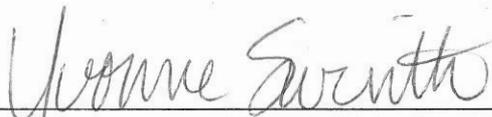


Dynamic Seating: Effects on Primary School Student Classroom Behavior

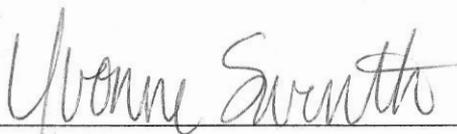
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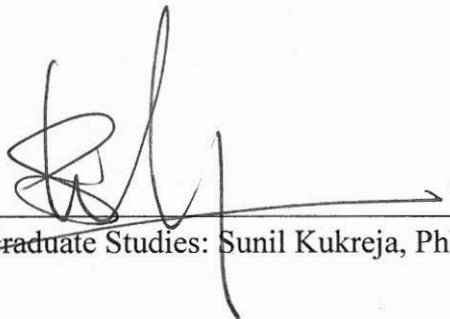
This research study, submitted by Jordan Kain, Alana Russell, and Shauna Irish, has been approved and accepted in partial fulfillment of the requirements for the degree of Master of Science in Occupational Therapy from the University of Puget Sound.



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Abstract

OBJECTIVE: This study analyzed data obtained from two studies on the effects of dynamic seating on classroom behaviors (Ivory, 2011; Kuhn & Lewis, 2013).

METHOD: Through the Sensory Processing Measure (SPM) and student self-report, the effects of traditional desks, Zuma[®] chairs, Disc 'O' Sit[®] cushions, standing desks, FootFidget[®] with typical desks, and FootFidget[®] with standing desks on 2nd and 4th grade student classroom behavior were analyzed.

RESULTS: A repeated measures analysis of variance test revealed significant differences on student work neatness when using traditional desks, Disc 'O' Sit[®] cushions, Zuma[®] chairs, and standing desks. When analyzed as a group, differences were significant for work completion or attention.

CONCLUSION: Results from this study suggest that no single type of dynamic seating intervention is universally effective to improve classroom behavior of all students. Thus, dynamic seating interventions should reflect the unique sensory needs of the individual student.

Dynamic Seating: Effects on Primary School Student Classroom Behavior

Background

Occupational Therapy in Schools. In 1935, occupational therapists expanded their scope of practice to work in public schools when individual states received federal grants from the Crippled Children's Services section of the Social Securities Act. The Education for All Handicapped Children Act of 1975 (EHA, P. L. 94-142), mandated that special education and related services, including occupational therapy (OT), be provided by the state to all eligible children in schools. In 1990, the EHA was reauthorized resulting in the subsequent name change to the Individuals with Disabilities Education Act (IDEA, P. L. 101-476), which aimed to serve a larger population, secure more funding and programs, and ensure that children with disabilities were not isolated from their peers but rather included in the same educational settings. Reauthorizations occurred again in 1997 (P. L. 105-117) and 2004 (IDEA, 2004, P. L. 108-446) with the latest resulting in the name change, Individuals with Disabilities Education Improvement Act. The 2004 reauthorization, requires that children with disabilities are educated in their least restrictive environment (LRE), which mandates that eligible students remain in a general education classroom and only be removed if the severity of their disability does not allow for academic success in the typical classroom (IDEA, 2004). Due to this statute, an increasing number of children with disabilities are currently educated in general education classrooms, an educational practice often referred to as inclusion.

According to the U.S. Department of Education National Center for Education Statistics, in the 2011-12 academic school year 61 percent of children served under IDEA spent 80 percent or more of their day in general education classes (Kena et al., 2014). Keeping these children in

the general education environment allows for maximum interactions with their non-disabled peers. Consequently, teachers are now expected to provide instruction to students with more diverse academic and social abilities, a variety of unique needs, and vastly different approaches to learning, all within the same classroom. In addition to the demands of teaching such a diverse group of students, teachers also must meet the demands of the No Child Left Behind Act of 2001 (NCLB, P. L. 107-110).

NCLB provides federal grants to states for primary and secondary education so long as they meet the teacher and school accountability and law's testing requirements. The pressure for students, teachers, and schools to perform well on the required standardized testing, has resulted in a significant increase in instructional class time with students seated at their desks. One potential negative outcome to these demands is a reduction in time for recess and movement (American Academy of Pediatrics, 2013). This is evidenced by a recent study, conducted by the Center on Education Policy, which found that 20 percent of school districts have decreased recess time by 50 minutes a week (Ramstetter, Murray, & Garner, 2010). However, both the Centers for Disease Control and Prevention and the U. S. Department of Health and Human Services recommend that school-aged children participate in 60 minutes of moderate exercise daily (Centers for Disease Control and Prevention, 2010; U. S. Department of Health and Human Services, 2008). According to the American Academy of Pediatrics (AAP), recess is a necessary break in the day for maximizing a child's social, emotional, physical, and cognitive development and it should not be withheld for academic reasons (American Academy of Pediatrics, 2013). Additionally, reduction in recess time is contradictory to much research demonstrating the positive benefits that unstructured play and movement breaks have on school related stress, sustained attention in class, and the social and emotional development of students (Clements,

2000; Holmes, Pellegrini, & Schmidt, 2006; Miller & Almon, 2009). Despite the current data on recess and movement, it does not appear that NCLB standards including testing and accountability will change anytime soon, therefore, interventions with the potential to improve engagement in educational activities and facilitate learning must be examined.

