilizes multi-sensory rooms and the products that comprise them. This was done to provide empirical research into the best practices for space planning an MSR. This chapter discusses the methodology and research design used to obtain and analyze the data important to the research questions. It begins with the settings and participant selection and continues with the research design, data collection methods, and analytical procedures used. It concludes with a discussion about the limitations of the study.

The objective of this study is to determine the best layout for a multi-sensory room and to find ways to incorporate some of the elements into general classrooms. The data collected from special education teachers contributes to the efforts to accurately demonstrate what works and what does not work for them and the students in their school's MSR. In addition, this study aims to fill the gap in current research regarding what design layouts work best.

The research questions that this study searches to answer are (1) how are the multi-sensory rooms used? (2) what elements are most beneficial? and (3) which layouts work best?

Research Design

This study uses a mixed-methods design that includes a qualitative descriptive design, which is most appropriate for achieving the aim of this study, as well a questionnaire to help show validity based upon triangulation (Tracy, 2013). The quantitative portion utilizes questionnaires that are sent out to all special education teachers in a medium-sized public school district in Western Pennsylvania. These provide general usage information that is used to formulate interview questions for the qualitative portion of the study. Participation is voluntary and participants are free to decline answering questions if they wish. The method used for the qualitative part of the study is a semi-structured interview consisting of twenty questions

delivered by an in-person interviewing process. This research examines the MSR usage in further detail as well as which layout and element(s) work best for their students.

Participants

For the quantitative part of the study, special education teachers from each of five local schools in Western Pennsylvania were contacted by email and asked if they would be interested in being part of the study. Provided in the email was an online survey link that included an integrated consent form via the Qualtrics survey platform. Email addresses were derived from the district website.

After results were analyzed from the Qualtrics survey, interview questions were constructed for the qualitative part of the study. Participants for this part included a lead special education teacher from each school chosen based upon schedule availability and willingness to participate in the study. Teachers were identified as a lead teacher by the principals of the respective schools. Once identified, teachers were contacted by email and asked if they would be interested in being part of the qualitative study. Once agreed, consent forms were sent via email to be completed and returned to the researcher. Then a mutually agreed upon scheduled meeting was held at their respective school.

Five elementary schools within the same district in Western Pennsylvania were chosen for this study due to their proximity to the researcher and because they each have a multi-sensory room. Each elementary school specializes in a different diagnosis and students attend the school that meets their specific need. These specialties include autistic support, emotional support, life skills, multiple disabilities, and intensive emotional and behavioral supports.

The demographic of students with disabilities using multi-sensory rooms throughout the school district provides a large sampling to help represent a larger population instead of focusing

on a particular disability. The quantitative portion of the study involves all special education teachers within the district area schools, representing roughly 250 special education students. The sample size consists of eight teachers (n=8) who participated in the study. A complete break-down of the demographics of the teachers, including years of teaching, is listed below in both Figure 5 and Table 2.

Figure 5

Participant Years of Teaching Experience

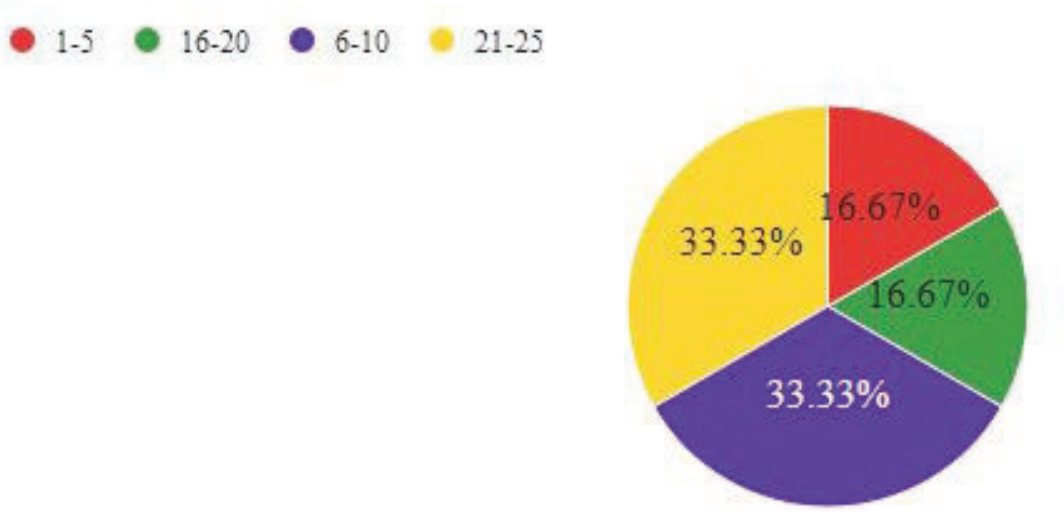


Table 2

Participant Years of Teaching Experience

Years of Experience	Number of Participants
1-5	1
6-10	2
11-15	0
16-20	1
21-25	2
26-30	0
31 +	0

The qualitative portion of the study includes five special education teachers, one from each school, who are identified as the lead special education teacher. Interviewing the lead teacher helped to gain a broad understanding of the space due to their experience utilizing it.

Data Collection

This is a concurrent mixed-model design classified based on conceptual dominance of the study. In this design, a quantitative phase is embedded within a predominantly qualitative study (quan-QUAL). The quan-QUAL model is where quantitative data is weighted less than the qualitative data and is collected first. This type of approach is used to "confirm, cross-validate, or corroborate findings within a single study" (Creswell & Plano Clark, 2007). This study includes a questionnaire for the quantitative research part (the first part) and an in-person interview for the qualitative portion (the second part). The questionnaire was sent out to all special education

teachers in the local district schools. It consists of sixteen questions to obtain general usage information. The questionnaire includes three parts: room size and usage, training and supervision, and opinion and experience. Responses from the questionnaire provide insight into each participant's views and experiences with using the MSR. Once information was obtained from the questionnaires, it was used to formulate interview questions for the qualitative portion of the study. Interview questions were comprised to gauge usage of specific elements of the room, element adjacencies, material, furnishings, and lighting used, as well as available natural lighting and views.

