The Effect of Dynamic Seating on Classroom Behavior and School Performance for Students in a General Education Classroom

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Abstract

This study examined the effect of using FootFidgets® and standing desks with FootFidgets® on attention and work completion for students in a fourth grade class in a private elementary school. An A-B-C single subject case study design where phases were one week, and students completed daily visual analog scales to examine classroom behavior. The mean attention of students significantly increased while using the standing desk and FootFidget®, $t(8) = 2.79$, $p = .024$. One student identified by the Sensory Processing Measure: Home Form as having *some problems* processing sensory input, increased work completion while using the standing desk and FootFidget®. The FootFidget® alone did not significantly increase attention or work completion of the students. Students reported liking the FootFidget® 90% of the time. The FootFidget® and standing desk may provide increased sensory input compared to the FootFidget® alone. The FootFidget® and standing desk are potential environmental adaptations to improve academic performance.

The Effect of Dynamic Seating on Classroom Behavior for Students in a General Education Classroom

Since the enactment of No Child Left Behind (2001) there have been increasing demands on schools nationwide to improve the academic performance of their students. No Child Left Behind mandates that by the 2013-2014 school year all students must pass a statewide test at a predetermined proficiency level. Furthermore, according to the Individuals with Disabilities Education Improvement Act (IDEA, 2004) students are only removed from the least restrictive learning environment if necessary. The least restricted environment mandate requires that students who demonstrate the ability to attend general education classrooms should be placed in such an environment. With this mandate, children with special needs may be increasingly placed in general education classrooms and settings (e.g. lunchroom, playground, library) where they may need modifications and supports that facilitate successful academic performance.

One special need that is becoming increasingly prevalent in schools is sensory processing disorders (SPD). According to the Sensory Processing Disorder Foundation, an estimated 5-15% of Americans are affected by a SPD (Dobbins, Sunder & Soltys, 2007). Children with a SPD in the classroom may fidget, be inattentive, and distracted, all of which may negatively impact their academic performance through decreased on-task behavior and work completion. Additionally, students with attention deficit disorder (ADD) and attention deficit hyperactive disorder (ADHD), and other diagnoses that affect attention may exhibit the same behaviors. It is important to explore different methods that can help these students be successful in the classroom.

Occupational therapists working in school systems are an integral facilitator of academic performance in school through fostering engagement in educational activities. It is within the domain of occupational therapy to modify environmental factors in order to increase a child's learning ability (American Occupational Therapy Association, 2008). According to Egilson and Traustadottir (2009) broad changes to the environment, instead of changing specific tasks, can be highly beneficial for children with disabilities.

Few studies have been conducted exploring various environmental modifications, such as different seating options (Bagatell, Mirigliani, Patterson, Reyes, & Test, 2010; Pfeiffer, Henry, Miller, & Witherell, 2008; Schilling & Schwartz, 2004; Schilling, Washington, Billingsley, & Dietz, 2003). By altering sensory stimulation available in the environment, therapists may effect changes in academic performance. Dynamic seating options alter the amount of sensory feedback received by a child by allowing movement while seated or standing at a desk. Various studies have measured the effect of dynamic seating on several aspects of classroom behavior for children with sensory processing difficulties including engagement, work completion, time in seat and time on task. Some of these studies have shown positive outcomes, although the generalizability of the results is often limited by a small sample size, specific diagnosis examined, and narrow scope of types of dynamic seating utilized. It is necessary to further explore the potential benefits of dynamic seating options because they are currently being discussed as a potential adaptation to the classroom that would benefit students with sensory processing challenges. Determining which dynamic seating options are effective in increasing positive behaviors in schools will help add to the literature regarding the best options for students to utilize.

Background

School-based occupational therapy. Occupational therapists are highly qualified individuals who work in the school setting to promote function and engagement and support participation of children in school routines and activities. As related service under Part B of IDEA (2004) and a pupil service under No Child Left Behind (NCLCB), occupational therapists work with children in schools to facilitate success their in school (American Occupational Therapy Association, 2012). Specifically occupational therapists create an optimal fit between student's abilities and environment as well as fine tune specific skills that enhance academic performance.

Response to Intervention (RtI) is an early intervening service in general education to provide support for struggling students (AOTA, 2012). This approach addresses the academic and behavioral needs of students who are having a difficult time in the classroom, before they are identified for or eligible for special education services. Services may be aimed at the school system, the classroom or the individual and can include supports or modifications, such as classroom adaptations, positive behavioral supports, assignment modifications, or education of school faculty and staff. The goal of RtI is to increase student performance in the least restrictive environment and reduce the number of student referrals to special education.

One service delivery model used by occupational therapists in school-based practice is a collaborative approach, often involving consultation. This is supported by IDEA 2004 in section 614(d)(1)(A)(i)(IV), which states that special education and related services, such as occupational therapy, can be provided "on behalf of the child, and… program modifications and supports for school personnel" (AOTA, 2012). This method of service delivery allows occupational therapists to participate in curriculum design, provide recommendations for classroom modifications and adaptations and develop school-wide initiatives to universally support student academic performance.

Ayres' sensory integration. The theory of sensory integration was first proposed by A. Jean Ayres (1972) as the neurobiological process by which a person detects sensory stimuli, organizes sensory information and uses it to formulate an adaptive response to the environment. This theory was founded on her observations of children's behaviors and her knowledge of neural processes (Ayres, 1972). Dr. Ayres emphasized the importance of sensory integration on everyday function, documenting that difficulty processing sensory input led to academic difficulty, impaired social and emotional development, motor skill deficits, and problems with overall function (Anzalone & Lane, 2012). Her work laid the foundation for specific interventions, various treatment approaches, and further theory development. Over the years other theorists and researchers have used Ayers' work as a foundation for new research and theory. All have sought to describe dysfunction in the sensory integration process and add to the literature on the topic. The result of this work has given rise to sensory processing.

Sensory processing and sensory processing disorder. Since the development of sensory integration theory, the contribution of sensory processing to everyday function has been well established (American Occupational Therapy Association, 2003). Sensory processing is the way the nervous system mediates the interaction between the person and their environment, which makes sensory processing fundamental to participation in occupation (Roley & Jacobs, 2009). Information from the senses (sight, sound, smell, taste, touch, and perception of movement and position) that is well regulated by an individual contributes to the proper development of many skills, including social-emotional, physical, communicative, self-care, and cognitive abilities (American Occupational Therapy Association, 2008). Vestibular, proprioceptive, tactile and visual sensation specifically contribute to the ability to concentrate, organize, control emotions, and learn, each of which is essential to a child's success in the classroom (Roley & Jacobs, 2009).

A typically developing person is able to filter sensory information to either act on or suppress various stimuli, which is known as sensory modulation. Sensory modulation is the neurological process by which a person organizes sensory information from his or her body, which is then used to act effectively in the environment (Anzalone & Lane, 2012). Children with autism spectrum disorder (ASD), attention deficit hyperactivity disorder (ADHD) and other diagnoses that present sensory processing challenges may have difficulty with sensory modulation and often are not able to ignore irrelevant or repetitive stimuli (Pfeiffer et al., 2008). Children who have difficulty with sensory modulation may engage in stereotyped, repetitive movements to regulate sensory input (Schilling & Schwartz, 2004). These behaviors impair a child's ability to sustain attention, engage in activities and tasks, and interact effectively with other people. It has long been established that dysfunction in sensory processing can contribute to learning difficulties (Ayres, 1972).