Response to Intervention (RtI). Response to Intervention (RtI), which has been promoted for use in schools following the latest reauthorization of IDEA (2004), provides an intervention approach for OT within the schools that supports access to general education. This approach aims to identify students struggling in general education, address the unique academic and behavioral needs of those learners, and prevent further decline of academic performance, prior to testing for special education (AOTA, 2012; Swinth, 2014). RtI typically uses a three-tiered approach where the first tier, “Universal Intervention”, includes a screening for academic difficulty and behavioral issues, high-quality educational and social supports, and Universal Design for Learning (UDL) targeting all students (AOTA, 2012). UDL is a set of principles which promotes the alignment of the educational environment with general student learning needs (Rose & Meyer, 2002). School-based occupational therapists are encouraged to consider and advocate for involvement in their district’s RtI program to analyze, adapt, and enhance the environment to provide a proper fit for the student, thereby facilitating their participation, learning, and academic performance (AOTA, 2014).

One population of students who would benefit from occupational therapists utilizing RtI principles are those with sensory processing (SP) challenges. Approximately 1 in 6 children experience SP challenges which negatively affect their performance in daily activities including academic performance (Ben-Sasson, Carter, & Briggs-Gowen, 2009). Using the first tier of the RtI approach, occupational therapists can provide environmental modification while considering

individual student needs to support the learning and engagement of students with these difficulties.

Sensory Integration and School Performance. Sensory integration is defined as the process by which the nervous system organizes and integrates incoming sensory information from the environment and responds to the stimuli adaptively and appropriately (Ayers, 1972; Dunn, 1997; Lane, Miller, & Hanft, 2000). Children with sensory difficulties can have impairments in any of the five major sensory systems, as well as, in the proprioceptive and vestibular systems, which may result in Sensory Integration Disorder (SID) or dysfunction. Children who experience sensory integration dysfunction may have difficulty clearly receiving sensory input from the environment or their nervous system has difficulty organizing and responding to that input. They may also demonstrate an increased or decreased sensitivity to sensory stimuli that normally occur in the educational classroom. This atypical response, of seeking or avoiding sensory input, can result in difficulty achieving success in their occupational role as a student (Dunn, 1997). Sensory processing is one method used to address children with sensory challenges to improve their ability to respond to the environmental demands of the classroom, such as the lack of opportunity for movement during instruction.

Recent literature has indicated sensory processing challenges lead to poor performance in the occupational areas of self-care, play, social participation, and academic success and involvement (Koenig & Rudney, 2010; White, Mulligan, Merrill, & Wright, 2007). A systematic review revealed that children with sensory processing difficulties engaged in fewer academic activities, demonstrated lower academic performance, decreased attention, and a greater chance of learning deficits (Koenig & Rudney, 2010). Additionally, research has shown that all children process and respond to sensory input in unique ways and sometimes an individual's sensory

processing patterns can result in poor attention and academic performance that falls below the student's potential (Worthen, 2010). Thus, all children, with or without disabilities or diagnoses, can experience sensory processing issues, which may affect their capacity to attend to educational activities, complete class-work, and perform to the best of their abilities.

Classroom Interventions. Students with sensory processing challenges typically exhibit restlessness, high distractibility, and poor concentration, which stem from their unique sensory issues. One way classroom interventions have historically addressed these behaviors is through behavior management strategies such as rewards and consequences. However, those methods fail to attend to the individual student's sensory issues, learning needs, and educational environment, all of which may contribute to the unwanted behaviors (Schilling & Schwartz, 2004). Therefore, therapeutic interventions focused on improving academic success and classroom behavior must take into consideration the unique characteristics and development of the child, their classroom environment, and the academic task(s) at hand. Occupational therapists are in a unique position, given their holistic approach to therapy and expertise in activity analysis and environmental modification, to promote the academic success of these children with sensory processing challenges through various strategies. They can support children in special education not only through direct, hands-on services, but also by working with teachers to adapt the classroom environment. Additionally, interventions that occur in the general education classroom support the LRE and are consistent with RtI, therefore, occupational therapists should address sensory issues through strategies that occur within the classroom rather than removing students from the educational context for sensory-based services.

