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Program Evaluation of the Impact of Sensory Room Activities on Student Readiness in

Muskegon County

Mary Spyhalski

Grand Valley State University

**Background:** There is a lack of research regarding the effect of sensory room interventions on student's school readiness, and a lack of research regarding documentation to measure sensory room effectiveness. This is a problem for occupational therapists and teachers implementing sensory interventions unsupported by research (Stephenson & Carter, 2011).

**Methods:** Grand Valley State University Masters of Occupational Science and Therapy students were contacted by Muskegon County Northern Service Unit occupational therapists to conduct a program evaluation regarding the impact of their sensory rooms on student readiness throughout the school day. During a 6-12-week period, this study utilized a Data Collection Sheet for Sensory Room Breaks created by the Muskegon County NSU occupational therapists to collect information during the sensory room interventions. Additionally, adult employees working with the students in the sensory rooms were asked to complete an online survey.

**Results:** On average, students were 56% more engaged in classroom activities post-sensory room intervention. Additionally, participation increased when the post sensory room classroom activity in which students engaged was active vs. stationary.

**Conclusion:** The sensory room interventions within Muskegon County NSU appear to positively impact a student's classroom performance by increasing their readiness to engage in educational activities by 56%.

### **Introduction to Study**

Currently in Muskegon County, MI, 3,807 students are receiving special education services, which represents 12.8% of the entire special education count in the state of Michigan (Michigan Department of Education, 2017). Some students receiving services have sensory processing issues that interfere with participation in school day routines, such as academic work. Occupational therapists who work in school settings provide interventions that address these sensory needs. There is a lack of research regarding the effect of sensory room interventions on student's school readiness, as well as a lack of research regarding documentation and evidenced based practice within sensory rooms. This is a problem for occupational therapists and teachers in schools who are implementing sensory interventions that are not backed by research (Stephenson & Carter, 2011).

Occupational therapists in Muskegon County Northern Service Unit (NSU) determined a need to collect data on the impact of sensory room interventions on student readiness for school-day activities within their district. Program evaluations are needed in order to gather data that discusses the use of sensory rooms and also to add to the body of knowledge for occupational therapists who wish to develop protocols for effective sensory room use in school settings. Grand Valley State University (GVSU) Masters of Occupational Science and Therapy students were contacted by Muskegon County NSU occupational therapists to conduct a program evaluation regarding the impact of their sensory rooms on student readiness throughout the school day.

### **Background**

According to the Individuals with Disabilities Education Act (IDEA), for a student to qualify for special education services they must meet one of the following eligibility

requirements: Autism Spectrum Disorder (ASD), Cognitively Impaired (CI), Deaf Blindness (DB), Early Childhood Developmental Delay (ECDD), Emotionally Impaired (EI), Hearing Impaired (HI), Other Health Impairment (OHI), Physical Impairment (PI), Severe Multiple Impairments (SXI), Specific Learning Disabilities (SLD), Speech and Language Impairment (SLI), Traumatic Brain Injury (TBI), and Visual Impairment (VI) (Michigan Department of Education, 2015). Any student with a diagnosis of one of the aforementioned eligibilities may benefit from sensory room interventions at their school to create adapted responses related to sensory processing issues. It is projected that within the general population, about 5-10 percent of students may have sensory integration dysfunction (Roley, Bissell, & Clark, 2009). Sensory integration dysfunction is also called Sensory Processing Disorder (SPD), and is defined as the inability to use information received through the senses in order to function efficiently in daily life (Kranowitz, 1998). For these students, it means there is a need for them to utilize a separate environment to engage in activities that will regulate their sensory processing during the school day and allow them to successfully access education through school-day activities. To address sensory processing issues in the school environment, occupational therapists evaluate and plan interventions to impact students' performance in school tasks and daily routines.

### **Significance to Occupational Therapy**

Occupational therapy (OT) services have been provided in the schools since 1975 when the Individuals with Disabilities Education Act (IDEA) was established (Block & Chandler, 2005). The American Occupational Therapy Association (AOTA) states that the goal of school OT practice is to improve the student's participation in school-related activities and his or her access to the general education curriculum, as well as to improve engagement in everyday occupations (Roley, Bissell, & Clark, 2009). Sensory integration (SI) is often used as a

theoretical framework for school occupational therapists to base their interventions on, which allows for students to have more effective access to school curriculum and adaptive responses in the classroom (Roley, Bissell, & Clark, 2009). Some of the purposeful activities, or occupations, that occupational therapists in the school systems focus their treatment on for students include swinging, climbing, jumping, buttoning, drawing, and writing (Kranowitz, 2006). These sensory-based activities often take place within a sensory room environment in a school setting and include equipment such as swings, weighted vests, sensory bins, music, and soft lighting.

The services that schools provide require that OT interventions meet each student's needs to facilitate an equal opportunity in his or her learning environment. Similar to the trend in the field of OT as a whole, the emerging practice of addressing population-wide issues in the schools is becoming more popular, along with the student-specific concerns (Block & Chandler, 2005). It is important for the OT to address the environmental aspects of the classroom for the entire group of learners, and to understand the educational theories involved in teaching (Block & Chandler, 2005). One of the current challenges facing school-based occupational therapists is a lack of research regarding the use of sensory interventions to support evidence-based practice for students receiving services. This gap in research includes a lack of evidence to guide school-based occupational therapists' choice of interventions to utilize within the sensory room. There is also a lack of data on documentation and effective monitoring techniques, which is a problem for school professionals when trying to meet the needs of their students in the sensory room (Stephenson & Carter, 2011).

### **Research Question**

The gap in research on sensory rooms in schools combined with the need for developing a method for evaluating the effectiveness of interventions, led the occupational therapists in

Muskegon County NSU to partner with Grand Valley State University (GVSU) student researchers to develop the following research question: “Does the use of sensory room activities increase readiness for participation in school environments among k-12 students with sensory processing disorders?”

### **Purpose Statement**

The overall purpose of this program evaluation was to determine the effectiveness of sensory room interventions and the impact on student readiness provided in the four sensory rooms located in Muskegon County Northern Service Unit (NSU) determine the impact the student’s level of school readiness. Thus, this program evaluation was conducted to determine if the current use of sensory room interventions increases readiness for participation in school environments among K-12 students with sensory needs. This information will be used by the school district to support or improve the current sensory interventions that are utilized.

### **Review of Literature**

#### **Person-Environment- Occupation Model**

The Person-Environment- Occupation (PEO) model was used to guide the literature review as it enabled the assessment of the transactional relationship between the person with his/her unique abilities, the school environment, and the occupations within the school day. The PEO model recognizes that occupational performance is the result of the dynamic relationship amongst the person the environments in which they live and work , and their occupations and roles within each (Law et al., 1996).