According to the Sensory Processing Disorder Foundation, a sensory processing disorder is defined as a condition where sensory information from the environment does not get processed or acted upon correctly, which may cause children with a SPD to fidget and be inattentive or distractible (About SPD, 2012). This can inhibit academic performance through decreased on-task behavior, work quality, and work completion. It is estimated that 5-15% of Americans are affected by a SPD, which makes it imperative that different methods are explored to help students with this diagnosis be successful in the school system (Dobbins et al., 2007).

Sensory-based intervention in the classroom. The American Occupational Therapy Association (2008) affirmed that school-aged children might benefit from occupational therapy using a sensory approach to support their educational needs. Occupational therapists in the school system may make environmental modifications to meet a child's sensory needs and enable a child with extra sensory needs to participate in school activities and to facilitate better learning opportunities.

Currently, in school-based occupational therapy, activities that provide increased proprioceptive and vestibular input are being used as interventions to improve attention in the classroom, such as fidgets or different seating options (Pfeiffer et al., 2008). It has been proposed that stimulating the proprioceptive and vestibular systems may regulate a child's state of arousal and allow him or her to remain alert and focused on classroom activities (Pfeiffer et al., 2008). Allowing movement while remaining on task may reduce a child's need to get out of his or her seat, which could increase engagement in classroom tasks. Current research supports this hypothesis, showing that, for children with sensory processing challenges that contribute to problems with arousal, attention and behavior, modifying the sensory environment while practicing functional tasks can be effective in reaching targeted performance outcomes (Case-Smith & Arbesman, 2008).

Providing sensory-based intervention in the form of classroom modifications is an opportunity for occupational therapists to collaborate with teachers and families to support students in the general education setting who may be having academic difficulty or are displaying behavioral problems. This approach is consistent with the federal mandate for children to be taught in the least restrictive environment and it could minimize the need for more intensive services or special education in the future. Furthermore, modifications to the sensory environment are feasible for use as a part of RtI. RtI is a systematic approach to supporting students at risk for poor learning outcomes (AOTA, 2012). Supports are proactively provided at a systems level. Also, in a RtI approach, students who are having difficulty achieving, making limited progress or are displaying behavioral issues, problems commonly seen in children with SPDs, are identified and evidence-based interventions are provided, monitored and adjusted to maximize student performance (Davies, 2012).

Dynamic seating in the classroom. Linton, Hellsing, Halme, and Akerstedt (1994) found that school consumes about 30% of children's days. While children are in class for lessons they are primarily seated at their desk. The traditional furniture used during school is typically standard sized chairs and desks based on the age of students. The standard furniture does not accommodate for student's individual heights or allow extra movement while seated. Parcells, Strommel, and Hubbard (1999) found that middle school children have over an 80% chance of sitting in chairs and desks that are not the appropriate height and depth. Wingrat and Exner (2003) found traditional furniture was associated with decreased on-task and seated behavior when compared to fitted furniture in fourth grade students. Poorly fitting chairs and desks negatively impacted children's attention and on-task behavior. The fitted furniture used in this study was selected for its ergonomic nature and had a slightly flexible back to allow for minimal rocking. These ergonomic chairs provided increased sensory information to the user by allowing movement within a limited range. The back support of the chair moved backward when the child pressed against it, and also pressed forward against the child. Increasing movement in chairs could provide increased sensory input necessary for children with a SPD. By providing increased sensory input, the chair may allow for increased self-regulation in children with a SPD. Through self-regulating their sensory needs, these children may require less intensive intervention or no further intervention from educators or ancillary professionals. Children with a SPD might then be more successfully integrated into least restrictive environments or mainstream classrooms when movement is incorporated into a seating arrangement.

Various seating options that provide movement, referred to as dynamic seating, are available for use in classrooms. These options include therapy balls, Disc-O® seat cushions, and standing desks with a FootFidget®. Single subject studies examining the effect of therapy balls have shown promising results. Schilling et al. (2003) found attention to task, in-seat behavior, and writing legibility increased when three children with ADHD used therapy balls. Similarly, Schilling and Schwartz (2004) found that four children with ASD had increased in-seat behavior and engagement in task while using therapy balls. Fedewa and Erwin (2011) also found that 8 children in 4^{th} and 5^{th} grade had increased on-task and in seat behaviors while using therapy balls. The teachers of these students also indicated high social validity of the therapy balls. The previous studies identified that the therapy balls, an environmental adaptation, increased attention for students (Schilling et al., 2003; Schilling & Schwartz, 2004; Fedewa & Erwin, 2011). Utilizing these adaptations may positively impact the learning ability of students.

Additionally, increased in-seat behavior is associated with fewer classroom disruptions and less off-task behavior. Bagatell et al. (2010) conversely found that six children with ASD had varied responses to therapy ball use. The Sensory Processing Measure (SPM): Main Classroom form was used to determine the participant's ability to process different types of sensory stimulation. Data were collected through videotaping specific classes. Videotaping allowed for increased accuracy when recording data. This study highlighted that the sensory needs for each child with a SPD may be different. Appropriate dynamic seating for each child may vary.

Another dynamic seating option explored is the Disc-O® seat cushion. Pfeiffer et al. (2008) found that second grade students with attention difficulties had increased attention while using the Disc-O® seat cushion. The Behavioral Rating Inventory of Executive Function (BRIEF) was used to identify sensory processing deficits in the children pre and post test. While Pfeiffer et al. (2008) contributed to the body of evidence supporting to the Disc-O® effectiveness, the information gained may not be generalizable due to insufficient controls. In contrast, Umeda and Deitz (2011) found seat cushions did not increase in-seat and on-task behavior for two boys with ASD. The finding of this study could be attributed to decreased movement in Disc-O® seat cushions compared to therapy balls. However, the limited sample size decreases the generalizability of this study as well. The Disc-O® seat cushion may only benefit children with fewer sensory input needs.

The standing desk with FootFidget® is a relatively new dynamic seating option. The FootFidget®, is connected to four legs of an individual's desk. It increases sensory feedback by allowing the student to press against it with his/her foot and it in turns provides pressure against the student's foot. A standing desk is another dynamic seating option, which allows the student to stand, with an option to use a stool for a seat. These two seating options can be used separately or in combination with each other. Ivory (2011) examined the effect of Zuma® chairs, Disc-O® seat cushions, and the standing desk with FootFidget® on attention, work neatness, and work completion in 19 second grade students. The SPM was used to identify sensory deficits in the participants. A rubric designed to measure the dependent variables was periodically completed by students after lessons, in order to collect data on their perception of the effect of the different dynamic seating options. Students' self-reported attention to task increased with all dynamic seating options, but work neatness and work completion varied for all groups. Among the few students who were identified as having some sensory processing dysfunction according to the SPM and who used a standing desk with FootFidget®, one student reported decreased work completion. One other student, also identified with a sensory processing dysfunction, showed increased work quality while using the standing desk and FootFidget®. These data were inconclusive as to the effect of the standing desk with the foot fidget on work completion, work neatness, and attention. However a large number of children reported a strong preference for the FootFidget® and standing desk over the other options.