Dynamic Seating. Dynamic seating is one type of environmental intervention utilized by occupational therapists, which is theorized to adjust the amount and alter the type of sensory

input a student's central nervous system receives, to improve performance and engagement in the classroom (Boutot & Smith Myles, 2011). These interventions intend to meet the child's specific sensory needs thereby supporting and improving student attention, work completion, and overall learning. Numerous dynamic seating strategies exist that manipulate the child's seat, desk, or a combination of the two. These adaptations do not remove students from learning opportunities but provide them with the means to more deeply engage in classroom discussion and activities.

Evidence supporting the use of dynamic seating, as a sensory processing approach to intervention in the classroom, has been demonstrated in the field of OT (Fedewa & Erwin, 2011; Ivory, 2011; Kuhn & Lewis, 2013; Pfeiffer, Henry, Miller, & Witherell, 2008; Schilling, Washington, Billingsley, & Dietz, 2003). The use of therapy balls in the classroom is one form of dynamic seating that has been extensively reviewed in literature. Therapy balls allow the child to move and adjust their posture while seated, thus providing additional sensory input during seated activity (Schilling et al., 2003). Several single-subject studies have shown that time spent engaged in classroom activity, time spent in seat, and time spent attending to educational tasks increased with implementation of therapy ball seating in the classroom (Bagatell, Mirigliani, Patterson, Reyes, & Test, 2010; Fedewa & Erwin, 2011; Schilling & Schwartz, 2004; Schilling et al., 2003). These studies examined the effects of therapy balls with students of multiple ages and focused primarily on children with ASD. While previous studies support the use of therapy balls in the classroom, these present studies cannot be generalized to a larger population of children with attentional difficulties due to limited sample sizes, constricted geographical locations, and a lack of evidence for children with other diagnoses or no diagnosis.

Therapy cushions have also been reviewed in OT research. Pfeiffer et al. (2008) examined the effect of therapy cushions on attention in the classroom using a large sample of 63

second-grade students without specific diagnoses. Attention was measured before and after intervention using the Behavior Rating Inventory of Executive Functioning (BRIEF), which examines a child's ability to regulate emotions and behavior. A one-way ANOVA statistical test, found a significant decrease in BRIEF scores for those who received the intervention. This suggests the Disc 'O' Sit[®] cushion intervention improved students attention and on-task behavior.

Additional dynamic seating options, including standing desks and the FootFidget[®], have not previously been explored in research studies but have social validation through common media. In recent years, there have been a variety of articles and blogs written in the common media validating the use of sensory strategies in the classroom (Hostetter, 2006; Jackson, 2011; Martinez, 2007; Parlier, 2013; Puliti, 2007; Sluga, 2009; Spinabella, 2011). Standing desks increase the amount of movement afforded to the student during class, thereby increasing the sensory input received by the child. The FootFidget[®] is a stretchable band with a ball at the center connected to the four legs of a desk. Students are able to tap their feet on the unit, which provides the child with increased movement and sensory input. Occupational therapists, who are trained in sensory processing strategies, should widely evaluate the effectiveness of dynamic seating interventions to build a body of evidence and better support educators and school administrators in providing adequate learning environments for their students. Further data is needed to analyze the effectiveness of various dynamic seating interventions on student learning and performance.

Methods

The current paper aims to analyze data obtained from two research studies headed by Dr. Yvonne Swinth at The University of Puget Sound's Occupational Therapy Program in 2011 and 2013 on dynamic seating (Ivory, 2011; Kuhn & Lewis, 2013). Both studies obtained approval from the University of Puget Sound's Institutional Review Board.

Ivory (2011)

Research Design

Ivory (2011) followed a within group single subject case study experimental design to assess the effects of various types of dynamic seating on student work completion, work neatness, and attention. Students were randomly assigned to one of four groups. The study took place over five weeks and followed an A-B-C-D-E, A-C-D-E-B, A-D-E-B-C, A-E-B-C-D design. During the first week, Phase A, baseline data was collected with all students using their traditional desks. During the second through fifth weeks, Phases B-E, the groups used one type of dynamic seating intervention per week. Phase B examined Zuma[®] chairs, phase C examined standing desks, phase D examined Disc 'O' Sit[®] cushions, and phase E again examined the traditional desk.

Participants

A convenience sample consisting of 19 students attending 2nd grade at a private school located in western Washington and their teacher were selected to participate in the research study. Students who received parental consent and child assent were eligible for participation in this study. Following informed consent and child assent, parents or caregivers completed the *Sensory Processing Measure (SPM): Home Form* to gain parental perspective of participants' ability to process sensory information (Parham & Ecker, 2007).

Instrumentation

The SPM: Home Form is a standardized evaluation used to assess children's sensory processing skills in the home environment (Parham & Ecker, 2007). The measure requires that a child's parent or caregiver, of at least one month, complete the form. The SPM examines eight subcategories which include, vision, hearing, touch, body awareness, balance and motion, planning and ideas, social participation, and total sensory systems. The subcategory scores are compared to three normed ranges: typical sensory development, some problems, or definite dysfunction. The SPM has been shown to be reliable and valid and has the ability to distinguish children with sensory processing issues 72% of the time and those without 92.3% of the time (Miller-Kuhaneck, Henry, Glennon, & Mu, 2007).