For this quantitative study, the areas of focus are room size and usage (Appendix A questions 1-10); training and supervision (Appendix A questions 11-13); and opinion and experience (Appendix A questions 14-16). The focus areas are based on research questions derived from the literature review. The opinion questions are important to show that MSRs are viewed as required areas and not just a current fad. This helps prove the value of this research in helping to properly design future multi-sensory rooms in schools all over. Multiple-choice questions asked include:

1. What type of equipment is in your multi-sensory room?
2. How was the multi-sensory room and/or equipment funded?
3. How many staff (teachers, therapists, aides) utilize the room on an average day?
4. What type of staff uses the room?
5. What type of student uses the room?
6. What is the room used for throughout the day?
7. When can you access the room?
8. How many students can use the room at one time?

9. How long does a typical session last?
10. Typically, is a child's time in the room guided or free to explore?
11. Who supervises the sessions?
12. Is training offered for staff on proper usage of the room and/or equipment?
13. Are students assessed for potential risks using the equipment?
14. How effective does spending time in the multi-sensory room contribute to a positive after-effect in the classroom?
15. Do you feel the multi-sensory room is worth the money (cost) and space?
16. How many years of experience do you have in the special education field?

The method for the qualitative part consists of questions being delivered by an in-person interviewing process. These questions derive from the results of the completed survey. This part of the research examines the MSR usage in further detail as well as which layout and element(s) work best for their students. Utilizing the interview process, the researcher probes the participants for deeper understanding of MSR usage. When a question arises from a participant's response, clarification can be addressed. In addition, by being on-site, the existing layouts can be visited to analyze the pros and cons of the current space planning. Furthermore, adjacencies can be noted as well as any interfering sounds. Interviews are audiotaped and manual transcripts are created from these recordings. Interviewed participants receive coding under pseudonyms to ensure anonymity.

Analysis

The analysis for the quantitative portion of the study includes analytics from Qualtrics. It was first analyzed with simple descriptive statistics to obtain frequency distribution of responses.

The analysis also includes the median and mode of all responses, which helps to show commonalities and differences amongst MSRs.

For the interview part of the study, member checking is utilized to verify accuracy of the data. Member checking is an important technique to establish credibility in a qualitative research study (Creswell & Plano Clark, 2007). Primary- and secondary-cycle coding are used to check for emerging themes and note how many times the same theme emerges. This consists of a first round of coding to classify the comments into themes. In the second round of coding, the narrower themes are collapsed into the broader themes. The data is finalized when no new similar themes are found in the interviews.

General trends based on phrases and key words in the open-ended responses help to organize the data into the appropriate focus areas. Once this is complete, a visual representation of the data further guides the analysis. The analysis ultimately includes the formation of conclusions and generation of patterns.

Site Permission

According to the Institutional Review Board (IRB) process, this study includes consent forms for both the quantitative and qualitative portions. This study was submitted to Slippery Rock University's IRB board and follows all necessary steps to receive approval.

Presentation of Results

All participants are offered the opportunity to examine the completed research outcomes at the end of the study. A best practices publication will be created to showcase the findings.

Limitations

One of the limitations was that a small convenience sample was studied. In addition, each educational setting that was studied had a different disability specialty (autistic support, emotional support, life skills, multiple disabilities, and intensive emotional and behavioral supports). These specialties could result in different MSR elements being used when compared to other schools. Lastly, the items in the questionnaire lacked homogeneity as they did not assess the same skill, characteristic, or quality of staff who were involved in the study. However, the data collection instrument could be considered adequate as it succeeded in achieving the objective of the present study which was to explore the variety of ways in which MSRs were used by teachers and staff to meet the needs of children with profound and multiple learning disabilities.

To review, the objective of this study was to determine the best layout for a multi-sensory room and to find ways to incorporate some of the elements into general classrooms. Interviewing special education teachers who utilize these rooms and analyzing the actual rooms helped to determine best practices for designing such spaces. The next section will explain the analysis in detail as well as results that culminated from this research.

CHAPTER 4 FINDINGS

The focus of this research study was to examine the way staff utilizes multi-sensory rooms and the products inside them. The results helped to determine the best layout for a multi-sensory room and find ways to incorporate some of the elements into general classrooms.

The data presented in this chapter is the result of the following research questions:

1. *How are the multi-sensory rooms used?*
2. *What elements are most beneficial?*
3. *Which layout works best?*

The findings in this study are the result of surveys and interviews with the participants.

The purpose of the first research question was to find out how the multi-sensory rooms were being used at each of the schools in the study. To uncover this, an analysis determined the trends in usage among staff daily.

The second research question investigated what elements were most beneficial to the students. The importance of this question relates directly in determining space allocation and needs for pertinent elements, such as aids and equipment, to satisfy the students' sensory needs.

The third research question was related to which layout works best. This entailed on-site interviews to note the location of sensory elements in the room and how the room relates in achieving sensory integration for the students who use it.

Subsequently, an overall analysis of the data presented for the three research questions occurred. This highlights the connectivity between the research questions and the framework used for this investigation. The chapter then concludes with additional findings collected as participants elaborated in response to some of the interview questions. Lastly, a school/participant profile is included to provide some context for the findings.

Profile of the Participants and the Schools

Of the five elementary schools in this study, 20 staff members met the criteria for the survey portion of the study, but only eight agreed to participate in the study, 40% (n=8). The staff were contacted via email to participate in the study using Qualtrics survey platform. Those that did not complete it were contacted via a follow-up email to participate in the study. However, some still did not respond, so this limited the number of participants.

The percent of free and reduced lunch students in the schools characterizes the socioeconomic status of the communities served. From the participants schools' data, 40% (n=5) of the schools had 0-25% free/reduced lunch; 20% (n=5) had between 26-50% free/reduced lunch; 20% (n=5) had between 51-75%; and 20% (n=5) had 76% or more free/reduced lunch.

Table 3

Profile of Schools

School	# of Students	# of Special Education Students	% Free/Reduced
S1	325	75	43.38%
S2	212	66	70.61%
S3	530	86	40.00%
S4	428	92	58.78%
S5	70	70	90.00%

Note. Source - A. Royhab, personal communication, February 15, 2022.

Addressing the Research Questions

The aim of this research was to examine the way staff utilizes multi-sensory rooms and the products that comprise them. The results help to determine the best layout for a multi-sensory

room and to find ways to incorporate some of the elements into general classrooms. This section contains participants' responses from the surveys and interviews for each research question. While most of the survey questions pertain to the first research question, the last six questions were used as a basis for constructing the interview questions for the qualitative portion of the study.