While some studies have explored the effects of dynamic seating on various aspects of classroom behavior and engagement, most have not explored the effectiveness of the FootFidget® and FootFidget® in combination with the standing desk compared to other dynamic seating options. Further research is needed to determine the effectiveness of the FootFidget® in different populations. Therefore, the purpose of this study is to determine the effect of the FootFidget® and standing desk with the FootFidget® on work completion and attention in 4th grade students of a private elementary school in order to identify practical adaptations to improve the classroom learning environment.

Method

Research Design

This study followed an A-B-C and A-C-B within group single subject case study experimental design. A represents the baseline of sitting in a typical desk, B the use of the FootFidget® while at a seated desk, and C the use of the FootFidget® at a standing desk. Phases occurred in four-day time spans (Tuesday- Friday) to accommodate for fluctuations in children's behavior. The first day of the week (Monday) was reserved for implementing a novelty phase, during which the children explored and adjusted to the new furniture type. This research design allowed the gathering of data about the children's attention and work completion under normal classroom conditions during the baseline phase, followed by data indicating the effects of FootFidget® during phase B, and the FootFidget® in combination with a standing desk during phase C. It provided an opportunity to examine and compare differences or similarities between the different types of seating options. During each phase of the study, responses to different types of furniture arrangements were assessed by student self-reports on attention and work completion using visual analog scales. Additionally, the teacher filled out a self-report compiled of multiple-choice questions weekly, assessing the perception of the impact of different furniture types on classroom behavior.

Participants

A convenience sample of a 4th grade class consisting of 13 students in a private school in northwest Washington was selected for this study. After receiving approval of the study procedures by a university human subjects ethics review, the teacher approval for the study was sought. Following approval from the teacher, a letter containing the study aims was sent to the principal and teacher to request participation, thus allowing the research to commence. The teacher had the right to refuse participation in the study, documented by teacher informed consent. Once teacher consent was obtained, children in her classroom were considered for this study.

The teacher sent a letter designed by the researchers home to parents of the students, which also requested parental consent and student assent for participation. Parents and children were asked to sign informed consent and assent forms after they were provided with information about the study and had the opportunity to ask any questions they might have had. Only students who returned both parental consent and child assent forms were enrolled in this study. At that time, parents were asked to complete the SPM: Home Form (Parham, & Ecker, 2007). Had there been any students with significant physical limitations or health issues that would have prevented the safe use of different classroom furniture they would have been excluded from this study. Students without either parental consent or assent used different seating options as determined by the teacher to minimize emotional reactions and did not participate in data collection.

Instrumentation

A standardized assessment of the sensory processing skills of each student was given at the beginning of the study. A daily self-report visual analog scale about student's perception of work completion and attention, in conjunction with multiple-choice questions pertaining to student's preference was used to collect data throughout the baseline and intervention phases (see Appendix A).

The SPM is designed to identify sensory processing skills, praxis, and social participation for children 5-12 years old (Parham, Ecker, Miller, Henry, & Glennon, 2007). It is composed of eight subsections that examine the five senses, social participation, balance, and planning. Specifically the SPM: Home Form was used to describe the individual's sensory processing skills and challenges within the two indicated environments. The SPM must be completed by an individual who has known the child for one month or more. It takes about 15-20 minutes to fill out. Therefore, the child's parent or guardian was asked to complete the home form. The SPM form was returned to and scored by the researchers. The SPM has been shown to have high internal consistency and was able to correctly identify children with sensory processing difficulties 72% of the time and typically developing children 92.3% of the time (Miller-Kuhaneck, Henry, Glennon, & Mu, 2007). For all forms of the SPM, test-retest reliability showed highly correlated scores ($r \geq 0.94$) (high test-retest reliability) (Parham et al., 2007). The SPM evolved from two previous evaluations and the items retained were reviewed by experts who found high content validity.

Throughout the baseline and intervention phases, students were asked to complete self-assessments of their academic performance after language arts, math, or reading portion of class. Additionally, the students reported whether or not they liked the furniture provided for that day by answering a multiple-choice question. Visual analog scales to document attention and work completion were created based on Ivory's (2011) study to best evaluate student behaviors and performance with and without dynamic seating. The visual analog scale asked students to rate their attention and work completion on a scale of 0 to 5. The visual analog scale was introduced to the students and explained by the researchers and teacher during class and the students were given the opportunity to practice and ask questions. The self-assessments were given at a time that accommodated the teacher's existing classroom routine to decrease distraction. Shields, Palermo, Powers, Fernandez, and Smith (2005) found that children above seven years old are capable of consistently and correctly completing a visual analog scale. Students filled out the self-report after they completed an assignment. Time of day and activity performed while using the furniture were also recorded to assess the influence of these variables. The teacher completed a weekly self-report on how the furniture impacted the classroom dynamics (see Appendix B). Students placed their self-assessments in a secure opaque box, which was placed in an accessible area of the room at the end of a particular part of class. The teacher also placed her self-report in the box at the end of each week.

The SPM screening test and self-evaluations was numerically coded and kept in a locked file cabinet in Weyerhauser Hall Medical Record and IRB room at the University of Puget Sound. If names were written on data forms they were crossed out with black ink and covered with a sticker containing a number. Data were numerically coded according to the key in a secure room then placed with the other data immediately after retrieval. The key containing the code information of student's names was kept in a locked cabinet separate from the rest of the data in Weyhauser Hall's Medical Record and IRB room along with all consent forms, assent forms, and any other identifying materials. The SPM screening test and student self-evaluations will be kept by the University of Puget Sound's Occupational Therapy Department for no more than five years and will then be destroyed. Future research reports or publications will not include identifying information about any of the participants.

Procedure

A meeting with the teacher was conducted prior to the baseline phase to reiterate procedures of data collection in the classroom. During the meeting the teacher was shown how to properly set-up the FootFidget® and standing desks according to the manufacturer's instruction. Researchers set up the equipment necessary for each phase. A specific data collection schedule was discussed with the teacher to guide implementation of a procedure that caused the least amount of disruption to the typical class structure. Furthermore, the meeting facilitated an opportunity to discuss questions the teacher had.

Baseline phase commenced with data collection occurring while students utilized traditional classroom furniture. Students assessed their academic performance daily after working on a written task previously determined by the teacher and researcher while using the prescribed seating option. After four days of the baseline phase, researchers visited the classroom to retrieve data collected and set-up the FootFidgets® and the FootFidget® and standing desk combinations in preparation for the following day's novelty phase. Different groups of students were introduced to the various furniture options in differing order, either A-B-C or A-C-B, with A representing baseline, B representing the FootFidget® and C representing the FootFidget® and standing desk combination.