In the last decade, the use of sensory rooms in schools has increased nationwide. These spaces are a place for students to go for emotional regulation, prepare for in-class activities, or as a reward for positive behavior. According to Linda Messbauer, an occupational therapist (OT) who created the first sensory room in the United States in 1992, “Kids are influenced by their

environment, and they want to control as much of it as they can. The room helps them learn to control behavior through understanding and using their sensory diet” (Newhouse, 2015, p. 1).

To understand which interventions are most effective to use in the sensory space, it is important for professionals to grasp an understanding of how a student with sensory difficulties may be feeling, and what they need to be able to adapt appropriately to the sensory input they receive.

To do so, the student’s person factors, environment, and occupations need to be considered in order to take a holistic approach while addressing the student’s occupational performance throughout the school day (Law et al., 1996).

### **Person**

The person factors in this literature review included: the students with sensory processing issues, and the individuals who work with them to facilitate participation in the school setting.

More specifically, the members of the IEP team which include: occupational therapists, teachers, and their parents. The literature suggests that certain person factors accompany students depending on the type of sensory processing disorder, or pattern that they have. Each sensory pattern is known to bring about a specific behavioral response within the student, which may inhibit their performance throughout the school day. Most frequently addressed by the literature, was the pattern of sensory over-responsivity or under responsivity, that is associated with having a sensory modulation disorder.

**Sensory modulation disorder.** A student with sensory modulation disorder has either have a pattern of over-responsivity, under-responsivity, or sensory craving (Atchison & Dirette, 2016). A common theme in the literature is that sensory over-responsivity results in behavioral responses to sensory input that are rapid in onset, prolonged, and vaster in intensity when compared to the student’s peers (Ben-Sasson et al., 2009; Kranowitz, 1998). For example, for a student with this pattern of dysfunction, a door shutting may sound too loud or an elastic

waistband may feel too tight, causing the child to act more cautious and fearful or destructive and defiant. Information from a systematic review on sensory responses suggests that over-responsivity is highly prevalent in children with autism and developmental delays, but also in typically developing children, with a higher prevalence in younger/less mature children (Baranek et al., 2006).

Likewise, a student who has sensory under-responsivity often ignores or does not notice sensory stimuli. These students may appear to others as passive, uninterested in their surroundings, and indolent or lethargic. These behaviors are hypothesized to occur due to the inability of the sensory information to reach the student's threshold of awareness (Schoen, Miller, Brett-Green, & Nielsen, 2009). A study that observed sensory features in children found that under-responsivity is linked to a lack of response to stimuli in social situations (Baranek, et al., 2006). In a school setting, this can interfere with a student's self-esteem, learning, and participation in group activities, as well as alter other students' perceptions of them. For sensory craving, some literature suggests that students may exhibit sensory-seeking behaviors in order to modulate their anxiety associated with unpredictable sensory stimuli (Little, Ausderau, Sideris, & Baranek, 2015).

**Sensory discrimination.** Sensory discrimination causes difficulties with the process of understanding and interpreting incoming sensory input and can be in the form of auditory, tactile, visual, proprioceptive, and vestibular discrimination (Miller & Fuller, 2006). Much of the literature discussing sensory discrimination disorder highlights how these students perceive themselves and how they are perceived by others. According to Wuang et al., students who show an impairment in sensory discrimination may discern themselves as apathetic, less motivated, and disoriented (2008). In the school setting, these students may have a lack of safety

awareness, trouble buttoning pants after using the restroom, trouble distinguishing between letter sounds, difficulty remembering visual information, and more (Wuang et al, 2008; Miller & Fuller, 2006).

**IEP team.** Many therapists work on a team within a department of therapeutic services and collaborate with other professionals to outline the abilities, needs, and goals of each specific student to plan his or her special education program. This specially designed student summary can be found on the student's individualized education plan (IEP). According to the literature, an IEP outlines a student's current abilities, declares his or her needs, sets goals, and postulates a guide to implementing an appropriate special education program (Patti, 2016). The IEP also includes the student's current levels of performance in the classroom, and how his or her disability impedes participation in general education (Center for Parent Information and Resources, 2016). The IEP team often consists of parents, teachers, and other school staff who are interested in the unique needs of the student with a disability (Center for Parent Information and Resources, 2017). Parental participation was also addressed by the literature, and suggested that students who have a sensory processing disorder and are currently receiving OT services may significantly advance in the achievement of therapy goals, as well as adaptive behaviors while at home (Hamill, 1987). Conclusively, the literature shows that a student's occupational performance throughout the school day is combination of the type of sensory processing patterns, the associated behaviors, and the response of the members of the IEP team and efforts to address those needs through therapeutic goals.

### **Environment**

Environments that impact the occupational performance of students in the school setting include: the classroom environment, the playground, and sensory room environment. When students begin education, sensory over-responsivity (SOR) can become evident, as the social and

physical environment around the students at school is frequently more stimulating than their home environment. Students have less control over their surrounding environment in the schools, which makes it more difficult for them to learn (Ben-Sasson et al., 2009). Occupational therapists in the schools use sensory interventions to facilitate students growing into their SPD, and can utilize sensory rooms as a safe and calming place for them to advance academically and developmentally. An anticipated outcome of sensory interventions is to increase students' performance at school in the many different environments they experience throughout their day.

**Classroom setting.** Students with sensory processing disorder (SPD) are known as learners with disabilities with regard to responding effectively to the demands made by a learning environment (Tsung-Yen & Ming-Shiou, 2016). Modern-day classrooms are frequently constructed with an overabundance of visual clutter and students are often seated in groups, which exposes them to unpredictable tactile input (Ashburner, Ziviani, and Rodger, 2008). The literature shows that excessive noise in modern-day classrooms can hinder academic performance (Anderson, 2001). According to a study that investigated the associations between sensory processing and classroom emotional, behavioral, and educational outcomes of students with autism spectrum disorder, students who have difficulty processing verbal instructions in noisy environments and who frequently focus on sensory-seeking behaviors have a higher prevalence of underachieving academically (Ashburner, Ziviani, & Rodger, 2008).

**Playground setting.** The playground is a critical environment for students' social participation. Playground activities can lead to the development of a student's physical, cognitive, and social skills, and observing students' play at recess can reflect their level of development with these skills (Pellegrini & Smith, 1993). A study was conducted to look at playground behaviors of students with and without sensory processing disorder. In this study,

classroom teachers recruited students who they suspected to have SPD for participation, and the students' behaviors were observed on the playground (Cosbey, Johnston, Dunn, & Bauman, 2012). The study found that not only were the students with suspected SPD less sought out to play by their peers, but they were also more likely to have conflict, less likely to pick up on the social cues from others, and engaged in more immature play than their peers (Cosbey, Johnston, Dunn, & Bauman, 2012). This study demonstrates how the social deficits that students with SPD possess can influence their play during the school day.