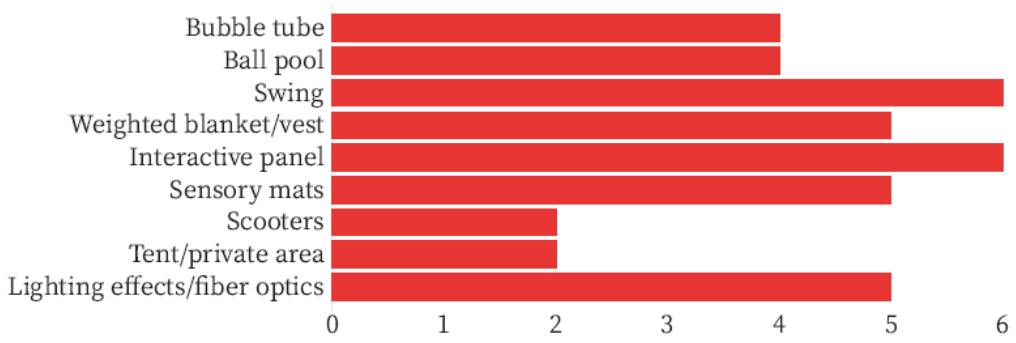
Results for Research Question 1: How are the Multi-Sensory Rooms Used?

Multi-sensory rooms can be used for multiple needs. These may consist of occupational therapy, de-escalation, sensory integration, and learning basic skills. Each school utilizes their multi-sensory room slightly differently, since no two schools have the same needs.

The quantitative portion of the study addressed this information with the first ten questions of the survey. The first question had the respondents select from a list all the equipment that is located within their multi-sensory room. The most common item was a swing (n=6) and interactive panel (n=6). Next commonly used was a weighted blanket/vest (n=5), sensory mats (n=5), and lighting effects/fiber optics (n=5). The bubble tube (n=4) and ball pool (n=4) closely followed in popularity. Lastly, scooters (n=2) and tent/private area (n=2) were sparingly used. Figure 6 illustrates the results below.

Figure 6

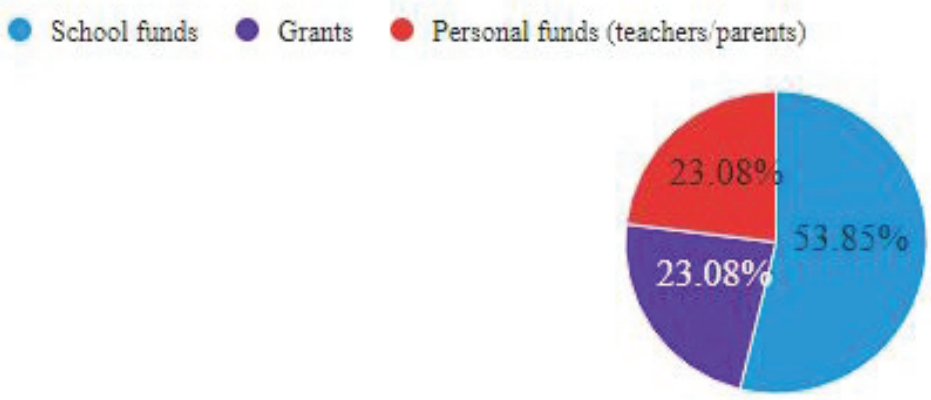
Types of Equipment



The next question asked how the multi-sensory room was funded. Respondents could select more than one funding source. The results stated that 53.85% (n=7) of the equipment was funded through school funds, 23.08% (n=3) through grants, and 23.08% (n=3) through personal funds financed by teachers and parents.

Figure 7

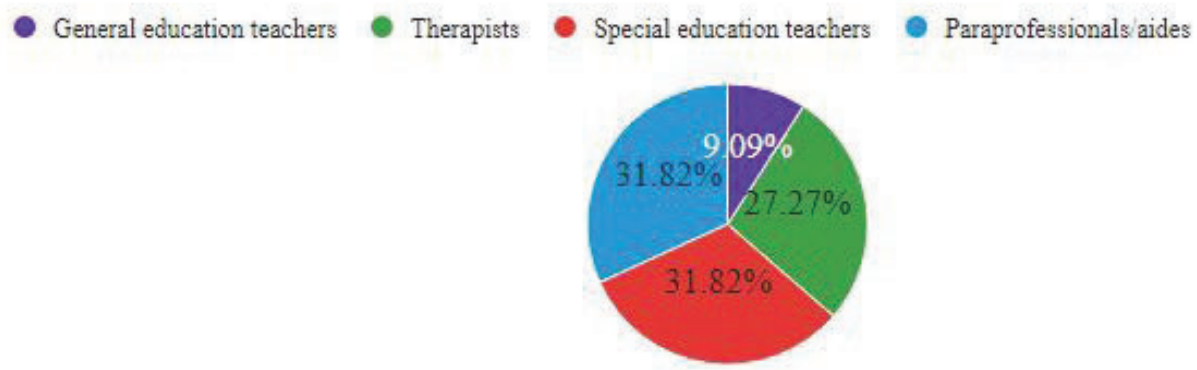
Funding Sources for Multi-Sensory Rooms



Question 3 addressed the number of staff that utilizes the room on an average day. This number could include teachers, therapists, and aides. 3-5 staff was the most common answer (n= 5) followed by 6+ which generated less than half the responses (n=3). Question 4 clarified what type of staff utilizes the space most often. Special education teachers (n=7) comprised 31.82% of the results and tied with paraprofessionals/aides (n=7). Therapists came in second with 27.27% (n=6), with general education teachers following at 9.09% (n=2).

Figure 8

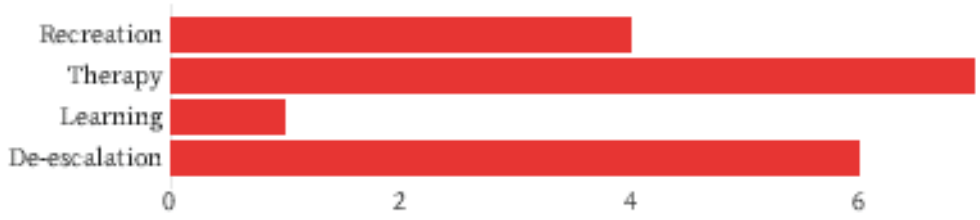
Description of Staff Who Utilize the Space



The next question asked what type of student uses the room. Respondents could select multiple answers. Special education students were selected unanimously with 100% (n=8), followed by 62.5% (n=5) stating that general education students used the space as well. Question 6 focused on what the room is used for throughout the day. The most common use was for therapy at 87.5% (n=7), followed by de-escalation at 62.5% (n=6). Recreation came in third at 50% (n=4) and learning trailed behind at 12.5% (n=1).