The novelty phase implementation provided time for student's behavior to stabilize as they became familiar with the new classroom furniture type to be examined the following week. The process of four days of an intervention phase followed by one day of a novelty phase utilizing the next phase's seating option was repeated. As a thank-you for participating in the study, at the end of the study the researchers made the standing desks, FootFidget® and other different types of dynamic seating options (e.g., Disc O' Sits® and Zumba® Chairs) not examined in the study, but shown to support student attention in other studies (Bagatell et al., 2010; Pfeiffer et al., 2008; Schilling & Schwartz, 2004; Schilling et al., 2003), available for the teacher to use until the end of the school year.

Data Analysis

The SPM Home form was scored to determine students who do not have problems, have some problems, or have definite dysfunction in processing sensory input. This was done following the procedures outlined in the test manual. Demographic information about the participants also obtained through the SPM and from a class roster provided by the classroom teacher. SPSS Statistics 17.0 was used to calculate descriptive statistics about the students.

The data for each student's responses to the different furniture types for each variable, attention and work completion was graphed separately across weeks to analyze trends. For each student, the mean rating for each variable, attention and work completion as rated on a visual analog scale by the participant, was calculated for each phase.

SPSS Statistics 17.0 was used to determine if there is a significant difference in mean responses for each variable between the intervention phases. The mean work completion and attention scores of the 9 students who were able to use all furniture types were analyzed for change between phases using a paired *t*-test. The 4 students' responses that were not included in the comparison of means were those that did not have the opportunity to use the standing desk and FootFidget® due to limited time and equipment. Ongoing data collection is in process and further student responses will be analyzed and presented in future written reports. The mean responses for the students identified as having difficulty processing sensory input were also individually analyzed for change between phases.

Results

The sample included 13 students in 4th grade classroom and their corresponding teacher. Demographic information about the participants was obtained through the SPM (Parham & Ecker, 2007) and is presented in Table 1. The data analyzed included the perceived attention and work completion from a visual analog scale for each of the 13 students.

SPM

In the class of 13 students, 2 were identified as having *some problems* in the total sensory systems category, indicating overall difficulty with processing sensory input (see Table 2). Student 3 scored as having *definite dysfunction* in the social participation category and *some problems* with vision, hearing, touch, balance and motion, planning and ideas, and the total sensory systems categories. This student's scores may have been affected by cultural or language differences because English is the second language of the parent who filled out the SPM. Student 7 scored as having *definite dysfunction* in planning and ideas and *some problems* with the hearing, touch, body awareness, balance and motion and the total sensory systems categories.

While student 9 and student 11 had total scores that indicated typical sensory processing, each of these students scored as having *some problems* in one or more of the sensory categories. Student 9 scored as having *some problems* in the social participation and body awareness categories. This child's mother also indicated in the comments section that he "has difficulty focusing at school." Student 11's scores indicated some problems processing touch and with planning and ideas. Additionally, Student 1's mother commented that her child "sometimes gets distracted during class" and "can have trouble focusing on the task at hand." All other students in the classroom scored in the typical range for all sensory processing categories.

Work Completion

The mean self-reported work completion scores for the whole class and the two students identified as having *some problems* processing sensory input and t test results comparing the means between phases are reported in Table 3. On a 5-point scale, the mean self-report score for the whole class for work completion was 4.26. There were no significant differences in self-reported work completion while using the FootFidget® or the FootFidget® and standing desk combination (Figure 1). For the two students identified as having *some problems* processing sensory input, work completion did not increase while using the FootFidget®. While using the FootFidget® and standing desk combination through visual analysis, both student 7 and student 3's self-reported work completion increased (Figure 2 and Figure 3), although this was only statistically significant for student 3, $t(1) = 13$, $p = .049$.

Each student's self-reported work completion while using the different furniture types are shown in Figure 4, Figure 5 and Figure 6. A missing data point on any of these graphs indicates a student absence or incompletion of the data worksheet. Visual inspection of the graph of self-reported work completion for the A-C-B group (Figure 4) showed that there is little change in work completion for any of the students. The student's work completion did not seem to be significantly impacted by the furniture type they used, except for student 8 who appeared to have benefited from using the standing desk and FootFidget® combination.

The group of student's using the furniture in the A-B-C order showed varying work completion while using the different furniture types (Figure 5). Generally, each student reported high work completion during the baseline phase. Data was only collected on 2 of the 4 days that this group was using the FootFidget® and standing desk combination. Student 3, student 5 and student 6 all reported very high work completion while using this furniture. In this group of students, there did not seem to be a marked trend in work completion across the furniture types.

The last group of students were only able to use the FootFidget® with a regular desk during this study period. Visual inspection of their graphed work completion using regular desks compared to using the FootFidget® (Figure 6) showed varying responses. The FootFidget® did not appear to significantly change the work completion patterns of any of the students in this group, except student 9 whose work completion decreased.

Attention

The mean self-reported attention scores for the whole class and the two students identified as having *some problems* processing sensory input and t test results comparing the means between phases are reported in Table 3. While using the regular classroom furniture, the class's average self-reported attention was 3.95. There was no significant difference in attention while using the FootFidget®, but with the addition of the standing desk to the FootFidget®, attention significantly increased to 4.46 (Figure 1), $t(8) = 2.79$, $p = .024$. There was little reported change in attention and no significant difference for either student 3 or 7 while using the FootFidget® at a regular desk. Both student 3 and student 7's attention increased while using the standing desk and FootFidget® combination, from 3.92 to 4.91 and 3.82 to 4.53, respectively, although neither of these increases were statistically significant (Figure 2; Figure 3).

Each student's self-reported attention while using the different furniture types are shown in Figure 7, Figure 8 and Figure 9. Again, a missing data point on any of these graphs indicates a student absence or incompletion of the data worksheet. Visual inspection of the graph of self-reported attention for the A-C-B group (Figure 7) showed slight increases in attention for some students while using the FootFidget® and standing desk combination and little change in attention for any of the students while using the FootFidget® alone.

The group of student's using the furniture in the A-B-C order showed varying attention while using the different furniture types (Figure 5). In general, the group's attention remained about the same or decreased slightly while using the FootFidget®, but increased significantly while using the standing desk and FootFidget® combination.

Most student's in this group reported their highest attention while using the FootFidget® and standing desk combination. It appears that this group benefited from the use of the standing desk and FootFidget®, but not from the use of the FootFidget® alone.

The last group of students were only able to use the FootFidget® with a regular desk during this study period. Visual inspection of their graphed attention using regular desks compared to using the FootFidget® (Figure 6) showed varying responses. It does not appear that this group benefited significantly from the use of the FootFidget® with their regular desks.