**Sensory Environments.** A review of the literature indicates that sensory rooms have become more prevalent throughout the last ten years as they provide students with sensory processing difficulties a place to go throughout the school day. These rooms are defined and labeled differently amongst different schools, but all create a therapeutic place for students who need sensory interventions. Schools refer to them as “motor rooms,” “sensory rooms,” or “multisensory rooms.” While there is no universal definition for what a motor room is, a program called “Ready Bodies, Learning Minds” describes a typical motor room as “aiming to enhance learning readiness through engagement in certain movement activities that develop the reflex and sensory systems” (“What is the RBLM Motor Lab?,” n.d.). The terms ‘multisensory room’ and ‘sensory room’ are often used interchangeably, both involving the use of visual, auditory, and kinesthetic modalities together in a calming environment where each student feels safe and can explore the space regardless of his or her limitations (Obaid, 2013; Says, 2013). These sensory environments are designed to stimulate and soothe emotions through the student’s senses and can utilize a variety of different equipment to match the student’s unique needs (Stephenson, & Carter, 2011). Conclusively, the literature supports that sensory spaces within

schools can assist students in learning how to modulate sensory responses to a variety of stimuli that impact occupational performance.

### **Occupations**

Occupations of a student indicated within a review of the literature included the areas of: academic work, social participation, and play. The literature frequently addressed how sensory processing impacts the students quality of participation, willingness to engage, and consistency in each of these occupations. The follows sections described the themes in the literature more thoroughly.

**Academic Work.** According to the literature, learning is dependent upon the ability to process sensation from movement and the environment and use it to plan and organize behavior (Bundy & Murray, 2002). Difficulties in processing sensory information for students within a classroom setting directly correlates with the quality of their occupational performance in the classroom, specifically regarding learning and behavior. Students with difficulties in processing sensory information are at an increased risk for learning disabilities and exhibit lower participation in school-related activities as well as decreases in academic achievements (Koenig & Rudney, 2010). Research shows that students with sensory processing difficulties perform below average in spelling, reading, and writing tasks (Koenig & Rudney, 2010). Thus, early intervention within the classroom setting has been found to play a crucial role not only in improving the sensory processing of the student and his or her academic performance, but also on educating the teaching staff on how to supplement their lessons to accommodate the sensory needs of the student (Lin, Min, Chou & Lin, 2012). Sensory interventions are able to effectively address and minimize the performance deficits supported by the literature in the occupations of learning, participation, play, and overall school function (Koenig & Rudney, 2010).

**Play.** Throughout the early school years, play is an important occupation for students as it

encourages learning and social participation with others. A systematic review on the performance challenges of children with SPD suggests that students who have trouble processing and integrating sensory input show decreased quality and quantity of play skills and social participation (Koenig and Rudney, 2010). Play is crucial for all students as it allows them to work towards healthy brain development and requires them to use creativity while developing their imagination, dexterity, as well as their physical, cognitive, and emotional strength.

**Social Participation.** While playing in groups, students can learn to share, problem solve, and acquire self-advocacy skills, which are all aspects of social participation that will benefit them in their future (Ginsburg, 2007). The literature proposes that students with motor disorders are at a high risk for significantly lower social participation rates. Poulsen, Ziviani, Cuskelly, and Smith (2007) uncovered that boys with developmental coordination disorder (DCD) had lower participation in structured and unstructured physical play activities than boys without DCD. However, participation in team sports showed to be a protective factor for boys with DCD, and participation was increased for these individuals (Poulsen et al, 2007). Additionally, a study examining children with an over-responsivity to sensory stimuli showed that students exhibiting the poorest social performance during play activities were those who had a sensory over-responsivity (Hilton, Graver, & LaVesser, 2007).

Conclusively, the literature shows that sensory processing difficulties can significantly obstruct student's school occupations of education, play, and social participation. These themes derived from the literature demonstrate the importance for occupational therapists to use evidence based practice to support their efforts in minimizing the sensory processing difficulties of students that result in occupational deficits in the areas of social participation, academia, and play.

## **Methods**

### **Research Design**

To evaluate the effect of participation in sensory room activities on school readiness behaviors in Muskegon County Northern Service Unit (NSU), a concurrent nested mixed methods design was applied. A mixed methods design allowed both qualitative and quantitative data to be incorporated within this study, while the concurrent nested approach allowed for the simultaneous collection and analysis of both types of data within this single study (Creswell et al, 2003). Two tools were used to collect both quantitative and qualitative data: the Data Collection Sheet (see Appendix A) created by the NSU occupational therapists, followed by an online survey administered to the professionals involved with sensory room study 3 weeks later (see Appendix B).

### **Sample**

A sample population of 6 students within the Muskegon County NSU already enrolled in special education services were recruited for participation in this study. The students' eligibilities for occupational therapy services in the sensory room included: Autism Spectrum Disorder (ASD), Emotional Impairment (EI), Early Childhood Development Delay, and Other Health Impairment (OHI) of Attention Deficit Hyperactivity Disorder (ADHD). Participants in this study were all elementary aged students. The students' eligibilities for services included: Autism Spectrum Disorder (ASD), Emotional Impairment (EI), Early Childhood Development Delay, and Other Health Impairment (OHI) of Attention Deficit Hyperactivity Disorder (ADHD).

Additionally, adult employees working within Muskegon County NSU were recruited for this study. These employees included 3 occupational therapists and 6 paraprofessionals. All sensory room interventions and documentation was carried out by the paraprofessionals after

being trained by the occupational therapists.

**Site**

Four sensory rooms included within this program evaluation were all located in the Muskegon County NSU. Each sensory room was housed within elementary school buildings and were utilized by both general education students and special education students alike to target sensory processing. Observational data of the 6 students recruited for this study were recorded using the Data Collection Sheet by sensory room paraprofessionals.

**Inclusion/Exclusion****Inclusion Criteria**

This inclusion criteria were chosen by occupational therapists at Muskegon County NSU to establish guidelines that allowed the student's information to be utilized within the research. By the student having an active IEP, the occupational therapists were given information on the students' current diagnosis and any accommodations they may need throughout the school day, such as sensory room interventions. The requirement of the student having to be currently participating in sensory room interventions allowed for the child to feel comfortable within the room prior to the research. Lastly, it is important that an adult employee of the school agrees to complete these data collection forms as they are essential to the research.

1. The student must have a current IEP within the school district.
2. The student must be currently participating in sensory interventions in the chosen sensory rooms.
3. An adult employee must agree to complete required data collection forms to collect research.

**Exclusion Criteria**

The exclusion criteria was also determined by occupational therapists at Muskegon County NSU to establish which students were appropriate to participate in the research collection. This allowed for similar criteria to be used across the four sensory rooms.

1. The student does not have a current IEP within the school district.
2. There is no documentation of a student's sensory processing issue.