Figure 9

Room Usage

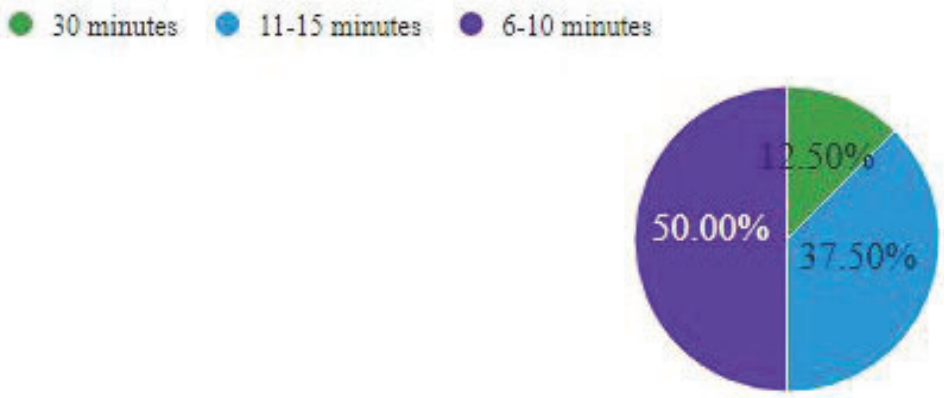


Question 7 addressed when staff can access the room. 75% (n=6) responded that they could access the room anytime it was not already occupied. 12.5% (n=1) responded that time needed to be scheduled before being used. Tied with being scheduled was being able to access the room

anytime they wanted at 12.5% (n=1). Question 8 asked how many students use the room at one time. 50% (n=4) replied 3 students at a time, 37.5% answered 2 students, and 12.5% responded 5 or more (n=1). The question asking how long a typical session last resulted in 50% (n=4) answering 6-10 minutes, 37.50% (n=3) answering 11-15 minutes, and 12.5% (n=1) responding an average of 30 minutes per session.

Figure 10

Typical Time Per Session



The last question in this section focuses on a child's time in the room and whether they are guided or free to explore on their own. Respondents mostly answered free to explore (n=5), next was loosely guided (n=2), and lastly prescriptive (n=1).

The last few questions of the survey helped to develop the interview questions for the qualitative portion of the study. The responses from the interviews expanded upon research question 1 and provided the basis for research questions 2 and 3. The interview questions addressed how multi-sensory rooms are used and what needs improvement. They included:

1. Is your current multi-sensory room adequate to fit your needs?
2. Would you prefer a larger or smaller space? Why?

3. Concerning the space planning, do you feel the current layout works? If so, how does it work well?
4. How could the layout be improved?
5. Do you feel the products/learning aids are used appropriately and children are observed effectively?
6. What additional training, if any, do you feel is needed to effectively use the room?
7. Are there any products/learning aids you feel students would benefit from that you currently do not offer? If so, what are they and what are the benefits?
8. Do you feel there is a benefit in incorporating smaller-scale MSR's into the general classroom?

These questions elaborated on the Qualtrics survey questions to provide clarification and a better understanding of usage of the space. The interview allowed a visual of the space along with an opportunity to read visual cues and ambiances of the teachers while recording their responses.

Table 4 presents the themes found in the teacher responses from the interviews detailing their thoughts on the current location of the multi-sensory room within the school.

Table 4

Codes Derived From Discussion About Multi-Sensory Room Location

Code	Frequency
Lack of privacy	1
Unwelcome odors	2
Flickering lighting	4
Unwanted sounds	2
Adjacent to special needs classrooms	4
Occupational therapists overtaking the MSR	4

Results for Research Question 2: What Elements are Most Beneficial?

The teachers that were interviewed for the qualitative portion of the study all agreed on certain beneficial elements. This was talked about on both the macro and micro levels. On the macro level, design elements such as location and lighting were discussed and rated by importance. On the micro level, actual sensory aids were discussed and the most beneficial were noted.

Macro Level Elements. Macro level elements include both location and lighting. These two important elements need to be incorporated in the predesign phase of new construction or remodeling of schools.

Location. One of the most important design elements discussed was location. Two out of the five schools studied had their multi-sensory room adjacent to the special education

classrooms. This provided a convenient path to the MSR and made it an efficient transition for students using the space. In the other schools, the walking path was not so direct or close by. The sometimes-unruly students have to walk past other classrooms on their way to the MSR, sometimes creating a commotion and bringing unwanted attention to themselves. Thus, having the MSR being located adjacent to the special education classrooms is a must.

In three out of the five elementary schools, the MSR was located by the cafeteria and/or food preparation room. This caused strong odors to waft into the room and oftentimes disturbed the students using the room. One teacher said that a child who could benefit from the room refuses to go there due to the unpleasant odors from the food in the nearby vicinity.

Another issue with the cafeteria being close by is the commotion of students going to and from the room. This commotion would disturb the students working in the room and oftentimes they would lose their train of thought and pay attention to the passers-by in the hall. This same issue could arise from an auditorium or gymnasium being adjacent as well. The noise, instead of the smell, could be an inconvenience for students utilizing the space.

Lighting. Natural lighting and views were seen as beneficial to all occupants in the room. However, being able to adjust the view and amount of sunlight entering the space was imperative. One school in the study used curtains and blinds to block unwanted distractions if needed, such as foot traffic or landscaping. As for the mechanical light fixtures, a dimmer switch was most requested by the teachers. Currently, two out of the three MSRs used fabric to shield the ceiling light fixtures and lessen the brightness. Teachers in these schools also used the light covers in their special education classrooms. A dimmer switch would allow them to adjust the brightness of the light fixtures easily depending on the children's needs.

Figure 11

Fabric Use to Reduce Brightness

Note. Objects were added to light covers to add visual interest (Source: Author).

Micro Level Elements. On the micro level, some of the most beneficial sensory elements discussed were the squeeze machine, swing, ball pit, sensory mats, and lighted sensory egg. The squeeze machine was found to be important because so many students have this tactile sensory need. One teacher was waiting for a replacement part to come in so her squeeze machine could be fixed. They said their students thoroughly enjoy being in the "machine" and added that it is one of the favorites in the room.

Figure 12

Squeeze Machine

Note. Cushioned squeeze machine (Source: Author).