Qualitative Data

Over the course of the study the students were asked to specify if they liked their seat, desk, and the FootFidget®. It was found that 70% of the time students said they liked their seat, and that they did not like their seat 30% of the time. Students reported 83% of the time they liked their desk, and that they did not like their desk 17% of the time. The students liked the FootFidget® 90% of the time, thought it was ok 10% of the time and never expressed that they did not like it. Some of the student's comments included, "I am paying a lot more attention at the FootFidget® desk than my own" and "I love the FootFidget®." The teacher expressed, during the first week of data collection, that she did not encounter any problems teaching her class and was able maintain her typical conduction of teaching. During the second week, she expressed that the new seating arrangement and different placement of children was disruptive to the attention and work completion. She mentioned it might have been due to the students who tended to be disruptive were all placed using the standing desks that week.

Discussion

As legislation, such as NCLCB (2004) and IDEA (2004), places increasing demands on classrooms to improve student academic performance while keeping children in the least restrictive environment, modifications have become increasingly important to support children with special needs in the general education classroom. With the increasing prevalence of children with sensory processing challenges, it is necessary to explore sensory-based strategies and supports to improve attention and work completion for these children. Dynamic seating options, such as therapy balls and Move and Sit® cushions, have been studied as a method of increasing sensory feedback by allowing movement. Some studies have had positive outcomes in the form of increased positive behaviors, such as time in seat or time on task. This study aimed to contribute to the body of research surrounding dynamic seating options and explore the relatively new furniture options of the FootFidget® and the FootFidget® in combination with a standing desk. Though the research was limited in control due to classroom routine, schedules and student learning priorities, the external validity of the findings is believed to be high.

The standing desk with the FootFidget® was shown to statistically significantly increase attention for 4^{th} grade students. This demonstrates that the FootFidget® in combination with the standing desk is an effective method to increase attention in the classroom. This finding is consistent with previous research (Fedewa & Erwin 2011; Ivory, 2011; Pfeiffer et al., 2008; Schilling et al., 2003; Schilling & Schwartz, 2004) that dynamic seating options increase attention to tasks. Furthermore, the FootFidget® and standing desk are not only beneficial for students with sensory processing problems, but also for those without sensory difficulties. It was also found that for some students with *some problems* work completion statistically significantly increased with use of the FootFidget® and standing desk. This indicates that some students with sensory processing difficulties may, in addition to increased attention, have increased work completion while using the standing desk with the FootFidget®. At this time, research does not support the use of the stand alone FootFidget® as a method of increasing attention or work completion in students with or without sensory processing difficulties. It is not clear if the standing desk alone could produce similar results as the FootFidget® and standing desk combination.

Providing the FootFidget® and standing desk for students in the classroom would modify the environment to support student learning. Students would be able to maintain their attention on the task, and could potentially increase their work completion, to foster a positive learning environment within the general education classroom. With high teacher and student approval, the standing desk with the FootFidget® has a high probability of being a welcomed modification to the classroom environment.

This furniture could support inclusive educational practices for students with sensory processing challenges, attention deficit hyperactivity disorder or autism spectrum disorder who are having academic difficulty or are displaying problem behaviors in the classroom. This classroom modification would be consistent with the federal mandate for students to attend class in the least restrictive environment and could decrease the need for more intensive services and special education. Additionally, RtI interventions may find this dynamic seating option appropriate for a school wide change to accommodate all students.

This study was conducted in a naturally occurring environment. The intervention encountered conflicts with the school schedule, such as an altered schedule due to a field trip, but limited control was imposed to reflect the typical classroom setting. This limited data collection to two days during one phase. Additionally, students were absent and not able to contribute data on those days. These students were still included in data analysis because a similar experience is likely to be encountered in any daily classroom routine. Despite considerations to accommodate stabilization of data, it may not have reached saturation during the intervention phase. Ongoing data collection is in process and will hopefully accommodate data saturation.

Seating arrangements ended up being a primary distraction for the teacher during the study. Due to random placement of students by researchers, the teacher expressed some students who caused more classroom disruptions were placed by each other. Understanding the classroom dynamic and student's personalities will influence the effectiveness of the seating arrangement.

Implications for Occupational Therapy

The FootFidget® and standing desk can be used to increase attention and work completion for students. This finding suggests that the FootFidget® and standing desk could be used as a systemic solution to increase positive classroom behaviors and decrease the need for one on one pull out therapy sessions. Occupational therapists can also work with teachers to identify the optimal classroom seating arrangement to decrease distraction and benefit all students. The standing desks should be placed in either the back or side of the classroom to allow other students in seated desks to have a clear view of the teacher. Occupational therapists can consult with the teacher to decide the best placement for a student using a standing desk or dynamic seating option. Through activity analysis the optimal fit between the student's skills, environment, and tasks can be determined. The occupational therapist should follow up with the classroom to determine if the FootFidget® and standing desk are meeting the needs of the student and providing the necessary support. Collaborating with the teacher while monitoring the use of the furniture will determine if the seating option is an effective intervention or if adaptations or modifications are needed.

As found in studies with other equipment (Ivory, 2011), not all students find one type of furniture beneficial. Students may find different dynamic seating options more favorable than others. Their preference of seating option can guide occupational therapist's decisions on which type to implement.

Limitations

This study had a limited sample size. The students were from one general education classroom in a private school. The duration of each phase was 4 days, and each phase may not have reached saturation of data. Data were not taken at a specific time each day, but rather in accordance to specific subjects taught, or every day the different seating options were used. Additionally the desk legs of the normal desks were not conducive for the FootFidget®. The teacher reported that at times the FootFidget® would snap off of the said desks, which may have caused increased distraction for the students. Last, the effectiveness of the standing desk alone was never examined.

Future Research

Investigating longer phase time for data collection would further determine the effectiveness of the FootFidget® and the FootFidget® and standing desk combination.

Longer phase times would accommodate for fluctuations in behavior and allow for data to stabilize further. Additionally examining the effect of the FootFidget® with students of different ages would broaden the scope of this study. Identifying specific diagnosis that benefit from the FootFidget® and standing desk would aid practitioners in determining the proper dynamic seating option for a child. Furthermore, determining if the standing desk alone could produce similar results to the FootFidget® and standing desk needs to be investigated. Different methods of data collection and response variables to the intervention may increase the rigor of future study.

Conclusions

This research continues to support the use of dynamic seating options as a method of increasing positive classroom behaviors in children with sensory processing difficulties. Additionally, it supports the use of FootFidget® and standing desk combination as an effective method of increasing attention in the average student as well. The FootFidget® and standing desk are an environment modification option for supporting inclusive education practices that occupational therapists can implement under RtI and in accordance with federal mandates for student learning in the least restrictive environment to support improved academic performance of students.

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Appendix A

Daily Self-Report Rubric

Student Number: ______________________ Reading/ Language Arts/ Math
Date: __________________________________ Time of Day: _____________________
Regular Desk/ FootFidget only/ FootFidget and Standing Desk

How did I do getting my work done?

____

I didn't finish anything I finished all of it

Did I focus on my teacher and/or work?

____

I talked with my neighbor and I played with items in or on my desk.

I was focused the whole time. I did not talk or play and I followed directions on my work

Did I like my seat and desk today?