### **Instruments**

Throughout the data collection process, two tools were used. First, during the 6-8-week data collection period, the adult employees implementing the sensory room interventions completed the Data Collection Sheet created by the Muskegon County NSU occupational therapists. The Data Collection Sheet consisted of qualitative and quantitative questions to guide their documentation. The occupational therapists collaborated amongst each other while making the Data Collection Sheet to allow for a single form that would work across all sensory rooms used. The Data Collection Sheet required that the adult employees document what the student was participating in before the sensory room intervention, as well as rate their level of engagement in that activity on a Likert scale (1=not at all engaged, 5= fully engaged). The same steps were taken after the sensory intervention when the student returned to their school day activities. During the sensory intervention, the adult employees also recorded the start and end time of the intervention, as well as the number of stations within the sensory room that the student completed during that time. This form included additional space for comments to be analyzed later by GVSU students for theming (see Appendix B)/

The second tool that was used was the electronic survey created by the GVSU student researchers using the SurveyMonkey program. Four weeks after the data collection period, the adult employees who implemented the sensory room interventions received an email with a survey consisting of qualitative and quantitative questions as well as a consent form. The

questions included in this survey were developed through collaboration between the student researchers and their mentor, as well as the GVSU Statistical Consulting Center. The responses to this survey were intended to be used for thematic analysis, however, not one of the paraprofessionals completed the survey, therefore no conclusions were drawn from use of this tool.

### **Reliability and Validity**

Preceding data collection, occupational therapists within Muskegon County NSU and GVSU student researchers teamed together to address the following components pertaining to reliability and validity: who is able to collect the data, what kind of instrument was to be used to collect the data, and how/when the data was to be collected. Reliability is the extent to which a research tool produces consistent and stable results (Phelan & Wren, 2005). Validity refers to whether an instrument measures what it is intended to measure within a study and is used to determine whether the findings from the data are accurate from the viewpoint of the researcher and participants (Creswell, 2003).

During the development of the Data Collection Sheet and electronic survey, steps were taken to increase reliability and validity. To promote interrater reliability, adult employees were given specific sensory motor room training from occupational therapists within Muskegon County NSU (see Appendix C), which allowed for consistent scoring on the Data Collection Sheet. The Data Collection Sheet was completed for each student multiple times throughout the 6-8-week data collection period, allowing for test-retest reliability, which is defined as when a test is administered more than once to the same group (Phelan & Wren, 2006). Reliability for the survey given to adult employees was established by the GVSU student researchers through collaboration with the GVSU Statistical Consulting Center to ensure the formatting of survey

questions provoked responses that elicited similar information between the different adult employees.

Content validity, or the extent to which a tool measures the entire construct of interest, was established by the Data Collection Sheet (Price, Jhangiani, & Chiang, 2015). The Data Collection Sheet used the same Likert scale pre-sensory intervention and post-sensory intervention, which allowed for comparison to be made that quantified the impact of the sensory intervention on students' school readiness. Construct validity, or the degree to which a tool measures the variable that it is intended to measure was addressed (Bolarinwa, 2015). On the Data Collection Sheet, a higher score for the Level of Engagement Likert scale from pre- to post-sensory intervention was used to show an increase in the students' school readiness, allowing for the intended variable to be measured. Additionally, concurrent validity, or the criterion and the construct being addressed at the same time (Price, Jhangiani, & Chiang, 2015). This was addressed by use of the Data Collection sheet; the adult employees recorded the criterion (or the students' level of engagement pre and post sensory intervention with the number of sensory activities completed), in addition to the students' school readiness (construct) at approximately the same time.

To promote accuracy of the qualitative data received from the Data Collection Sheet and survey, triangulation, member checking, and rich descriptions were utilized. Triangulation, or use of multiple methods to collect data on the same phenomena, was used in this study by collecting data through the observations on the Data Collection Sheet and survey, to assess the impact of the sensory interventions on the students' readiness (Carter, Bryant-Lukosius, DiCenso, Blythe, & Neville, 2014).

### **Data Collection/ Analysis**

All quantitative and qualitative data collected during each session within the sensory

room was documented by the paraprofessionals within the NSU using the Data Collection Sheet. This included documenting the identity of the student (using numbers 1-6), recording the type of activity being participated in, as well as each students level of engagement on the Likert Scale. After 8 weeks of data collection, the data was then de-identified by the occupational therapists to ensure no students name or identifying traits were included within the documentation. After the data was de-identified, it was securely sent to the student researchers at Grand Valley State University (GVSU) to be analyzed using SPSS statistics and thematic analysis.

Generalized estimated equation (GEE) was used to analyze the quantitative data from the Data Collection Sheets. The statistical consulting center utilized this type of analysis Generalized as it allowed for inclusion of all variables/data indicated on the Data Collection Sheet, to compensate for the small sample size of 6 student participants in which data was collected. Using this type of analysis, enabled a more reliable and accurate interpretation of the data.

Observational data recorded on the Data collection sheet was analyzed by the GVSU student researchers for thematic analysis. The themes derived from qualitative data were utilized by the student researchers to compare to the themes identified within the literature, to determine if the findings were accurate. The findings from the data analysis were disseminated through rich descriptive implications for practice to provide meaning for the individuals using the results from this study, as well as to enhance the services provided by the Muskegon County NSU occupational therapists.

### **Procedure**

The three occupational therapists from Muskegon County NSU recruited 1-2 students from each of their caseloads to participate in this research study. Within the 8-12 week timeframe, observational data of the 6 students recruited for this study were recorded using the Data Collection Sheet by sensory room paraprofessionals. This included documenting the

following areas: the school activities each student was engaged in before and after the sensory intervention, how long each student was in the sensory room, what sensory activities were completed while in the room, and any additional comments to be noted. Additionally, the guidelines that were given to each of the adult employees involved in documenting the sensory room interventions is provided in Appendix C.

It is important to note that no deviation from regular therapy interventions for each student occurred, throughout this process, as they were already receiving sensory interventions throughout the school day. Rather the documentation of each students' participation in sensory room activities was new for the adult professionals working with these students in Muskegon.

Following data collection, a survey created by the student researchers found in Appendix B was administered online through SurveyMonkey to all adult employees involved in monitoring the students in the sensory rooms. Prior to participating in the survey, the adult employees were required to provide their consent by agreeing to the terms on the consent form (See Appendix B).