Throughout the study, data regarding student attention, work completion, and work neatness were collected using a rubric created by the authors in conjunction with the teachers. Students completed the rubric self-assessment 1 to 6 times a week depending on classroom scheduling constraints and absences. Three scales, with ratings of 1-5, were included on the student rubric for work completion, work neatness, and focus. Student ratings for work completion ranged from 1 (*I didn't finish anything*) to 5 (*I finished early and moved to the next activity*). Student ratings for work neatness ranged from 1 (*It looked very bad and sloppy*) to 5 (*It was my very best work and it was very neat*). Student ratings for attention ranged from 1 (*I talked with my neighbor and I played with items in or on my desk*) to 5 (*I was focused the whole time. I did not talk or play and I followed directions*).

Data Analysis

The program Statistical Package for the Social Sciences (SPSS 17.0) was used to analyze the data. Students' average scores for every variable (work completion, work neatness, and attention) during every phase were entered into SPSS. Descriptive statistics were run on these

data to determine the average scores for the entire class when using each type of dynamic seating intervention. Statistical analysis of individual students' change was not possible, therefore, visual analysis of graphed results were employed. It should be noted that Student 1 was only present for the baseline phase of the study and was therefore excluded from data analysis.

Results

The SPM identified 8 of the 19 students, about 42.1 percent of the class, as having sensory processing issues, including 6 students with “some problems” and 2 students with “definite dysfunction” in some area of sensory processing. The means and standard deviations on *work neatness* for each seating option were as follows; baseline (M=3.41) (SD=0.62), Disc ‘O’ Sit[®] (M= 4.11) (SD=0.44), Zuma[®] chair (M= 4.06) (SD= 0.45), standing desk (M=4.12) (0.52), and traditional desk (M=4.04) (SD= 0.65). The descriptives on *work completion* were; baseline (M=4.53) (SD=0.62), Disc ‘O’ Sit[®] (M=4.51) (SD=0.45), Zuma[®] chair (M=4.58) (SD=0.48), standing desk (M=4.59) (SD=0.44), and traditional desk (M=4.44) (SD= 0.44). Descriptives for *student attention* were; baseline (M=4.81) (SD=0.40), Disc ‘O’ Sit[®] (M=4.81) (SD= 0.33), Zuma[®] chair (M=4.78) (SD=0.32), standing desk (M=4.77) (SD=0.35), and traditional desk (M=4.70) (SD=0.30). These results can be seen in Table 1 and Figure 1.

A repeated measures analysis of variance test (ANOVA) was conducted for work neatness, work completion, and attention to determine if differences in ratings for each dynamic seating option were statistically significant from scores while using a typical desk during baseline. No significant differences were observed for work completion and attention scales between any of the four seating types. An ANOVA on work neatness found significant differences between baseline and Disc ‘O’ Sit[®] (p=.004), baseline and Zuma[®] chair (p=.006), and baseline and standing desk (p=.004). These results can be seen in Table 1.

When individual students' self-ratings were graphed and visually analyzed, both positive and negative effects on classroom behavior were evident. For example, Student 14 demonstrated improved work neatness when using the standing desk while Student 15 demonstrated decreased work neatness also when using the standing desk. See Figure 3 through Figure 14 for evidence of these trends.

Kuhn & Lewis (2013)

Research Design

Kuhns and Lewis (2013) followed an A-B-C and A-C-B within group single subject case study experimental design to assess the effects of the FootFidget[®] used with the traditional desk versus a standing desk on student attention and work completion. Phase A served as a baseline period during which data was collected with students seated at their typical classroom desks. Following the four days of baseline, half the students began Phase B (FootFidget[®] with typical desk) and half began Phase C (FootFidget[®] with standing desk). After five days of intervention, the groups switched seating types. During each phase, students completed a daily visual analogue scale to self-assess their level of work completion and attention.

Participants

A convenience sample consisting of 13 students, attending 4th grade at a private school located in western Washington and their teacher were selected to participate in the research study. Students who received parental consent and child assent were eligible for participation. Similar to Ivory (2011), parents or caregivers of participating students completed the *Sensory Processing Measure (SPM): Home Form* (Parham & Ecker, 2007). The SPM was also used to collect demographic information and determined all but one student was 10 years old and all but

two students identified their race as “white”. Additionally, there was an equal ratio of male to female students.

Instrumentation

The SPM: Home Form was used to assess student sensory processing skills (see Ivory 2011 Instrumentation for a detailed description). Data regarding student attention and work completion were collected using a self report visual analogue scale (VAS), which is essentially a line with either end indicating opposite classroom behaviors that the child marks to indicate their own behavior. Evidence supports the use of an analog scale in children aged seven and above, showing children of this age are able to accurately understand and utilize this type of measure (Shields, Palermo, Powers, Fernandez, & Smith, 2005). In regards to work completion, students were asked to rate themselves from “*I didn’t finish anything*” to “*I finished all of it*”. Regarding attention, students were asked to rate themselves from “*I talked with my neighbor and I played with items in or on my desk*” to “*I was focused the whole time. I did not talk or play and I followed directions on my work*”. These ratings were then measured and recorded.