I did not like the seat or desk	I did not like the seat but the desk was ok	I did not like the desk, but the seat was ok	I liked both the seat and desk

Did I like the FootFidget today

I did not use the FootFidget today	I did not like the FootFidget at all	I thought the FootFidget was ok	I liked the FootFidget

Appendix B

Daily Self-Report Rubric

Teacher Form

Teacher Initials: ______________________ Date:_________________

For the kids, the furniture used today seemed:

Disruptive to the attention and work completion	Didn't change the attention and work completion	Increased attention and work completion

If it was disruptive, was it because it created:

More noise	More movement	A different classroom layout

Other:

For you, the teacher, the furniture used today seemed:

Disruptive to teaching the class	Didn't change how I conducted teaching class	Improved teaching the class

Additional comments:

Table 1

Demographic Information on Participants

Characteristic	n	%
Sex		
Male	6	46.2
Female	7	53.8
Race		
Asian/Pacific Islander & African American & Native American	1	7.7
Cambodian	1	7.7
White	11	84.6
Age		
<10	1	7.7
10-10.4	7	53.8
10.5-10.7	5	38.5

Table 2

SPM Results for Children Indicated as Having "Some Problems" Processing Sensory Input

SPM Scales								
Student	SOC	VIS	HEA	TOU	BOD	BAL	PLA	TOT
3	3	2	2	2	1	2	2	2
7	1	1	2	2	2	2	3	2
9	2	1	1	1	2	1	1	1
11	1	1	1	2	1	1	2	1

Note. 1=Normal; 2=Some Problems; 3=Definite dysfunction.

Table 3

Mean Work Completion and Attention

	Total Class			Student 3			Student 7		
	Mean ± SD	t(df)	p	Mean ± SD	t(df)	p	Mean ± SD	t(df)	p
Self Reported Work Completion									
Regular Desk	4.26 ± .80			4.30 ± .245			4.05 ± 1.10		
FootFidget®	4.06 ± .90	1.51(8)	.169	3.66 ± 1.39	1.00(3)	.390	3.86 ± 2.18	.475(3)	.667
FootFidget® + Standing Desk	4.14 ± .87	.693(8)	.541	4.66 ± .31	13.00(1)	.049*	3.47 ± 2.17	.260(1)	.838
Self Reported Attention									
Regular Desk	3.96 ± .96			3.92 ± .92			3.82 ± .98		
FootFidget®	3.98 ± .92	.061(8)	.953	3.65 ± 1.40	1.05(3)	.373	3.19 ± 1.80	1.98(3)	.142
FootFidget® + Standing Desk	4.46 ± .65	2.79(8)	.024*	4.91 ± .13	1.00(1)	.500	4.53 ± .66	.543	.683

Note. Paired t tests were done to compare the mean self report score for attention and work completion while using a regular desk to using either a FootFidget® or FootFidget® and standing desk. *p < .05.

Figure 1. Class Mean Self-Reported Work Completion and Attention Across Furniture Types