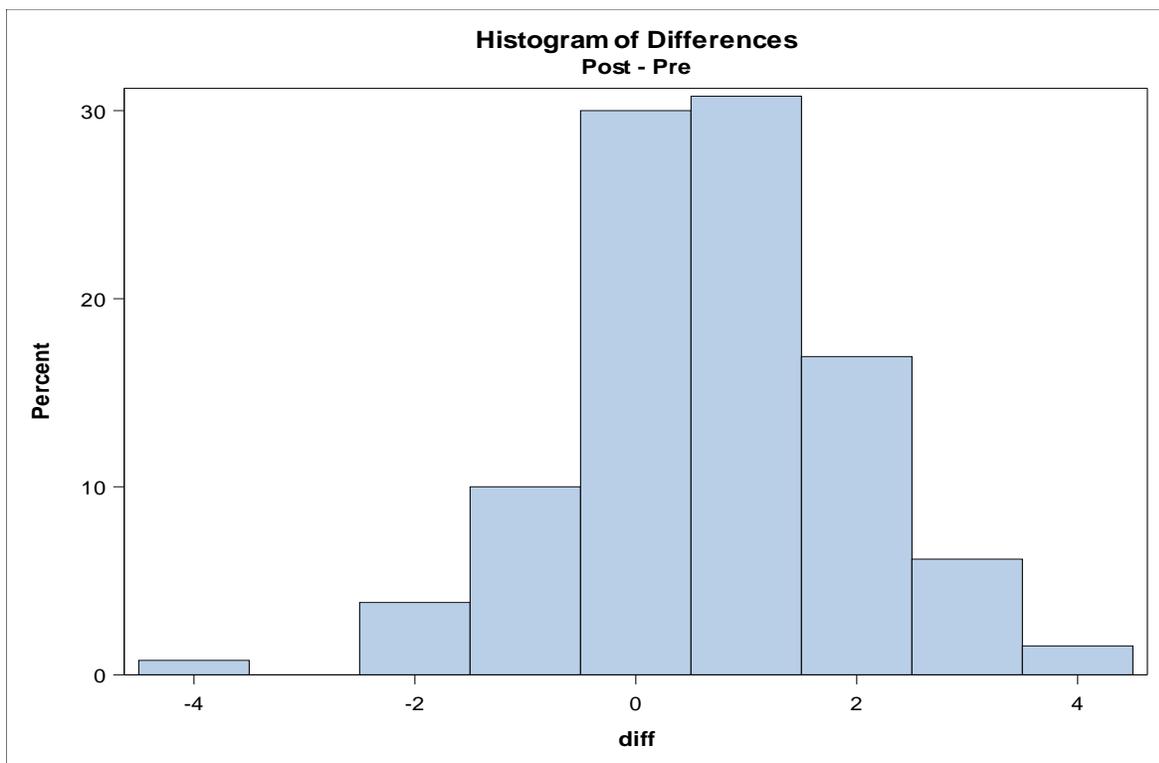
## **Results**

### **Quantitative Data**

In order to incorporate all variables documented on the Data Collection Sheet (described previously in Instruments), the statistical consulting center at GVSU used a Generalized Estimated Equation (GEE) to analyze the data. This type of analysis allowed for pre-post sensory room variables to be analyzed without excluding any additional information provided ( i.e number of stations completed, duration of time in sensory room, etc.) . Additionally, in using a GEE analysis it was assumed that each documented sensory room intervention for each participant was independent from another, allowing for conclusions to be drawn from a larger data pool. The data pool consisted of a total of 260 pre/post sensory room logs/measurements (130 pre, 130 post). Formatting the data in this way allowed for more entries to be analyzed as

not all students participated in the sensory room an equal number of times (discussed further in the thematic analysis).

According to the quantitative data provided on the Data Collection Sheet, an analysis of the Generalized Estimated Equation (GEE) parameters measuring pre-post level of engagement indicated that on average students were more engaged in their classroom activities after having participated in a sensory room break (see Figure 1). Shown in Figure 1, the Histogram of Differences provides a visual representation of the percent of change (or difference) in academic readiness, or level of engagement pre/post sensory room, as measured using the Likert Scale on the Data Collection Sheet. Additionally, the bell shape of the histogram denotes a non-skewed, or normal distribution of the data set demonstrating a relatively consistent change in performance was seen pre/post sensory room break interventions across each participant.



*Figure 1 .Mean difference values representing the percentage of difference in level of*

*engagement seen pre to post sensory room interventions*

Furthermore, analysis of the quantitative data also indicated that the type of activity the student engaged in post sensory room also impacted the students level of engagement. The various activities written on the Data Collection Sheet included: writing, play, mathematics, snack, and recess. In order to analyze these activities further, they were divided into two categories by the GVSU student researchers: stationary activities vs. active activities. The stationary activities included those that required a student to remain seated at a desk in order to complete (i.e writing and mathematics), while the active activities accounted for the school day occupations that allotted for regular, physical movement (such as recess, snack, art, etc.). According to the analysis of GEE parameters, students were 56% more engaged in the activities post-sensory room when the type of classroom activity (activity A) was active as opposed to stationary (referred to as activity S) (see Figure 2 Analysis of GEE Parameter Estimates).

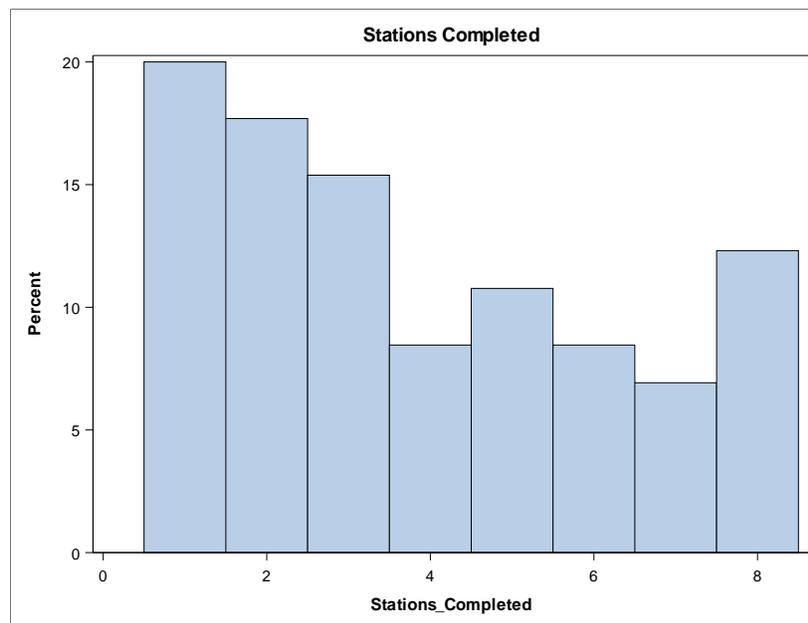
Analysis Of GEE Parameter Estimates							
Empirical Standard Error Estimates							
Parameter		Estimate	Standard Error	95% Confidence Limits		Z	Pr >  Z
Intercept		2.3700	0.4682	1.4524	3.2876	5.06	<.0001
Activity	A	0.5600	0.1827	0.2018	0.9181	3.06	0.0022
	S	0.0000	0.0000	0.0000	0.0000	.	.
Time	Pos	0.6756	0.1175	0.4454	0.9059	5.75	<.0001
Time	Pre	0.0000	0.0000	0.0000	0.0000	.	.
Break		0.0276	0.0247	-0.0209	0.0761	1.11	0.2650
Stations_Completed		0.0620	0.0299	0.0033	0.1206	2.07	0.0383

Figure 2. Analysis of GEE Parameter: % of Difference in Participation between type of activity, Stationary (S) versus Active (A).