Data Analysis

Collected data were evaluated using the SPSS 17.0 program. The mean scores for each individual student’s level of work completion and attention, during each phase of intervention, were calculated. Descriptive statistics were run to determine the overall class mean and standard deviations on work completion and focus for each intervention variable (baseline, standing desk, and standing desk with FootFidget®). A repeated measures analysis of variance (ANOVA) was run on the mean work completion and attention scores of the class during the intervention phases to determine if there were significant difference in scores between the dynamic seating

interventions and baseline. Statistical analysis of individual students' change was not possible, therefore, visual analysis of graphed results was employed.

Results

The SPM identified 4 of the 13 students, about 31.7 percent of the class, as having “some problems” or definite dysfunction” in one or more sensory categories. The mean class ratings and standard deviations on level of *work completion* for each seating option were as follows; baseline-traditional desk (M=4.38)(SD=0.70), FootFidget[®] (M=4.33) (SD=0.69), standing desk and FootFidget[®] (M=4.21) (SD=0.89). The descriptives on level of *student attention* were as follows; baseline-traditional desk (M=4.09) (SD=0.85); FootFidget[®] (M=4.19) (SD=0.78), standing desk and FootFidget[®] (M=4.30) (SD=0.71). An analysis of variance revealed no significant differences between baseline mean scores on work completion or attention when compared to the mean scores during the intervention phases. See Table 2 for these results. However, the trend of the mean scores on work attention increased from baseline to FootFidget[®] with traditional desk and from baseline to FootFidget[®] with standing desk.

Again, when individual students' self-ratings were graphed and visually analyzed, both positive and negative effects on classroom behavior were evident. For example, Student 3 demonstrated improved attention while using the FootFidget[®] with the standing desk while Student 11 demonstrated decreased attention while using the same seating combination. Additionally, while Student 4 demonstrated a large individual improvement for attention with the standing desk and FootFidget[®] this student also showed a large decrease in work completion while using the same seating type. When students' work completion ratings, while using the FootFidget[®] with both the standing desk and traditional desk, were visually analyzed about a

third of the students improved, a third stayed the same, and a third declined. See Figure 15 through Figure 20 for evidence of these individual trends.

Discussion

The results of this study reinforces that dynamic seating can improve student attention, work completion, and work neatness when the sensory input provided by the sensory strategy is matched with the unique sensory needs of the individual. Other studies addressing dynamic seating tend to be single subject or apply one type of seating to all participating students. The results of this study suggest that occupational therapists must collaborate with teachers and other professionals in the schools to ensure they are meeting the unique needs of the students and the classroom environment. This is consistent with the changing role of occupational therapists, in the schools, due to the enactment of IDEA (2004) and NCLB, leading to an increased emphasis on whole school approaches and interventions, such as RtI and UDL. Within the social literature (Hostetter, 2006; Jackson, 2011; Martinez, 2007; Parlier, 2013; Puliti, 2007; Sluga, 2009; Spinabella, 2011) as well as current research (Fedewa & Erwin, 2011; Ivory, 2011; Kuhn & Lewis, 2013; Pfeiffer, Henry, Miller, & Witherell, 2008; Schilling, Washington, Billingsley, & Dietz, 2003) dynamic seating has become a socially accepted practice; often presented as an easy solution to improve classroom behaviors and academic performance of students. While teachers can and should initially utilize these systems, occupational therapists provide a deeper layer of clinical reasoning due to their background in sensory processing, activity analysis, and environmental modification. Occupational therapists must utilize this body of knowledge and clinical reasoning in order to provide students with dynamic seating strategies or interventions which match their unique sensory needs to promote academic success and engagement in

classroom learning. This paper contributes to the existing body of research on the emerging practice area of the use of dynamic seating in the classroom, a socially acceptable practice.

Classroom Behaviors

The data from this study suggest that dynamic seating may positively affect the work neatness and attention of all students in general education classrooms. Therefore, dynamic seating interventions should be accessible on a school systems level and implemented in every classroom, to address the learning needs of students with and without disabilities or diagnoses.

Significant differences between intervention phases were not evident for all classroom behaviors when the data were analyzed as a whole class. However, when students' individual changes in classroom behavior ratings were visually analyzed, differences in response to various dynamic seating strategies were evident. For example, a portion of students demonstrated improved ratings while using the Disc 'O' Sit[®] cushion while others demonstrated a decline or no change in classroom behaviors. These results align with sensory processing theory by illustrating that no singular universal dynamic seating intervention can meet the unique sensory needs of every student. Thus, significant improvement in classroom behaviors cannot be expected when applying one intervention. Therefore, results from the current study suggest that decisions for utilizing dynamic seating options must take into account the unique sensory processing patterns of students to provide the appropriate amount and type of sensory stimuli and thereby improve student engagement and learning.