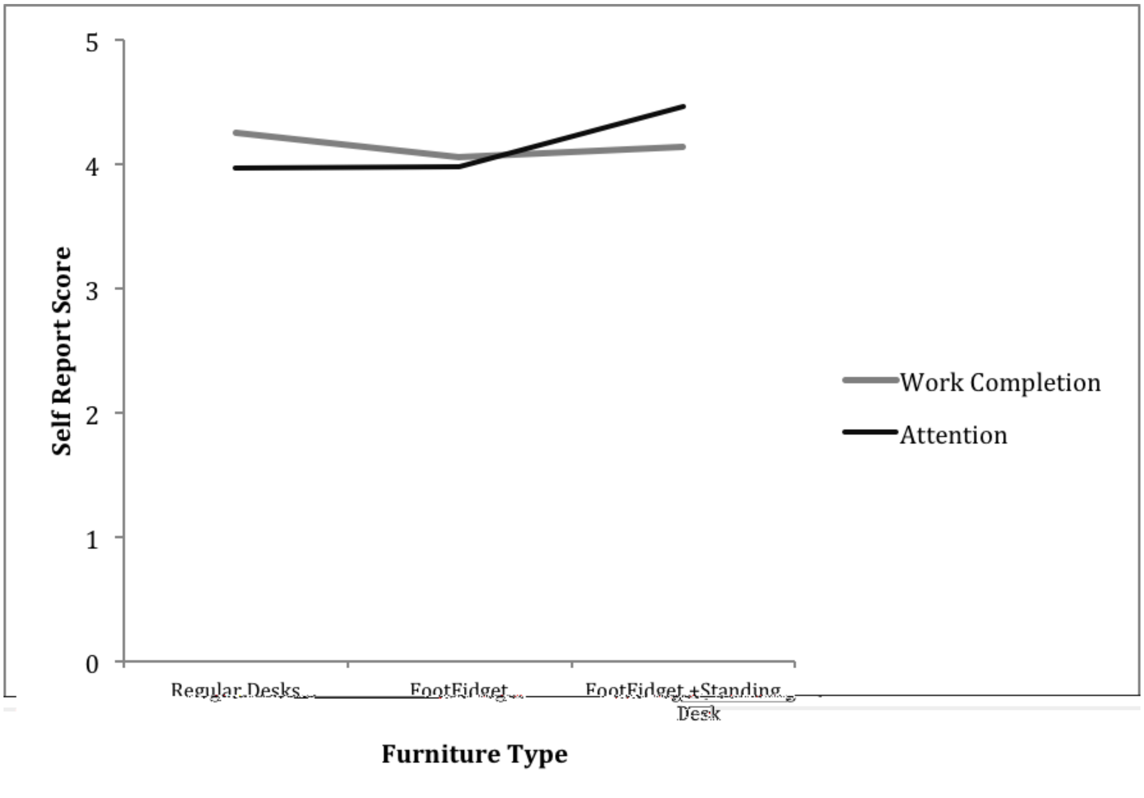

Figure 2. Student 3 Mean Work Completion and Attention Across Furniture Types

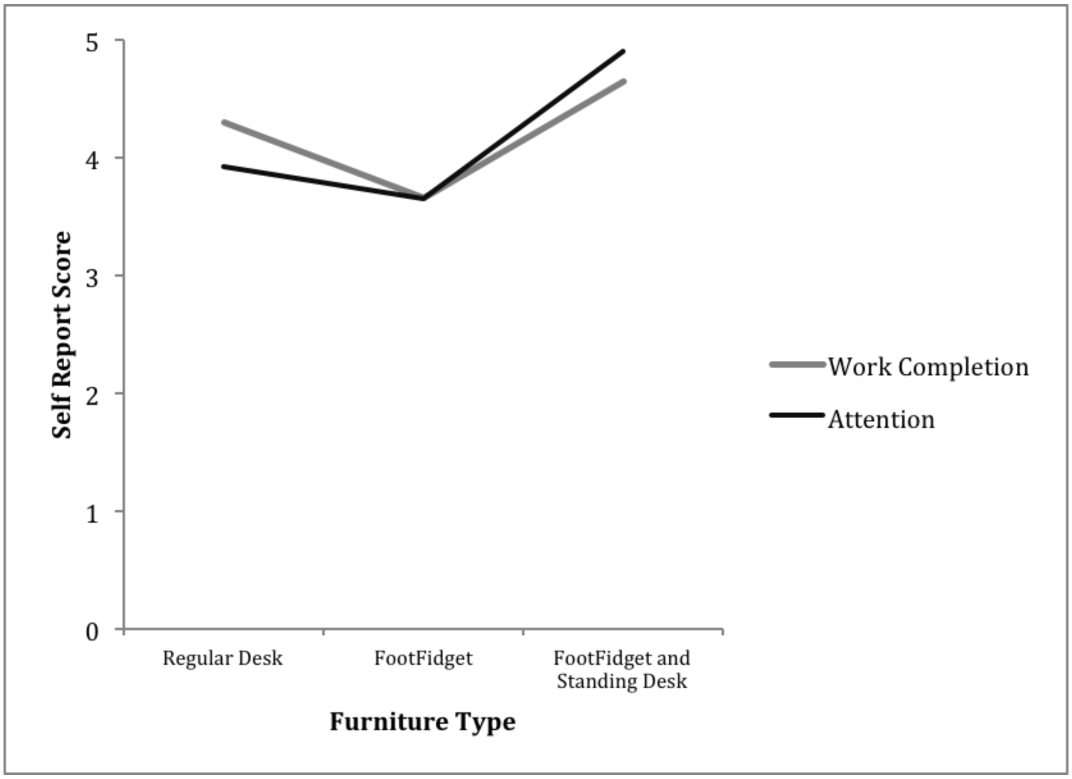

Figure 3. Student 7 Mean Work Completion and Attention Across Furniture Types

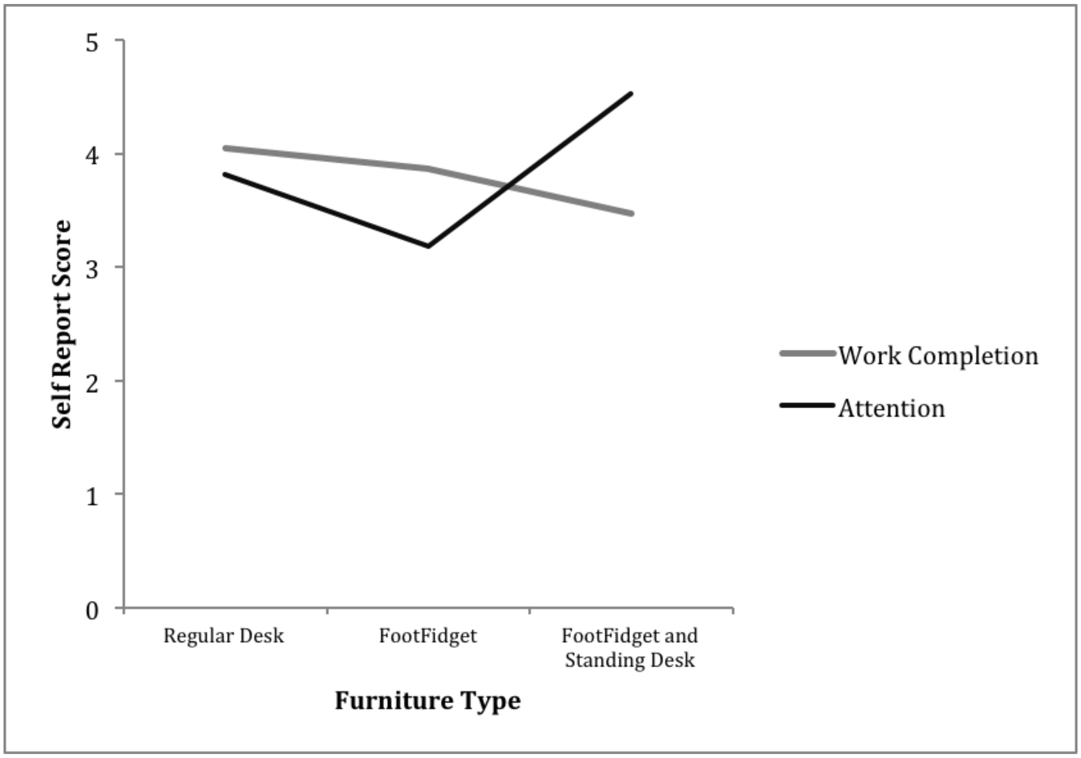

Figure 4. Self Reported Work Completion for Students in the A-C-B Group

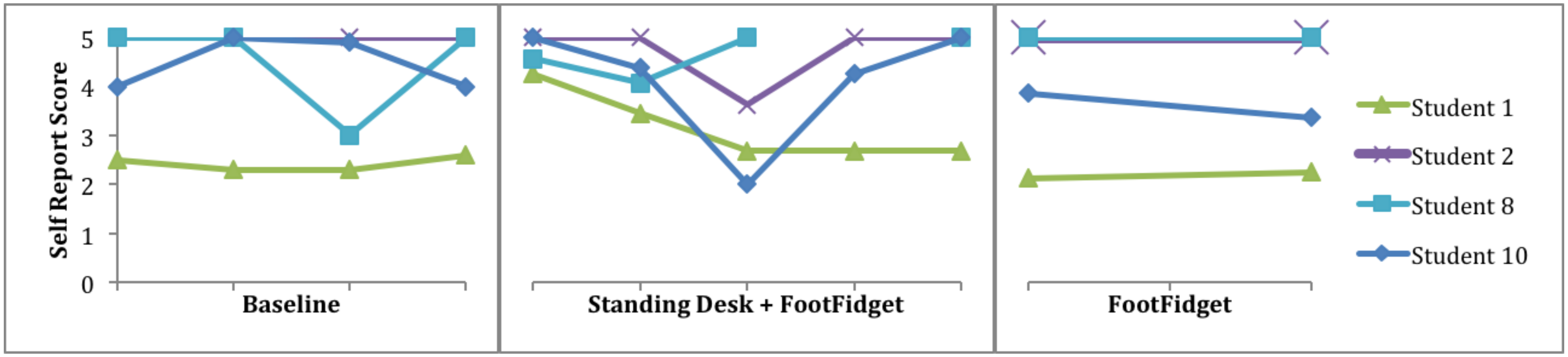

Figure 5. Self Reported Work Completion for Students in the A-B-C Group