Additionally, the GEE analysis revealed that remaining at one of the eight stations within

the sensory room (as opposed to completing a greater number of stations), had a greater effect on increasing post level engagement/participation. As shown by Figure 3, on average students who remained at one station during the sensory room break were 20% more engaged in the activity/station being completed within the sensory room. Likewise, there was no difference for students who completed the number of stations 4-6, as engagement remained at (8%). Those who completed station seven had the lowest recorded percent of engagement (6%).

Unfortunately, rationale as to why engagement was higher or lower at certain stations is inconclusive/uncertain as the manner in which the stations completed were documented by each of the paraprofessionals inconsistent as interpretations of the guidelines differed (discussed further in limitations).



*Figure 3 . Percentage of stations completed most frequently based on average number of times a participant engaged in each.*

### **Qualitative Data**

Qualitative methods involve non-numerical examination and interpretation of observations to discover underlying means and patterns of relationships (Mortenson & Oliffe,

2009)., A common theme in the literature is that by combining qualitative and quantitative approaches, a greater and deeper degree of understanding is provided than if a single approach was taken (Almalki, 2016; McKim, 2017). For occupational therapists, the combination of these approaches allows researchers to target their research from multiple perspectives to facilitate understanding about multifaceted phenomena such as health, illness, and occupation (Mortenson & Oliffe, 2009). By using a mixed methods approach to determine the effect of Muskegon County NSU's sensory rooms on student's school readiness, the student's school occupations were able to be analyzed with numerical and categorical data to fully understand the results and patterns that emerge.

Upon analysis of the qualitative data derived from the comments section of the Data Collection Sheet, four trends emerged in regards to having an effect on each participants' level of engagement or willingness to participate in sensory room interventions, including: 1) general absence from the sensory, pre-engaged in an activity prior to receiving a sensory room break, and 3) whether or not they were having a good day, versus 4) a bad day. Each of these four categories, or themes, was founded by the GVSU student researchers, upon both individual and group thematic analysis of the qualitative data. More specifically, each of the comments was analyzed by the student researchers through coding, and then separated into four distinct categories by the GVSU student researchers to compare to the literature to fully understand the patterns that emerged. There was limited to no additional context or information provided to these comments; as such, definitions of each theme are broad and will be discussed further in the following sections.

### **Absence from the Sensory Room**

Absence from the sensory room is defined as a student's lack of participation in the sensory room on any given day. Out of 76 comments provided by the paraprofessionals on the

Data Collection Sheet, absence from the sensory room was one of the major themes that transpired from the qualitative data. There were twenty-two various comments in total pertaining to this theme, including: “absence from school day due to an appointment”, “gone on mid winter break”, “only had a half day of school”, “refused to come to sensory room”, etc. See Appendix D to view all 22 comments. Ultimately, these comments indicated that a general underlying theme of missing out on a sensory room break occurred (for various reasons).

### **Type of Activity Prior to Sensory Room**

There were five different instances documented by the paraprofessionals in which a student chose not to attend the sensory room as they were pre-engaged in an activity within the classroom during the time in which they were offered a sensory room break. The pre-engaged activities that led a student to not wish to go to the sensory room simply ranged from: “it was the students’ birthday” (1), “they wanted to stay in class to finish work and come later” (3), and there was “no need” for the student to have a sensory room break at that time (no additional context provided) (1). The lack of context provided in attempting to theme each of these comments is definitely a limitation that will be discussed further within the limitation section. However, this information is indicative the additional stimuli pertaining to the course of a typical school day that could deter a student’s focus and willingness to engage in skilled OT interventions.

### **Good Versus Bad Day**

Additionally, whether or not a student was having a “good” or “bad” day, as documented by the paraprofessionals within the sensory room, was a common theme derived from the qualitative data influencing sensory room participation. Twenty-eight comments suggested that the student was having a good day. These comments including phrases such as, “doing really well at station 5 today”, “loved motor room today”, “very willing to work on math today”, etc.

Likewise, 17 comments in total were indicative of a bad day. This included comments such as, “hungry today”, “did not go due to behavior”, “having an off day”, “hard time redirecting”, etc. As to what specifically quantified each of the participants documented “good” vs. “bad” days (whether it was behavioral, temperament, hunger, etc.) is not described in any further detail outside of context provided in the short comments/phrases used above. As such, other than being aware that all of these factors can influence a student’s participation in the sensory room on any given day, no other meaningful conclusions were deduced from this data.

### **Discussion**

By conducting a program evaluation on the sensory rooms within Muskegon County NSU, the findings of this study effectively conclude that the use of sensory room interventions does in fact increase the academic readiness of eligible participants by 56% in Muskegon County. What this means is that should these sensory rooms breaks be replicated and provided to each student eligible for occupational therapy services within Muskegon County NSU, it is with a confidence level of 95% that both teachers and occupational therapists would see a both clinically/statistically significant improvement in students’ engagement in their academic work. Additionally, when engaging in a post sensory room activity that is active (as opposed to stationary) such as play or social participation, engagement is shown to improve by 56%. Should Muskegon County NSU align their academic curriculum with the timing of the sensory room breaks/interventions, overall occupational performance of the eligible students would increase. Furthermore, by focusing on the quality of the engagement within the activities performed in the sensory room, as opposed to the quantity or number of stations completed, participation within occupational therapy/sensory room interventions would have a general increase (as demonstrated by Figure 2).

Additionally, the themes derived from the qualitative findings correspond to the themes within the literature. By conducting a program evaluation on the sensory rooms within Muskegon County NSU, overall, this study supports the themes transpired from the literature in that by addressing the sensory processing needs of students by implementing sensory breaks throughout the school day, student participation in the occupations of academic work, social participation, and play would be enhanced.

The four sub themes derived from the comments section of Data Collection Sheet support the broader themes of the literature that equate school day occupational performance to being primarily influenced by the students over responsivity or under responsivity to sensory input/stimuli. According to the literature, over responsivity is defined by the fearful, avoidant, defiant behavioral responses to sensory input (Ben-Sasson et. Al, 2009; Kranowitz, 1998). This corresponds to the qualitative data provided by the comments section in the Data Collection Sheet as it acknowledges the relationship between the school day environmental and person factors (such as having a good vs. bad day, being absent from school, etc.) and its effect on a student's willingness and readiness to engage in the typical school day occupations of social participation, academic work, and play.

### **Limitations and Future Research Recommendations**

There are several limitations to consider in regards to this research study. First and foremost, this study utilized a small sample size of 6 participants which provided a limited amount of data to be analyzed, that ultimately restricted the methods that could be used for data analysis. In total, there were 260 pre/post logs documented using the data collection sheet. However, because this was gathered from such a small sample size, the only way to perform an accurate statistical analysis was to assume that each documented log on the Data Collection

Sheet was independent from the other. What this meant was that we could not analyze the change in participation of each individual student across the 8-week period, to gain insights specific to their individual performance. Thus, future research should focus on expanding the sample size so as to strengthen the statistics yielded from the analysis of the data, and the generalizability to the population as a whole.