A swing is a close second favorite for students to use. Whether it is the idea of swinging inside or simply an easy was to satisfy this sensory need, a swing is imperative for students. One teacher said they have a swing for students to use but their MSR is too small to house it. Fortunately, they can place it in a corner of a classroom for students to use. On the downside, if the room is being occupied by a class, the swing is off-limits.

Figure 13

Sensory Swing

Note. Rotating sensory swing (Source: Author).

Another item perceived as very beneficial was the ball pit. Three out of five elementary schools had a ball pit in use, and the ones who did not wished they had one.

Figure 14

Ball Pit

Note. Ball pit in corner of MSR (Source: Author).

An often-requested aid is sensory pads, which students find fascinating. They walk, crawl, and press their hands on the surface which makes the liquid move and change colors.

Figure 15

Sensory Mats

Note. Heat-sensitive sensory mats in various colors (Source: Author).

One popular item was the lighted egg, which provides a smooth transition of colors with an option to select a favorite color to remain constant.

Figure 16

Sensory Egg

Note. Lighted sensory eggs (Source: Author).

Most MSRs had these items available for students to use, while a couple of the schools had to remove items and replace them due to space constraints. For example, they may need to place the trampoline in the closet while the swing is in use, and so forth. Ideally, there would be space for everything.

Results for Research Question 3: Which Layout Works Best?

This question resulted in different answers amongst each person interviewed. One thing they all agreed upon was that having separate areas for accessing specific sensory aids is critical for children to benefit from being in the multi-sensory room.

While the rooms varied from large to small between the elementary schools studied, they all had informal "sensory zones" separated from each other. This helped to separate multiple kids in the same room and allow them to spend time meeting their sensory needs. For example, if a child needs pressure, a tactile sensory need, he or she could use the weighted blanket while another child with visual sensory needs is able to watch the lighted egg. Both students can be utilizing the aids without interfering with each other's private space.

There was some difference of opinion on the best size of a multi-sensory room. Most teachers preferred a medium-sized room while a couple preferred a larger room. Their reasoning for these choices came from both need and experience.

Teachers who had a large MSR often found it difficult to reign children in so they could focus on their sensory need(s). The children instead would run around in the space and get more excited than before entering. This defeated the purpose of the MSR, as it is not meant to be a playroom. These teachers said they prefer a medium-sized room, which would allow space for large sensory aids but also limit the open space that could entice children to run around.

Conversely, some teachers were limited in the space allocation of their current MSR. This limited what items could be used at a single time. For example, one teacher explained how she had a tunnel for students to use but had to keep it in a closet until the need arose for use. Her MSR was relatively small and did not allow for some popular items to be accessed due to space restrictions. One school had a tent, while another had a swing, but neither of these aids could be used because their respective MSR space did not allow it. This is a disservice to both the children and the teachers alike. Proper space planning is critical to allow the appropriate spacing and adjacencies for these sensory aids to be used. Sensory aids are of no use sitting in a closet and should be made available for all to use.

CHAPTER 5 CONCLUSIONS AND RECOMMENDATIONS

There were three main questions that developed through an in-depth investigation of the research, which guided this study. They were:

1. *How are the multi-sensory rooms used?*
2. *What elements are most beneficial?*
3. *Which layout works best?*

Special education teachers in five elementary schools within the same district were sent a survey as well as interviewed for this mixed-methods study. In this chapter, the findings presented in Chapter 4 have several implications meriting discussion. This chapter also includes a discussion of major research findings in connection with the research literature. Lastly, it discusses potential implications for practice and future research.

Findings Related to Existing Research

There are several parallels between the results of the present study and existing research. First, the multi-sensory rooms that are currently used have found their "home" by accident. They are housed in unused rooms throughout the school, with little thought about room adjacencies or building materials used (Martin, 2016; Mostafa, 2008).

In addition, every room studied had fluorescent lighting. As stated earlier, teachers often placed fabric over the lights to help diffuse the brightness of the light fixtures (Martin, 2016; Tufvesson, C. & Tuffvesson, J., 2009). When asked whether they noticed any flickering or humming of the light ballast, the teachers noticed nothing amiss until it was mentioned. Then they noticed a slight sound (Kanakri, 2014). When asked if students using the room were bothered by it, they did not think so, but never considered it an issue. However, once they

noticed the sound, it was difficult for them to “unhear” it. This made them ponder what their students may be hearing while using the room.

As for natural lighting, one of the multi-sensory rooms had an outside window, whereas the rest did not offer views of the outdoors (Martin, 2016; WELL certified, n.d.). The multi-sensory room with a window often provides distractions for the children utilizing the space due to the window’s size and low location on the wall. Curtains and blinds are used to block unwanted views.

Key Elements Used in the Typical Multi-Sensory Room

Most of the multi-sensory rooms in this study included similar sensory aids. While each MSR studied had multiple sensory aids for most of the senses: auditory, visual, tactile, vestibular, and proprioception, there were very little to satisfy the olfactory sense. However, they offered children scented playdoh and putty to meet this specific sensory need. As discussed in the findings (Chapter 4), the most beneficial sensory elements were the squeeze machine, swing, ball pit, sensory mats, and lighted sensory egg. Every school studied had all these aids at their disposal, regardless of the location, albeit the multi-sensory room or a nearby classroom.

Effectiveness of Usage and Incidental Learning Benefits

All the teachers interviewed agreed that students were more relaxed and receptive to learning new skills after being in the multi-sensory room. The teachers include a visit to the room as part of a student’s daily schedule. This way, it is used as a proactive means to stave off unwanted behavior and prepare the students for their lessons that day. Of course, the MSR also works well as a means of de-escalation of sensory-overloaded or -underloaded children.

Integrated Design Solutions

This part of the study took a life of its own through the qualitative portion: the interviews. Integrating sensory aids into the classroom has become a necessity due to the COVID pandemic. When schools were faced with denied access to the multi-sensory room due to fear of spreading germs, teachers circumvented this shortfall by including sensory bins in their classrooms for the students. These sensory bins proved to be a success, as the students could meet their sensory needs throughout the day without leaving the classroom. The bins were also welcome because it did not require a paraprofessional to leave the classroom with a student to take them to the multi-sensory room.

Another issue that became evident during the interviews was the limited availability of the MSR for students due to the Occupational Therapist (OT) using the room as their personal space. One school that was interviewed stated that their MSR was always occupied by the OT and their daily therapy sessions, so teachers and students could not use the space. The teachers had to get creative and start integrating sensory aids into their classrooms to meet the students' needs.

