Georgia Educational Researcher

Volume 14 | Issue 2 Article 4

2018

Alternative Seating and Students' Perceptions: Implications for the Learning Environment

Alicia Stapp
University of Mississippi, acstapp@olemiss.edu

Alternative Seating and Students' Perceptions: Implications for the Learning Environment

Abstract
Expectations placed on educators to improve academic performance continue to increase across the United States. One reason for this rise in expectancy is the enactment of The Every Student Succeeds Act (ESSA) of 2015. Replacing the No Child Left Behind (NCLB) Act of 2002, the ESSA mandates that "all students are taught to high academic standards" (ESSA, 2015). Subsequently, educators constantly seek best practices that foster effective learning environments. A component of the learning environment oftentimes excluded from research is the physical structure of a classroom, such as the type of seating in a classroom. Research suggests that students who are expected to spend extended periods of time sitting in traditional desks with limited movement breaks during the school day are at risk for inattention to learning and increased misbehaviors (Wingrat & Exner, 2005). Thus, this quantitative study examined the effect of alternative seating in the form of disc 'o' sit cushions on fifth grade students' time on- and off-task during mathematics instruction. In addition, a survey was administered to determine students' perceptions of alternative seating.

Keywords
learning environment, alternative seating, on-task behavior, mathematics instruction

Introduction

Concerns for the current state of public education continue to rise across the United States. Targeting the academic performance of underperforming public schools, these concerns prompted reform of the No Child Left Behind (NCLB) Act of 2002. Replacing the NCLB Act, the Every Student Succeeds Act (ESSA) requires additional school accountability and mandates "action to create positive change," so that students are college and career ready (ESSA, 2015). To produce this positive change, administrators and educators continually evaluate their schools' needs. Following evaluation, action plans are created with the goal of increasing overall student achievement. Inevitably, most plans include new pedagogies, curricula, or professional development on current research-based practices.

As these action plans are developed and implemented with best practices in mind, it is imperative to include strategies that foster high levels of student engagement. Engaged or on-task learners equate to increased instructional time, which research shows has a positive impact on academic achievement (Halm, 2015). Studies of students' on-task behaviors in the classroom primarily focus on student responsiveness to reinforcers or to the type of activities in which the student engages (McCurdy, Skinner, Watson, & Hindman, 2001). While these factors play a role in on-task behaviors across classrooms in the K-12 setting, the physical learning environment, specifically, the type of seating in a classroom and its effect on the learner's engagement level during instruction is a less explored area of study. A limited number of studies examine various environmental modifications in the classroom, such as alternative seating (Bagatelli, Mirigliani, Patterson, Reyes, & Test, 2010; Pfeiffer, Henry, Miller, & Witherell, 2008; Schilling & Schwartz, 2004). Therefore, this quantitative study aimed to determine if alternative seating in the form of disc 'o' sit cushions had an effect on fifth grade students' time on- and off-task task during mathematics instruction. Additionally, the present study analyzed students' perceptions of comfort and engagement levels while using disc 'o' sit cushions through an anonymous classroom seating rating survey.

Literature Review

The learning environment and off-task behavior.

Designing an effective learning environment encompasses multiple components. Those parts are inclusive of, but not limited to the physical setting, social contexts, and innumerable instructional elements composed of teacher characteristics and behaviors (Patrick, Ryan, & Kaplan, 2007). While instructional contexts remain the central focus of analysis for effective learning environments, it is critical to consider the role that the physical environment has on learning. Oftentimes excluded from the literature, the physical structure of a classroom refers to such elements as lighting, temperature, seating arrangements, floors, walls, desks, computers, and whiteboards. When utilized effectively, these elements aid in constructing an advantageous learning environment that can have positive effects on the teaching and learning process (Suleman & Hussain, 2014).

Educators who consider the learning environment are more likely to utilize instructional time to its fullest potential and foster an environment where high levels of learning occur (Halm, 2015). One way to ensure instructional time does not decrease during the school day is to create a learning environment that enables students to remain on-task during instruction. Off-task behaviors are noted in the literature as one of the most persistent barriers to learning in the

classroom (Baker, 2007; Dixon & Salley, 2007 Lemov, 2010). Studies have found that off- task behaviors are displayed during instruction between ten to fifty percent of the time (Lee, Kelly, & Nyre, 1999). This provides further justification to examine all facets of the learning environment, including the physical environment.

Traditional seating and sedentary classrooms.

Classroom seating is a standard element of the physical environment that has been examined since the eighteenth century. However, most research has examined the effect of traditional seating and arrangements on classroom behavior (Bicard, Ervin, Bicard, & Baylot-Casey, 2012; Knight & Noyes, 1999; Mahar et al., 2006). In a typical classroom, traditional refers to an arrangement of equidistant rows with identical chairs and desks. From its inception, traditional seating and arrangements were designed to allow for the best use of natural light in classrooms that did not have access to electricity (Summer, 1969). Even though lighting has progressed tremendously, this type of seating still persists in twenty-first century classrooms.