Implications for Occupational Therapy

The environment and dynamic of the general education classroom is changing due to increased emphasis on NCLB standards, including testing and accountability, and increased inclusion of students with sensory processing challenges. As these changes continue to impact

student learning in the general education classroom, occupational therapists, utilizing RtI methods at both the individual student and school system levels, should collaborate with educators to implement dynamic seating interventions to ensure academic success for all students, both with and without disabilities or diagnoses. Currently, the social perception is that dynamic seating positively affects student behavior and that it is easily implemented (Hostetter, 2006; Jackson, 2011; Martinez, 2007; Parlier, 2013; Puliti, 2007; Sluga, 2009; Spinabella, 2011). However, the expertise of occupational therapists, in sensory integration theory, activity analysis, and environmental modification, is necessary to ensure the appropriate selection and use of dynamic seating occurs in the general education classroom. Additionally, when implementing dynamic seating strategies, occupational therapists should utilize data driven decision making (Schaaf, 2015; Schaaf & Mailloux, 2015), by tracking individual changes in performance and behavior, in order to select the dynamic seating option that provides the best-fit for the student.

Limitations

Ivory (2011) noted several limitations of her study. Most significantly, school scheduling limited the data collected during the baseline phase to one rubric per student. Completion of the rubrics was left up to the participating teacher's discretion, which led to inconsistency in data collection frequency. Additionally, a lack of exposure to the rubrics may have affected the understanding and accuracy of student self-reporting. Khun and Lewis (2013) also documented various limitations. The time students spent in each phase was limited to 4 days, which may not have been enough time for them to adjust to the dynamic seating options resulting in novel classroom behaviors and thereby influencing the results of the study. Teacher report also indicated issues with the compatibility between the FootFidgets® and the typical desks, resulting in the unit breaking off and causing a distraction to the students. While both the Ivory (2011) and

Kuhn and Lewis (2013) studies occurred in the natural classroom environment, they additionally noted similar limitations of small classroom sizes, short durations of intervention phases, and inconsistency with frequency of data collection. Both studies were conducted at private schools with a small population of students, which limits the generalizability of the results.

The current paper was limited by the data analysis procedure of examining the effects of dynamic seating types through interpreting the scores of individuals as a group. If the data were statistically analyzed on a case by case basis, the individual students' changes in classroom behavior, when utilizing dynamic seating strategies, may have been more evident. Additionally, this type of analysis would better reflect sensory processing theory, which asserts that individuals have unique sensory processing patterns and needs and therefore would benefit from intervention reflecting and addressing their specific needs.

Future Research

The American Occupational Therapy Association (AOTA) centennial vision asserts that occupational therapists must meet the needs of the service recipients with scientific evidence-based treatment (AOTA, 2006). Future research on the effects of dynamic seating on classroom behavior and academic performance should attempt to better match sensory processing theory. This can be achieved by utilizing various dynamic seating options, which complement the unique sensory needs of each individual student. Additionally, the research design should attempt to include a larger population, encompass a broader demographic of students, and employ longer periods of exposure to dynamic seating interventions.

Conclusion

The findings of this study begin to support the use of various dynamic seating options to improve classroom behavior and academic performance of children experiencing sensory

processing challenges. Occupational therapists should implement this type of intervention under RtI, at both the individual student and school system levels, to address the effects of the changing dynamic of general education classrooms on student behavior. When utilizing dynamic seating, occupational therapists must determine the appropriate strategy for the specific student by considering both the individual's unique sensory processing patterns and the best fit for the classroom environment in order to produce the most effective academic outcomes. Additionally, occupational therapists can work at the systems level to educate and train school staff on sensory processing theory and how to best utilize dynamic seating strategies in their classrooms, libraries, and laboratories.

References

- American Academy of Pediatrics (2013). *Policy statement: The crucial role of recess in school*. doi: 10.1542/peds.2012-2993
- American Occupational Therapy Association. (2006). *AOTA Centennial Vision*. Retrieved from <http://www.aota.org/-/media/Corporate/Files/AboutAOTA/Centennial/Background/Vision1.pdf>
- American Occupational Therapy Association. (2012). *AOTA practice advisory on occupational therapy in Response to Intervention*. Retrieved from <http://www.aota.org/-/media/Corporate/Files/Practice/Children/Browse/School/RtI/AOTA%20RtI%20Practice%20Adv%20final%20%20101612.pdf>
- American Occupational Therapy Association. (2014). *Frequently asked questions (FAQ): Response to intervention for school-based occupational therapists and occupational assistants*. Retrieved from <http://www.aota.org/-/media/corporate/files/secure/practice/children/faq-school-based-revised-09-2014.pdf>
- Ayers, A. J. (1972). *Sensory integration and learning disorders*. Los Angeles, CA: Western Psychological Services
- Bagatell, N., Mirigliani, G., Patterson, C., Reyes, Y., & Test, L. (2010). Effectiveness of therapy ball chairs on classroom participation in children with autism spectrum disorders. *American Journal of Occupational Therapy, 64*, 895-903. doi:10.5014/ajot.2010.09149
- Ben-Sasson, A., Carter, A. S., & Briggs-Gowen, M. J. (2009). Sensory over-responsivity in elementary school: Prevalence and social-emotional correlates. *Journal of Abnormal Child Psychology, 37*, 705-716. doi: 10.1007/s10802-008-9295-8