Conversely, another school interviewed did not have access to their MSR due to its poor state. Unfortunately, unruly students over time have damaged a lot of the sensory aids, so a functioning multi-sensory room was not an option. A large amount of money would be needed to fix the room, which is not feasible at this time. Like the previous school, the teachers integrated sensory aids into their classroom time to meet their students' needs. The teacher interviewed stated it was not an ideal solution, but it works for the time being.

As stated in the review of literature, there are many factors to consider when integrating these elements into the design of a space, such as: What are the students' needs and what

products will help meet their needs? Where can the sensory space be placed? How should it be set-up? The following section answers these questions by explaining how they can be utilized in future practice.

Implications for Future Practice

The findings of this study connect directly to the literature review, and the findings have implications for the future practice of interior designers and school leaders.

The Importance of Location

The location of the multi-sensory room is one of the most important aspects that is often overlooked by both school leaders as well as the architects who design the schools. This study revealed that unpleasant odors and sounds from adjacent cafeteria or food preparation areas were detrimental to the positive experience of the multi-sensory room. By locating the multi-sensory room away from unwanted noise (gymnasiums and cafeterias) and odors (food prep areas and cafeterias), it will only benefit all the students so they can relax and enjoy the space instead of being distracted and agitated.

Another adjacency that should not be overlooked is locating the multi-sensory room by the special education classrooms. Special education students use both the MSR and their classroom daily, so a close vicinity makes it easier for everyone involved. This will limit the time it takes to travel to and from the room and reduce the number of distractions getting there. In the schools studied, the ones with multi-sensory rooms adjacent, or nearby, the special education classrooms were coveted and used often. On the contrary, the schools studied that had multi-sensory rooms further away from the special education rooms did not use them quite as often as they should. The main reasons for this are the lack of staff to walk the child to the MSR, the time involved to get there, and distractions along the way.

The significance of view and natural lighting cannot be emphasized enough. The calming feeling of nature can do wonders to relieve stress and the benefits of Vitamin D from sunlight offers nutritional and health benefits that cannot be matched. Incidentally, the multi-sensory room in the study that had a window to the outside allowed a distracting view due to the size and position of it on the wall. A favorable position would be a windowsill height of 4' AFF (above finished floor) or higher which would offer an upward view of nature without the distraction of outdoor activities.

The Importance of Lighting

Continuing with the topic of window locations and views is the natural lighting that comes from them. Simply placing a window higher on the wall would allow sunlight to filter in without the distraction of seeing outside activities. In addition, window treatments that can be adjusted to filter sunlight throughout the day should be included. This allows the teacher to adjust the brightness while still allowing natural sunlight to filter through. Natural lighting should not be overlooked as it helps support healthy circadian rhythms. Light can also be a source of sensory regulation and an opportunity for stimming, as users will often appropriate naturally occurring light effects for this purpose. While a direct view of the outdoors should be limited so as not to introduce distractions, the use of adjustable window shading and blinds working in conjunction with conventional lighting is an ideal solution.

While this may not seem important to the average person, fluorescent lighting can be detrimental to those with special needs. The subtle flickering of the light may not be noticed by the typical person but can be bothersome and interrupt a child with specific sensory issues. This type of lighting is found to trigger seizures in children (Martin, 2016), so LED (light-emitting diode) lighting is more favorable. LEDs are energy efficient, cool to the touch, and have a long

life, far surpassing incandescent and halogens. A dimmer switch should be used as well to adjust the light levels in the room. Indirect lighting is preferred to avoid distraction from the light source and its brightness.

The concept of layered lighting is not new to interior designers, but it is to educational settings. Allowing the capability to choose one, two, or multiple types of lighting for a space is important. This can be achieved by switching different light fixtures for independent operation. The ambient, or general, lighting can be on a dimmer switch for overall control of brightness. Task lighting can be on another switch for ease of use when needed. Decorative or accent lighting can be on a switch that can be operated when the sensory need requires it. This may include bubble tubes, sensory mood eggs, or sensory mood balls.

Lastly, color temperature is another aspect that is often overlooked. According to the U.S. Green Building Council (2022), the WELL Building Standard "is a performance-based system for measuring, certifying, and monitoring features of the built environment that impact human health and wellbeing, through air, water, nourishment, light, fitness, comfort, and mind". WELL certification stresses the importance of circadian rhythm by offering flexibility for adjusting the color temperature from 2700 K, mimicking early morning equivalents, to mid-morning amounts at 4700 K, and finally to 6500 K during peak noon equivalents (WELL certified, n.d.). LED lighting offers this flexibility in both color temperature as well as light intensity.

The Importance of FF&E (Furniture, Finishes, & Equipment) Selection

The role of the interior designer or architect specifies the material used for the walls, floor, and ceiling, both for the construction and the finish application. They also specify furniture used within the space. We can further break this area down into smaller focus areas such as acoustics, color, materials, and furniture.

Acoustics. To minimize background noise and echo, proper ceiling materials should be used to absorb sound and eliminate reverberation and echo. This can be achieved by using sound dampening ceiling tiles or cloud panels, wall-mounted sound-absorbent materials, or sound-absorbent acoustic flooring systems such as carpet tiles or vinyl.

The level of sound control should vary depending on the need of the space; activities of higher focus would require a higher level of sound control, whereas a high stimulus area may require a lower level for less sound control. Provisions should be made for different levels of control so users can get used to functioning in different sound levels. Care must be taken as to avoid the "greenhouse effect," where students rely on intensive acoustical control and cannot function in a typical environment. Research has shown that sounds below 55 db is best for reducing negative behavior in autistic individuals. Sounds between the 55-70 db range dramatically increase distressed behaviors (Kanakri, 2014).

Rooms should be located as far as possible from the auditorium, gymnasium, and lunchroom to minimize the noise levels. Rooms should also be positioned away from HVAC ducting and handling units. All air outlets should be tightly installed with sound insulation to avoid any vibration noise.