Additionally, the number of variables indicated on the Data Collection Sheet ( the type of activity engaged in pre/post, the Likert scale engagement pre/post, the duration of time spent in the sensory room, and the number of stations completed), resulted in inconsistent documentation, and varied interpretations across paraprofessionals using the sheet. Not every paraprofessional documented the type of activity being engaged in pre/post, which provided limited data to draw conclusions from in the thematic analysis. Additionally, there was limitations associated with utilizing a Likert Scale, as there was no way to ensure that the intervals between 1-5 (rating the level of engagement) was interpreted equally and documented consistently across the varying paraprofessionals in the sensory rooms. Future research should focus on limiting the number of variables to be recorded using the Data Collection sheet, as well standardizing the manner or protocol in which each variable is to be recorded.

Lastly, although it was documented that each occupational therapist provided clear instructions to the paraprofessionals on how to use the Data Collection Sheet, it was used inconsistently. There were inconsistencies in documenting on the Data Collection Sheet the type of activity being engaged in, which manifested as logs appearing incomplete (blank spaces). Additionally, it was evident that there was also confusion regarding the difference in how to document the number of stations (1-7) completed during the sensory break (i.e some personnel circled random stations 1-7 in regards to the specific activity their sensory room had at those,

whereas other personnel interpreted it as the total number of activities/stations completed within the entirety of the session). Thus, defining the differences between stations across sensory rooms across the varying schools as well as clarifying the differences mentioned above would overall result in a stronger, more consistent body of data to draw conclusions from.

There were also limitations regarding the tools used to gather the qualitative data within this study. First and foremost, the survey that was created using SurveyMonkey, was not completed by any of the adult employees that participated within this study with whom it was sent. This limited the depth of the thematic analysis, as there was very little qualitative data to draw conclusions from. Additionally, the comments section within the Data Collection Sheet was used inconsistently and provided little depth in regards to the context (as evidenced by the thematic analysis). It was unclear what necessarily caused a “good vs. bad day”, what type of activity(s) caused the participant to be “pre-engaged before sensory break”, and what regularly factored into “lack of attendance” in the sensory room for that given day. Thus, providing more context when recording qualitative data would benefit future research and overall contribute more fully towards building the body of research regarding the effectiveness of sensory interventions and evidence based practice within schools.

### **Conclusion**

The sensory room interventions within Muskegon County NSU appear to positively impact a student’s classroom performance by increasing their readiness to engage in educational activities by 56%. For school occupational therapists working with students who have sensory processing needs, this data supports not only the effectiveness of this sensory room in specific, but also contributes towards building the body of evidence to bridge the overall gap in sensory room research, while promoting evidence based practice in schools. This increase in readiness

supports the students in Muskegon County NSU development of adapted responses to sensory stimuli, thus providing evidence to support the effectiveness of Muskegon County NSU OT sensory room use.

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Appendix A

Data Collection Sheet

**Data Collection Sheet for Sensory Room Breaks**

**Building:**

**Student**

**#:**

<b>Date</b>	<b>Classroom Activity Prior to Break</b>	<b>Break</b>	<b>Classroom Activity Following Break</b>	<b>Comments:</b>
	Activity:	Start time: End time:	Activity:	
	Level of Engagement 1 2 3 4 5 (not at all) (fully)	Stations Completed: 1 2 3 4 5 6 7 8	Level of Engagement 1 2 3 4 5 (not at all) (fully)	

<b>Date</b>	<b>Classroom Activity Prior to Break</b>	<b>Break</b>	<b>Classroom Activity Following Break</b>	<b>Comments:</b>
	Activity:	Start time: End time:	Activity:	
	Level of Engagement 1 2 3 4 5 (not at all) (fully)	Stations Completed: 1 2 3 4 5 6 7 8	Level of Engagement 1 2 3 4 5 (not at all) (fully)	

<b>Date</b>	<b>Classroom Activity Prior to Break</b>	<b>Break</b>	<b>Classroom Activity Following Break</b>	<b>Comments:</b>
	Activity:	Start time: End time:	Activity:	
	Level of Engagement 1 2 3 4 5 (not at all) (fully)	Stations Completed: 1 2 3 4 5 6 7 8	Level of Engagement 1 2 3 4 5 (not at all) (fully)	

## Appendix B

### Survey for Adult Employees

#### **Consent Form**

The purpose of this research study is to determine the effect of sensory interventions used in four Muskegon County Northern Service Unit (NSU) sensory rooms on the student's level of school readiness. This is a research project being conducted by Grand Valley State University (GVSU) Occupational Therapy students in accordance with Muskegon County NSU occupational therapists. You are invited to participate in this research project because you are an adult employee within the Muskegon NSU who has been selected to administer and observe sensory interventions with the students involved in the study.

Your participation in taking this survey is voluntary, and you may choose not to participate. If you do decide to participate in this survey, you may withdraw from participating at any time and your responses will not be used.

The procedure involves filling out an online survey that will take approximately 15 minutes. All responses given will be confidential, and data will be stored in a password protected folder. The responses of this survey will be used for scholarly purposes only and may be shared with the GVSU Statistical Consulting Center the student researchers mentor.

If you have any questions about the research study, please contact Olivia DeWeerd (holwerdo@mail.gvsu.edu), Erica Roll (rolle@mail.gvsu.edu), Emilie Sickles (sicklese@mail.gvsu.edu), or Mary Spyhalski (spyhalsm@mail.gvsu.edu). This research has been reviewed according to Grand Valley State University IRB procedures for research involving human subjects.

By selecting the agree button below you indicate that:

- You have read the above information
- You voluntarily agree to participate
- You are at least 18 years of age and are an adult employee in the Muskegon County NSU

If you do not wish to participate in the survey, please decline participation by selecting the disagree button.

- Agree
- Disagree

**Survey Questions**

**1. What is your job title?**

**2. How many years have you been working with children with sensory needs (Select one)?**

**0 1 2 3 4 5 6 7 8 9 10**

**3. How many students with sensory needs do you currently work with on a weekly basis? 0**

**1 2 3 4 5 6 7 8 9 10 more than 10**

**4. Describe a situation where the child had a non-optimal experience in the classroom following the sensory room intervention.**

**5. Describe a successful observation experience in the sensory room. Provide the child's eligibility criteria, and include what sensory stations were completed.**

**6. Were you given any specific training from the occupational therapists before implementing sensory room interventions?**

**7. If you received training, do you think it helped you complete your job duties?**

**8. How did you know when students were in need of a sensory room intervention?**

**9. To what extent did the Data Collection Sheet provided for you help you accurately document your observations? (0=not at all, 9= very helpful)**

**0 1 2 3 4 5 6 7 8 9**

## Appendix C

**Sensory Motor Room Training**

Purpose: Equipment and activities in the sensory/motor room are designed to help students regulate their nervous system to be ready to learn. Adult guidance and structure is necessary for this to occur.