- Boutot, E. A., & Smith Myles, B. (2011). *Autism spectrum disorders: Foundations, characteristics, and effective strategies*. Upper Saddle River, NJ: Pearson Education.
- Centers for Disease Control and Prevention. (2015). *Physical activity for everyone: How much physical activity do you need?* Retrieved from <http://www.cdc.gov/physicalactivity/everyone/guidelines/children.html>
- Clements, R. L. (2000). *Elementary school recess: Selected readings, games, and activities for teachers and parents*. Lake Charles, LA: American Press.
- Dunn, W. (1997). The impact of sensory processing abilities on the daily lives of young children and their families. *Infants and Young Children, 9*, 23-35. doi: 10.1097/00001163-199704000-00005
- Education for All Handicapped Children Act. (1975). P. L. 94-142.
- Fedewa, A. L., & Erwin, H. E. (2011). Stability balls and students with attention and hyperactivity concerns: Implications for on task and in-seat behavior. *American Journal of Occupational Therapy, 65*, 393–399. doi: 10.5014/ajot.2011.000554
- Holmes, R., Pellegrini, A., & Schmidt, S. (2006). The effects of different recess timing regimens on preschoolers' classroom attention. *Early Child Development and Care, 176*, 735-743. doi:10.1080/03004430500207179
- Hostetter, J (2006, March 28). Active classroom frees kids from desk chairs: Experiment encourages students to fidget, sway and burn calories. *Childrens Health on NBCNEWS.com*. Retrieved from http://www.nbcnews.com/id/12055137/ns/health-childrens_health/t/active-classroom-frees-kids-desk-chairs
- Individuals with Disabilities Education Act. (1990). P. L. 101-476
- Individuals with Disabilities Education Improvement Act. (2004). P. L. 108-446, 118 Stat. 2647.

- Ivory, D. M. (2011). *The impact of dynamic furniture on classroom performance: A pilot study* (Unpublished master's thesis). University of Puget Sound, Tacoma, WA.
- Jackson, R. (2011, April 13). Teachers, parents favor exercise balls in classroom (with video). *The News Herald*. Retrieved from <http://www.news-herald.com/articles/2011/04/13/news/nh3879946.prt>
- Kena, G., Aud, S., Johnson, F., Wang, X., Zhang, J., Rathbun, A., Wilkinson-Flicker, S., & Kristapovich, P. (2014). *The Condition of Education 2014* (NCES 2014-083). U.S. Department of Education, National Center for Education Statistics. Washington, DC.
- Koenig, K. P., & Rudney, S. G. (2010). Performance challenges for children and adolescents with difficulty processing and integrating sensory information: A systematic review. *American Journal of Occupational Therapy*, *64*, 430– 442. doi: 10.5014/ajot.2010.09073
- Kuhn, D., & Lewis, S. (2013). *The effect of dynamic seating on classroom behavior and on school performance for students in a general education classroom* (Unpublished master's thesis). University of Puget Sound, Tacoma, WA.
- Lane, S. J., Miller, L. J., & Hanft, B. E. (June, 2000). Toward a consensus in terminology in sensory integration theory and practice: Part 2: Sensory integration patterns of function and dysfunction. *Sensory Integration Special Interest Section Quarterly*, *23*(2), 1–3.
- Martinez, S. (2007). Burn while you earn: Desk treadmill keeps you walking at work. *The Seattle Times*. Retrieved from <http://www.seattletimes.com/seattle-news/health/burn-while-you-earn-desk-treadmill-keeps-you-walking-at-work>

Miller, E., & Almon, J. (2009). *Crisis in the kindergarten: Why children need to play in school.*

Retrieved from

http://www.allianceforchildhood.org/sites/allianceforchildhood.org/files/file/kindergarten_report.pdf

Miller-Kuhaneck, H., Henry, D.A., Glennon, T.J., & Mu, K. (2007). Development of the Sensory Processing Measure-School: Initial studies of reliability and validity. *American Journal of Occupational Therapy, 61*, 170-175. doi: 10.5014/ajot.61.2.170

No Child Left Behind Act. (2001). P. L. 107-110.

Parham, L. D., & Ecker, C. (2007). *Sensory Processing Measure (SPM) Home Form*. Los Angeles, CA: Western Psychological Services.