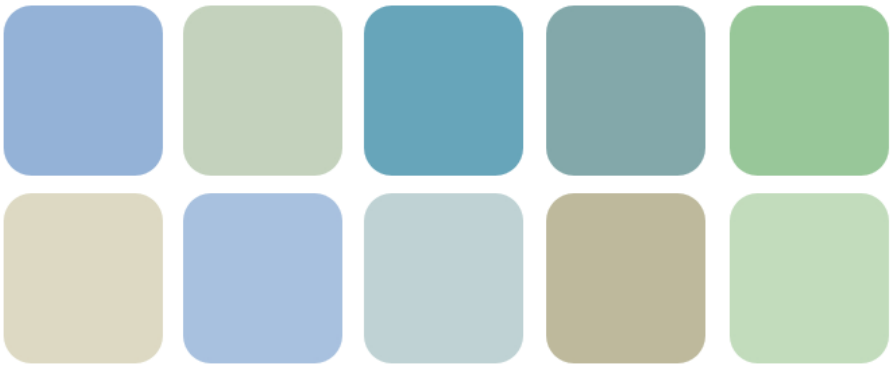
Color. A neutral color palette is preferred. Any accent or contrast should be added judiciously with utility and purpose. Contrast should be limited to transitioning and defining boundaries as opposed to creating visual stimulation for stimulation's sake. Natural and earth tones are the preferred choice.

Research has shown a preference for the blue to green color spectrum and a slight aversion to yellow in autistic individuals (Grandgeorge & Masataka, 2016). This could be the calming effect of the cool colors and the over-stimulation of the warm colors. Gradual transitions

of color, and the use of complementary colors, can provide a comfortable feeling as well. See Figure 17 below.

Figure 17

Color Palette for Autism-Friendly Classrooms



Note. Neutral colors with subdued tints and shades (Source: Author).

Another option is to add color when needed. This can be accomplished by using an indirect RGB light washed over a neutral painted wall surface or as a backlight to create a temporary color that is adaptable to each student's needs. This lighting technique could prove very helpful in a calming space.

Materials and Furniture. Non-slip surfaces, stable fixation, and soft edges minimize physical harm and avoid injury. Solid and durable furniture is required to endure banging and other hard use by the students. Natural materials are preferred; these include wood, stone, and cotton-based fabric. Tactility should be a guiding factor when selecting material that will be in direct contact with users. Textural quality can always be added with loose furnishings such as pillows and blankets. It is easier to add texture than to remove it if the texture becomes uncomfortable for some users. Lastly, maintenance and care of use must be simple and inexpensive. Robustness is important so the materials have a long life, can be cleaned often, and withstand daily wear before needing replacing.

A variety of seating should be included so students can choose which chair fits their sensory needs. Offering a selection of bouncy, rocking, hammock, cushioned, balance, and spinning chairs will meet their variety of needs. While the use of casters can help to reconfigure the space without offensive noise, this could be a distraction for users who have sensory issues with spinning, etc. Limited use is best in this case.

The Importance of Design Integration in the Classroom

The importance of design integration became evident during the COVID-pandemic. Schools were not using their multi-sensory rooms to prevent the spread of germs. Teachers improvised the best they could to incorporate sensory breaks into their classroom routine. They created sensory bins that were used to mimic items found in the MSR. Also, in instances where the multi-sensory room is being utilized by another teacher/therapist or simply cannot be used for possible contamination, an integrated solution must be considered for the classroom. Designing a larger classroom size during space planning will allow for the integration of a sensory corner or closet if needed. This could provide a calming area for an over, or under, stimulated child to retreat to satisfy their sensory needs. They would still be within sight of the teacher and be included in the learning occurring in the classroom. This area is needed to provide respite for students who need to get away and compose themselves. This could be a small alcove or quiet seating arrangement that provides a neutral sensory environment. Individual control of lighting and sound levels should be made available, if possible, in these areas. Full body tactile stimulation from soft furnishings can be a powerful support. Contour chairs and sofas help provide this.

Another design element would be to include space allocated for the storage of sensory bins and aids that can be utilized within the classroom if the need arises. This allows the

paraprofessional to continue assisting students in the classroom instead of leaving the room to walk the sensory-deprived student to the multi-sensory room. Furniture to help with this includes bookshelves and free-standing storage units. Aids such as fidget toys, sensory supports, ear plugs, etc. can be stored here. Students can see the items in bins, and there is a picture on the bin that matches the picture on the shelf on which it belongs. This helps with order and sequence, which is longed for by autistic users.

Routine and predictability are critical for autistic individuals and the spatial sequencing of a room can make or break them. Areas should be organized in a logical manner, based upon the typical scheduled use of the space. Specific areas need to be space planned to provide sensory cues as to the user's expectations in each space, with minimal ambiguity. An area for transitioning into the classroom is needed to hang-up coats, place bookbags, etc. An area for individualized instruction is needed so students can work independently at their desks. Another area for teacher learning with one-on-ones to work on IEPs is important as the students know when they are in that area what is expected of them. Lastly, a group area where all the students can gather around a whiteboard is important to facilitate group interaction.

The beginning of a set of guidelines for designing an autism-friendly classroom was a result of this study. These guidelines cover important aspects to consider when designing such a space: location, lighting, acoustics, color, materials and furniture, calming spaces, and space planning.

Implications for Future Research

Several implications for future research arise from this study. Broadening the scope of the investigation to include the entire state would provide data that more accurately depicts multi-sensory room usage in elementary schools.

Also, the qualitative analysis of the lead special education teacher's perception of the multi-sensory space limits the findings of the study. Future quantitative analysis of student achievement and performance in these same newly designed multi-sensory rooms may shed light on the validity of the perceptual data collected in this study.

This study also could serve as a foundation for in-depth case studies of schools preparing for a school project. Room adjacencies have shown to be beneficial and/or detrimental depending on location.

Lastly, and most importantly, the insight obtained through this study can be incorporated into a set of guidelines for the space planning of a multi-sensory room within the school design. Including this information into the initial planning of the school will only benefit everyone involved and allow the students to realize their full potential. Instead of placing the multi-sensory room into an extra room, why not space plan it in a proper position within the school during the design phase so that a thoughtful selection of adjacencies, materials, and finishes can occur. This multi-sensory room placement should not continue to be an afterthought. Our children deserve better.

In conclusion, this study found that while there is a plethora of information regarding sensory aids to use in a multi-sensory room, and how a room can be designed using these aids, there is little researched information on the validity and effectiveness of these sensory products. Most of the information easily found came from manufacturers and dealers of the sensory aids, thus the "research" being a sales tool instead of a source of unbiased information. Most schools have limited funds to purchase these expensive aids, so they often do without, or improvise and find similar items on their own. Seldom do the schools have adequate space to house the sensory aids that would be most useful for the students. It became evident that special design

consideration should be given in the early space planning stages of the school design to incorporate proper size and location of the multi-sensory room. During this programming stage, designers or architects could discuss space requirements of the special education teachers to allow proper spacing and room for all the desired aids. Ultimately, the special education students are the ones who are being overlooked. Their needs should be noted, and a space designed accordingly. Then teachers will be able to have all sensory aids within reach instead of having to remove an item just to replace it with another that was put aside since there was not enough room for both. Would it not be ideal if multi-sensory rooms were designed specifically for the children who need them instead of being an afterthought? Just imagine where our children would be if all their sensory needs were met in one space!