In recent years, the trajectory of children diagnosed with ADHD has increased from 7.8% in 2003 to 11% in 2011 (Center for Disease Control and Prevention [CDC], 2012). Hanscom (2014) stated that the increase of students identified with ADHD can be partially attributed to the sedentary nature of the physical environment in most classrooms. According to Hunsberger, McGinnis, Smith, Beamer, & O'Malley (2014), school consumes about 30% of a child's day, during which students are seated at desks a majority of the time. The average child spends approximately 15,000 hours of their school life sitting in a chair (Ramaswamy, 2015). This exorbitant amount of time spent sitting in an upright position provides minimal opportunities for children to move their body in natural ways throughout the school day to release built up energy. Ultimately, leaving students restless, fidgeting, and off- task in their chairs due to a lack of exertion. Traditional desks and chairs are also sized based upon a child's age and normally do not take into account a child's height or allow for ample movement while seated. Furniture that inadequately fits a child can have a negative impact on attention and on-task behavior (Ramaswamy, 2015). Jensen (2000) argued against the structure of a sedentary classroom, noting that teachers need to engage students in a variety of positions throughout the day, including walking, leaning against walls or desks, perching, or even squatting. This helps to promote physical activity, which ultimately increases learning capacity (Jensen, 2000).

A decrease in movement and play throughout the school day has also led to increased sensory issues (Strauss, 2015). When children sit in chairs any longer than ten minutes, it is likely to have a negative effect on their physical and emotional senses (Strauss, 2015). As their senses become deregulated, students tend to become fatigued. Oftentimes this leads to disruptive behavior, when the cause may be a lack of movement (Brekke-Sisk, 2015). However, alternative seating such as the disc 'o' sit cushion enables a range of natural movement for children and increases sensory integration. A limited number of studies have explored alternative seating (Bagatelli, Mirigliani, Patterson, Reyes, & Test, 2010; Pfeiffer, Henry, Miller, & Witherell, 2008; Schilling & Schwartz, 2004). Therefore, this type of alternative seating should be thoroughly examined to determine the benefits for all students, inclusive of those with sensory processing disorders (SPD), attention deficit disorder (ADD), and attention deficit hyperactivity disorder (ADHD). Through increased sensory input, alternative seating such as the disc 'o' sit cushion may help promote self regulation, leading to improved behavior, attention and academic performance for all learners in the classroom.

Researchers have also evaluated the causal relationships between sitting and decreased health, poor behavior, and the lack of inactivity in children that occurs with traditional seating (Levine, 2015; McManus et al., 2015). Reynolds (2015) noted that children who sit for too long are at risk for adult-sized health consequences and found that elongated periods of inactivity

DOI: 10.20429/ger.2018.140204

changed the blood flow in the arteries of children. If this change in blood flow were identified in an adult, it would be considered a precursor to cardiovascular disease (Reynolds, 2015).
When children sit still for too long, the processes that normally break down fats and carbohydrates are considerably hindered. This results in a multitude of health concerns, including diseases that are usually onset by obesity. Therefore, it is critical to research alternative seating for the twenty-first century classroom to determine the possible effects it may have on overall child development, inclusive of academic behavior and performance.

While the traditional structure of the physical environment still dominates, there is an increasing trend to change from teacher centered seating to student centered seating. Also known as alternative seating, this type of seating gives students choice in the type of seating they utilize throughout the day (Daily & Suite, 2015). Many educators across the United States are incorporating alternative forms of seating into their classrooms. However, there is minimal evidence on the effect that alternative seating has on academic performance and behavior. As academic standards continue to rise in the United States and the overall goal of improving academic achievement becomes increasingly apparent, the amount of time a child remains on-task is critical. Therefore, it is essential to discern the function that the physical environment, particularly the use of alternative seating has on precipitating an effective learning environment.

Emergence of alternative seating.

Alternative seating is an emerging trend for occupational school therapists (Merritt, 2014). Based on the Anna Jean Ayres sensory integration theory (Ayres, 1972), alternative seating is regarded by occupational therapists as a means to improving adaptive behaviors (Merritt, 2014). Research suggests that teachers and students are likely to benefit from the implementation of research-based and sensory-motor activities that coalesce with everyday classroom routines (Polcyn & Bissel, 2005). Thus, a possible correlation may exist between the use of alternative seating and the improvement of daily academic behavior and performance. Even though the use of alternative seating has significantly increased with occupational therapists, there are few studies that have examined the relationship between alternative seating for children and its effect on learning for all populations of students in the general education classroom.

Forms of Alternative Seating

Standing desks.