Parlier, G. (2013, December 29). Alternative classroom seating helps seventh-graders focus. *The Ledger*. Retrieved from www.theledger.com/article/20131229/NEWSCHIEF/131229156

Pfeiffer, B., Henry, A., Miller, S., & Witherell, S. (2008). The effectiveness of Disc 'O' Sit© cushions on attention to task in second-grade students with attention difficulties. *American Journal of Occupational Therapy, 62*, 274-281. doi: 10.5014/ajot.62.3.274

Puliti, B. (2007). Standing room only. *ADVANCE for Occupational Therapy Practitioners, 23*(1).

Ramstetter, C.L., Murray, R., & Garner, A.S. (2010). The crucial role of recess in schools. *Journal of School Health, 80*, 517-526. doi: 10.1111/j.1746-1561.2010.00537

Rose, D. H., & Meyer, A. (2002). *Teaching every student in the digital age: Universal design for learning*. Alexandria, VA: Association for Supervision and Curriculum Development.

- Schaaf, R. (2015). Creating evidence for practice using data-driven decision making. *American Journal of Occupational Therapy, 69*, 6902360010. doi: 10.5014/ajot.2015.010561
- Schaaf, R., & Mailloux, Z. (2015). *Clinician's guide for implementing Ayres Sensory Integration: Promoting participation for children with autism*. Bethesda, MD: American Occupational Therapy Association.
- Schilling, D. L., & Schwartz, I. S. (2004). Alternative seating for young children with autism spectrum disorder: Effects on classroom behavior. *Journal of Autism and Developmental Disorders, 34*, 423-432.
- Schilling, D. L., Washington, K., Billingsley, F. F., & Deitz, J. (2003). Classroom seating for children with attention deficit hyperactivity disorder: Therapy balls versus chairs. *American Journal of Occupational Therapy, 57*, 534-541. doi: 10.5014/ajot.57.5.534
- Shields, B. J., Palermo, T. M., Powers, J. D., Fernandez, S. A., & Smith, G. A. (2005). The role of developmental and contextual factors in predicting children's use of a visual analogue scale. *Children's Health Care, 34*, 273-287.
- Sluga, C. (2009, March 7). *Stand up for education* [Web log post]. Retrieved from <http://mybignoise.blogspot.com/2009/03/stand-up-for-education.html>
- Spinabella, K. (2011). *Stand up for good health*. *ADVANCE for Occupational Therapy Practitioners, 27* (26), 14.
- Swinth, Y. L. (2014). Education. In B. A. Boyt-Schell, G. Gillen, & M. E. Scaffa (12th ed.), *Willard and Spackman's occupational therapy* (pp. 653-677). Baltimore, MD: Lippincott Williams & Wilkins.

U. S. Department of Health and Human Services. (2008). *2008 Physical activity guidelines for Americans*. (ODPHP Publication No. U0036). Retrieved from

<http://www.health.gov/paguidelines/pdf/paguide.pdf>.

White, B. P., Mulligan, S., Merrill, K., & Wright, J. (2007). An examination of the relationships between motor and process skills and scores on the sensory profile. *American Journal of Occupational Therapy, 61*, 154-160. doi: 10.5014/ajot.61.2.154

Worthen, E. (2010). Sensory-based interventions in the general education classroom: A critical appraisal of the topic. *Journal of Occupational Therapy, Schools, & Early Intervention, 3*(1), 76-94, doi: 10.1080/19411241003684217

Table 1

Ivory (2011) Descriptive and ANOVA Data

	Mean \pm SD	F	p
Work Neatness		4.97	.002*
Baseline	3.41 \pm .62		
Zuma chair	4.06 \pm .45	10.17	.006*
Standing desk	4.12 \pm .52	10.97	.004*
Disc 'O' Sit	4.11 \pm .44	11.25	.004*
Traditional	4.04 \pm .65		
Work Completion		0.48	.753
Baseline	4.53 \pm .62		
Zuma chair	4.58 \pm .48		
Standing desk	4.59 \pm .44		
Disc 'O' Sit	4.51 \pm .45		
Traditional	4.44 \pm .44		
Attention		0.75	.562
Baseline	4.81 \pm .40		
Zuma chair	4.78 \pm .32		
Standing desk	4.77 \pm .35		
Disc 'O' Sit	4.81 \pm .33		
Traditional	4.70 \pm .30		

Note. Repeated measures ANOVA were used to compare baseline performance to each dynamic seating option. * $p < .05$.

Table 2

Kuhn & Lewis (2013) Descriptive and ANOVA Data

	Mean \pm SD	F	p
Work Completion		0.78	.471
Baseline	4.38 \pm .70		
Footfidget & Traditional desk	4.33 \pm .69		
Foot Fidget & Standing desk	4.21 \pm .89		
Attention		1.04	.370
Baseline	4.09 \pm .85		
Footfidget & Traditional desk	4.19 \pm .78		
Foot Fidget & Standing desk	4.30 \pm .71		

Note. Repeated measures ANOVA were used to compare baseline performance to each dynamic seating option. * $p < .05$.

Figure 1. Classroom Behavior Across Dynamic Seating Type, Ivory (2011)

Figure 2. Classroom Behavior Across Dynamic Seating Type, Kuhn & Lewis (2013)

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