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Appendix A Questionnaire/Interview Questions

Introduction: The following questions pertain to how the multi-sensory room is used by occupants and the products used. In addition, the interview questions provide further clarification and visuals of the spaces being researched.

Survey questions:

1. What type of equipment is located in your multi-sensory room?
2. How was the multi-sensory room and/or equipment funded?
3. How many staff (teachers, therapists, aides) utilize the room on an average day?
4. What type of staff uses the room?
5. What type of student uses the room?
6. What is the room used for throughout the day?
7. When can you access the room?
8. How many students can use the room at one time?
9. How long does a typical session last?
10. Typically, is a child's time in the room guided or free to explore?
11. Who supervises the sessions?
12. Is training offered for staff on proper usage of the room and/or equipment?
13. Are students assessed for potential risks using the equipment?
14. How effective does spending time in the multi-sensory room contribute to a positive after-effect in the classroom?
15. Do you feel the multi-sensory room is worth the money (cost) and space?
16. How many years of experience do you have in the special education field?

Interview questions:

1. Is your current Multi-Sensory Room adequate to fit your needs?
2. Would you prefer a larger or smaller space? Why?
3. Concerning the space planning, do you feel the current layout works? If so, how does it work well?
4. How could the layout be improved?
5. Do you feel the products/learning aids are used appropriately and children are observed effectively?
6. What additional training, if any, do you feel is needed to effectively use the room?
7. Are there any products/learning aids you feel students would benefit from that you currently do not offer? If so, what are they and what are the benefits?
8. Do you feel there is a benefit in incorporating smaller-scale MSR's into the general classroom?

Appendix B Interview Consent Form

Slippery Rock University of Pennsylvania
Department of Special Education
114 McKay Education Building
724.738.2332

CONSENT TO PARTICPATE IN RESEARCH

Study of Multi-Sensory Room Usage in Elementary Schools

Belinda Nuth Sloboda email: bxn1012@sru.edu cell: (412) 603-0151

1. WHAT IS THIS FORM?
This form is called a Consent Form. It will give you information about the study so you can make an informed decision about participation in this research.

2. WHO IS ELIGIBLE TO PARTIPATE?
Participants must be at least 18 years old to participate.

3. WHAT IS THE PURPOSE OF THIS STUDY?
The purpose of this research study is to find out how multi-sensory rooms are being used.

4. WHERE WILL THE STUDY TAKE PLACE AND HOW LONG WILL IT LAST?
The study will take place via an interview in which you will be asked five open-ended questions. It should last @ 15 minutes.

5. WHAT WILL YOU BE ASKED TO DO?
If you agree to take part in this study, you will be asked to answer twenty-one open-ended questions. You may skip any question you feel uncomfortable answering.

6. WHAT ARE THE POTENTIAL BENEFITS OF BEING IN THIS STUDY?
You may not directly benefit from this research; however, we hope that your participation in the study may help understand how multi-sensory rooms are being used and for the correct reasons.

7. WHAT ARE THE POTENTIAL RISKS OF BEING IN THIS STUDY?
We believe there are no known risks associated with this research study; however, a possible inconvenience may be the time it takes to complete the study.

Initials: _____

8. HOW WILL YOUR PERSONAL INFORMATION BE PROTECTED?

The following procedures will be used to protect the confidentiality of your study records, including the field notes and audiotapes. The researchers will keep all study records, including any codes to your data, in a secure, locked file cabinet. Research records will be labeled with a code. A master key that links names and codes will be maintained in a separate and secure location. The master key and audiotapes will be destroyed 3 years after the close of the study. Any computer hosting such files will also have password protection to prevent access by unauthorized users. Only the members of the research staff will have access to the passwords. At the conclusion of this study, the researchers may publish their findings. Information will be presented in summary format, and you will not be identified in any publications or presentations.

9. WHAT IF YOU HAVE QUESTIONS?

Take as long as you like before you make a decision. We will be happy to answer any questions you have about this study. If you have further questions about this project or if you have a research-related problem, you may contact the researcher, Belinda Nuth Sloboda at (412) 603-0151. If you have any questions concerning your rights as a research participant, you may contact the Institutional Review Board of Slippery Rock University at (724)738-4846 or via email at irb@sru.edu.

10. CAN YOU STOP BEING IN THE STUDY?

You do not have to be in this study if you do not want to. If you agree to be in the study, but later change your mind, you may drop out at any time. There are no penalties or consequences of any kind if you decide that you do not want to participate.

11. WHAT IF YOU EXPERIENCE PROBLEMS RELATED TO BEING A RESEARCH SUBJECT?

Slippery Rock University does not have a program for compensating subjects for injury or complications related to human subjects research, but the study personnel will assist you in getting treatment.

12. SUBJECT STATEMENT OF VOLUNTARY CONSENT

When signing this form, I am agreeing to voluntarily enter this study. I have had a chance to read this consent form, and it was explained to me in a language which I use and understand. I have had the opportunity to ask questions and receive satisfactory answers.

I understand that I can withdraw at any time. A copy of this signed Informed Consent Form has been given to me.

_____	_____	_____
Participant Signature	Print Name	Date

By signing below, I indicate that the participant has read and, to the best of my knowledge, understands the details contained in this document and has been given a copy.

_____	_____	_____
Signature of Person Obtaining Consent	Print Name	Date

Appendix C Audiotape Consent Form

Slippery Rock University of Pennsylvania
Department of Special Education
114 McKay Education Building
724.738.2332

Photo/Videotape/Audiotape Release Form

Study of Multi-Sensory Room Usage in Elementary Schools

Belinda Nuth Sloboda email: bxn1012@sru.edu cell: (412) 603-0151

We request the use of audiotape material of you as a part of our study. We specifically ask your consent to use this material as we deem proper, specifically, for news releases, professional publications, websites and pictorial exhibits related to our study. Regarding the use of your likeness in audiotape, please check one of the following boxes below:

☐ I do…
☐ I do not…

Give unconditional permission for the investigators to utilize audiotapes of me.

_____	_____	_____
Participant Signature	Print Name	Date

PLEASE NOTE: Even should you choose not to allow your image or voice to be used, we can still benefit from your inclusion as a research study participant.