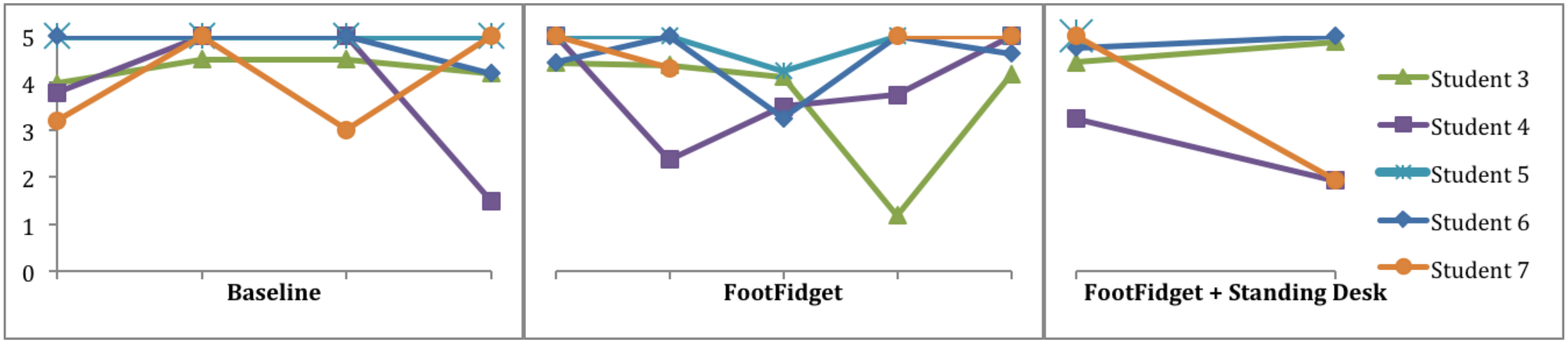

Figure 6. Self Reported Work Completion for Students in the A-B-B Group

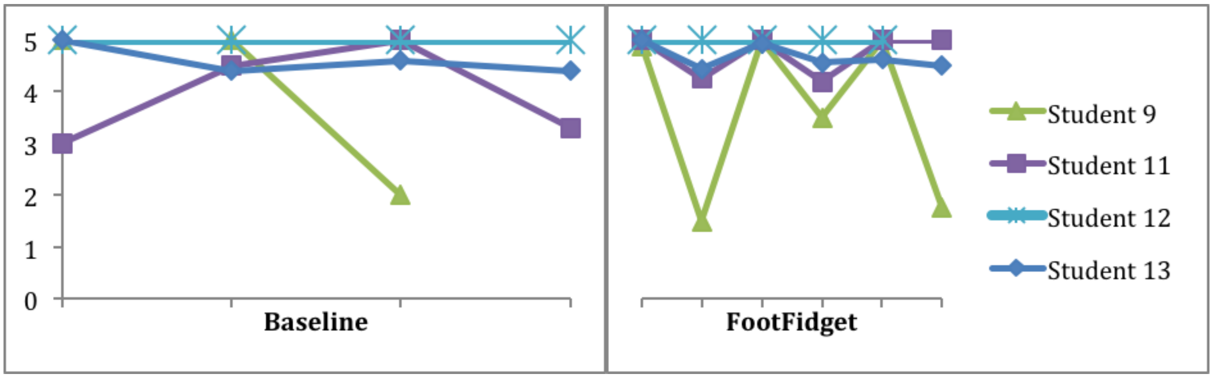

Figure 7. Self Reported Attention for Students in the A-C-B Group

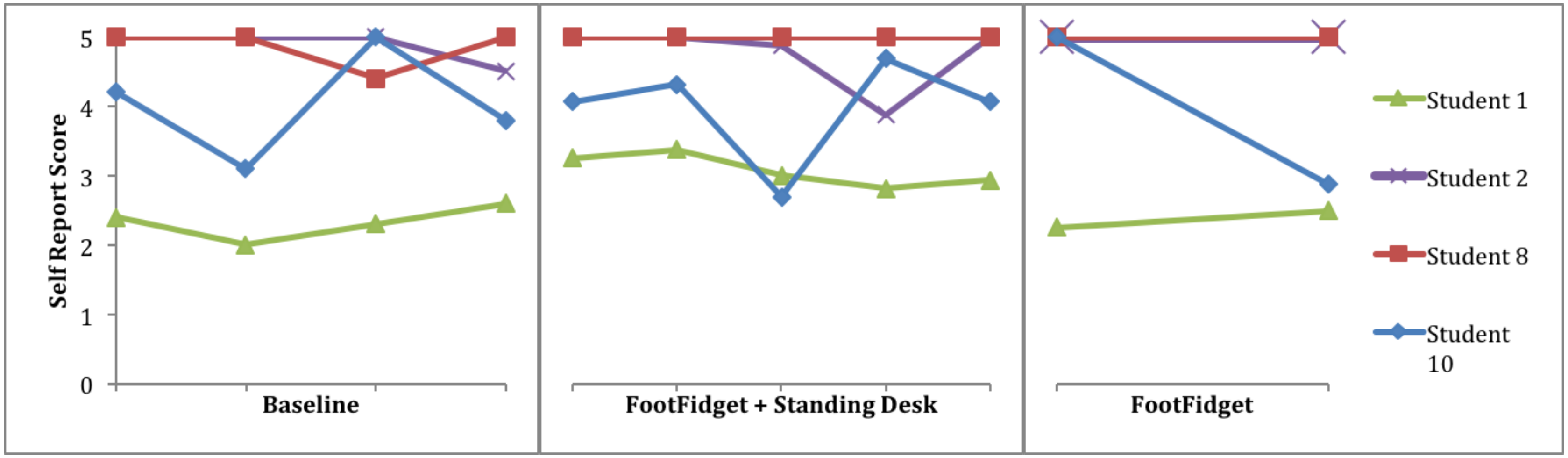

Figure 8. Self Reported Attention for Students in the A-B-C Group

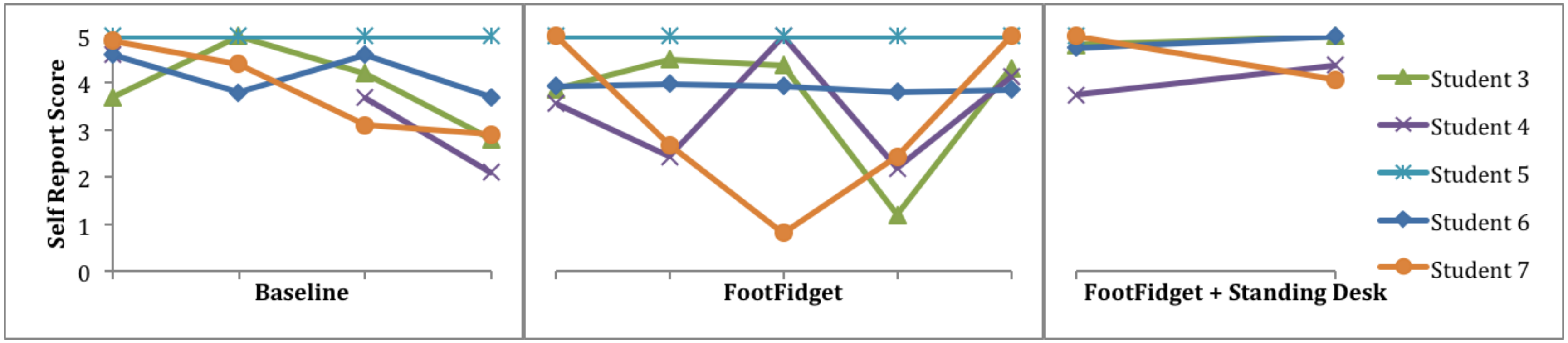

Figure 9. Self Reported Attention for Students in the A-B-B Group