**Rules**

1. Adult supervision is required at all times
2. If a student is not following directions and/or not being safe with the equipment, he/she needs to exit the room.
3. Typically breaks should last 10-15 minutes (refer to each student's individual plan.) This room is meant to help students organize sensory input in order to learn, not to avoid academic tasks.
4. Please reset each station so it is ready for the next person. (It is helpful to have the student reset the station themselves before moving on to the next; helps provide a pause between activities.)
5. For students requesting non-scheduled breaks during and academic activity, it's important for the student to return to the same academic activity briefly in order to prevent specific task avoidance.

**Basic Procedure Information**

1. Activities will change periodically, however some items will remain the same.
2. There will be directions and rules provided for each activity. Please review these before beginning an activity. Safety precautions will be listed as necessary. (i.e. Rock wall: no lanyards, jewelry, flip flops or boots. Feet must remain below the red line. No jumping down from wall.)
3. Athletic shoes are required when using the rock wall.
4. Student should spend approximately 2-3 minutes at each chosen station (This is a general guideline, and may vary depending on the activity.)

**How To Effectively Complete a Sensory Break**

1. Have students choose a variety of activities, unless otherwise directed by the occupational therapist.
2. If you observe the student's energy increasing, alternate between proprioceptive activities (heavy work, deep pressure) and movement activities.
3. When using the swing please note that rotational swinging can have a very STRONG impact on the nervous system, and can be cumulative. While many students enjoy swinging in

circles, encourage them to do linear, back and forth swinging instead, which is more organizing to the brain.

4. If students do complete rotational swinging, please ensure that they complete the same number of rotations in the opposite direction to help balance their vestibular system. **Please refer to the attached information on signs of sensory overload and strategies to offset.**
5. End the break with at least one calming activity to ensure the student is ready to learn upon leaving the room. This could include deep breathing, yoga poses, steamroller, or activities from the “I Can Calm Myself” poster.

### **Sensory Overload**

#### **Signs of Sensory Overload**

- Yawning
- Changes in skin color
- Headache
- Changes in heart rate or respiration
- Pupil dilation
- Prolonged dizziness
- Nausea

#### **Offsetting Sensory Overload**

- Override excessive vestibular stimulation with immediate vigorous, intensive, self-generated proprioceptive input
- Utilize intense physical activity as outlines below even if the student expresses a desire to lie down

#### **Specific Strategies to Offset Sensory Overload**

- Run, crawl, or jump vigorously around the room
- Place hands on head and press down while jumping in place and sucking vigorously with sealed lips (picture 1 below)
- Place ice cubes into the student’s hands, at the base of the skull, and on the temples
- Have student press into the crash pad or mat with entire body as hard as possible (picture 2 below)

Picture 1

Picture 2



### **Sensory Motor Room Data Collection Training**

- Please use data collection sheet given by your therapist.
- Collect data for each break during the 8 week data collection period.
- Fill in the date and the start and stop times of the break.
- Fill in or circle which stations were completed during the break.
- Fill in the activity prior to and after the break.
- Use the Likert scale to indicate the student's level of engagement in the activity within 15 minutes before leaving for the break and after returning from the break.
- A small space is provided for comments. Please use this area to describe noteworthy events, circumstances or difficulties like schedule changes, illness, etc..
- Return completed data sheets to student's Occupational Therapist.

Appendix D

Thematic Analysis of Qualitative Data

Comment	Did not attend	Pre-engaged before break	Good day	Bad day	N/A	
Absent from school	x x x x					Emilie
Absent from school	x x x x					Olivia
Absent from school	x x x x					Erica
Absent from school	x x x x					Mary
Wanted to finish word works before going to sensory room :)		X	x		x x	
It's my birthday today!!					x x x	
Chose not to go. Not feeling well	x x x x					
Leaving for an appointment (he wanted to stay)	x x x x					
Busy on a project in class	x x x x					
I was gone so another para pro took student	x x x				x	
Wanted to stay in class and do work-came later		x	x		x x	
Wanted to stay in class and do work- come later		x	x		x x	
Guest teacher today					x x x x	
No motor room today (Playdoh break instead)	x x x x					
Hard time redirecting today- better after lunch worked great today				x x x x		
Doing really well at station 5- no interest in motor room			x x x x			
loves yoga, usually participated			x x x x			
yoga after lunch, loves it			x x x		x	
would not go to motor room- didn't want to do anything	x x			x x		
loved motor room today, very cooperative today			x x x x			
spoke w/ sara on break re: attitude (no motor room)	x			x x	x	
loved motor room today			x x x x			
great time, more focus afterward			x x x x			
worked on all stations- no break			x x x x			
needed break, more focused			x x x x			
no motor room today, did playdoh though	x x x x					
sub teacher class was all off today				x x x x		
2nd day w/ sub teacher, hard to focus				x x x x		
totally focused today			x x x x			
good morning			x x x x			
great break, much needed			x x x x			
first day back from break, focus was difficult				x x x x		
good day			x x x x			
no motor room	x x x x					
good day			x x x x			
somewhat in desk both times					x x x x	
absent	x x x x					
very willing to do mathwork			x x x x			
having an off day				x x x x		
took a little longer to get back to class				x x x	x	
wasn't feeling well				x x x		
having an off day				x x x x		
had a good day, not a big difference			x x x x			
not much change		x			x x x	
wasnt here to collect data	x x x				x	
not much of change- Vday party		x			x x x	
wasnt here to collect data	x x x				x	
mid-winter break	x x x x					
had a hard time getting back				x x x	x	
kind of off today				x x x x		
having an OK day				x x	x x	
half day no sensory	x x x x					
having an off day				x x x x		
didn't go- early release day	x x x x					
absent from school	x x x x					
left school early for appt	x x x x					
not allowed to come today	x x x			x		
did not go-class party	x x x x					

Appendix E  
**Glossary of Terms**

**Sensory Processing Disorder:** When sensory signals are not processed into appropriate responses and can therefore impact a child's daily activities and routines (Miller & Fuller, 2006).

**Sensory Modulation Disorder:** Problems matching the nature and intensity of sensory information and turning it into controlled behaviors (Miller & Fuller, 2006).

**Sensory Over-Responsivity:** Responding to sensory input faster, more intensely, and for a longer period of time than those of typically developing children (Miller & Fuller, 2006).

**Sensory Under-Responsivity:** Responding to sensory input slower, less intensely, and/or requiring longer sensory messages before reacting (Miller & Fuller, 2006).

**Dyspraxia:** Difficulty processing sensory information into unfamiliar movements, physical movement, or movement that requires multiple steps (Miller & Fuller, 2006).

**Apraxia:** Difficulty performing skilled movements and gestures, despite having the want and the physical ability to perform them (Ming, Brimacombe, & Wagner, 2007).

**Postural Disorder:** Problems with body stability as well as mobility, affecting daily activities (Miller & Fuller, 2006).