One of the most common and accessible forms of alternative seating is standing desks. Standing desks allow students to stand, with the option of sitting on a stool. Enabling students to sit or stand at their discretion is known as stand-biased. Stand-biased desks are inexpensive alternatives to traditional seating and have the ability to “interrupt sedentary behavior patterns” (Benden, Blake, Wendel, & Huber, 2011, p. 1433). Brenden et al. (2011) examined four first-grade classrooms, wherein students were asked to wear calorie expenditure armbands for a period of ten days. Results of the study indicated that the students who utilized the standing desks had a significant increase in energy expenditure compared to the control group who did not utilize the stand-biased desks. Minges et al. (2016) completed a systematic review of eight studies that examined the effect of standing desks on children’s physical activity levels, sit and stand behaviors, classroom behaviors, and academic performance. Results suggested that time standing increased in all studies, time spent sitting decreased in all studies, and physical activity and positive academic behavior increased in most studies. However, the study noted that further research is needed to determine the impact of standing desks on academic performance.

Foot fidgets.

Hartanto, Kraft, Losif, & Schweitzer (2015) found that students with ADHD were able to concentrate at higher levels when given the opportunity to fidget in the classroom. Results of this study support the use of interventions that enable students to fidget while seated. Providing students the opportunity to fidget with predetermined manipulatives such as squishy balls, silly putty, or velcro, fulfills students' sensory needs that are often neglected when asked to sit still for lengthy periods of time. Another tool that addresses fidgeting while seated is the FootFidget®. The FootFidget® converts traditional seating by connecting a stretchy band to the legs of a student's chair or desk in a continuous loop. The purpose of the FootFidget® is to provide sensory input by allowing students to press against the fidget with their foot. This sensory input affords students the opportunity to concentrate at elevated levels. Sarver, Rapport, & Kofler (2015) found that students need to fidget more while completing highly complex cognitive tasks in the classroom. This could be one reason students are oftentimes more restless during reading and mathematics (Sarver et al., 2015). While the focus on fidgeting in the classroom appears to be deterred through alternatives modes of seating, there is very little evidence on the effect that foot fidgets have on attention to task in the classroom.

Therapy balls.

Al-Eisa, Baragadda, & Melam (2013) investigated the impact that therapy balls, used as a replacement for traditional chairs, had on sitting discomfort and academic performance in an elementary classroom. The study found that students who used therapy balls had a significant decrease in discomfort while seated, $p < .05$, and that each student's problem based learning scale score increased in all areas (Al-Eisa, Baragadda, & Melam, 2013). Single subject studies have also examined the use of therapy balls as a form of alternative seating. These studies determined that attention to task, in-seat behavior, and writing legibility increased when the therapy balls were used (Schiling & Schwartz, 2004). Another study indicated that fourth and fifth-grade students had increased on-task and in-seat behavior when therapy balls were utilized (Fedewa & Erwin, 2011). The aforementioned studies all indicated an increase in attention within the learning environment when therapy balls were used as an alternative seating in the classroom.

Disc 'o' sit cushions.

Another form of alternative seating are disc 'o' sit cushions (See Figure 1). These round discs are flat on one side and have a bumpy texture on the other side. When placed in traditional chairs, the cushions offer learners a natural range of movement and an opportunity for increased sensory input. Even though some studies have examined the effects of alternative seating on learning and engagement in the classroom, very few studies have explored disc 'o' sit cushions in the context of a general education classroom and on the population of an entire classroom. There is also a gap in the literature that explores the difference in time on-task with and without alternative seating in the classroom setting. Moreover, research has not disaggregated data between genders to determine if alternative seating has more of an effect on the time on-task of one gender over the other. Therefore, the purpose of this study was to investigate the effect of alternative seating in the form of disc 'o' sit cushions on fifth grade students' time on- and off-task and to determine whether or not disc 'o' sit cushions had a significantly higher effect on the time on-task of one gender over another. Furthermore, this study elicited responses from students through a rating scale seating survey that identified students perceptions about the alternative form of seating examined in this study.

DOI: 10.20429/ger.2018.140204

Figure 1. Disc ‘o’ sit inflatable seat cushion.

Research Questions

The following questions guided this study’s data collection and analysis:

1. Are the average minutes of time on-task higher when a disc ‘o’ sit cushion is used during mathematics instruction compared to a regular chair?
2. Are the average minutes of time off-task lower when a disc ‘o’ sit cushion is used during mathematics instruction compared to a regular chair?
3. Do disc ‘o’ sit cushions affect male and female students’ time on-task differently during mathematics instruction?
4. Do fifth grade students perceive disc ‘o’ sit cushions positively in the learning environment?

Methods

Participants and procedures.

This study implemented a quasi-experimental removed-treatment design with convenience sampling to determine if alternative seating, in the form of disc ‘o’ sit cushions, increased the time on-task and decreased time off-task of fifth grade students during mathematics instruction. Prior to implementation of the study, approval from the University’s institutional review board, consent from a fifth grade teacher in the study classroom, and a documented signature from the study school’s principal were obtained. Parental consent and each child’s assent were also collected. Participants included 25 fifth grade students, 13 males and 12 females, in one general education classroom at a public elementary school in northwest Mississippi. The participants were 10 and 11 years-old.
Demographics of the participants were 72% White, 27% Black, and 1% Asian.

Data were collected during the study for nine, thirty-minute observation periods on Mondays and Wednesdays from October 2016 to December 2016 by three coders. All coders received training prior to the study, which consisted of coding videotaped and live class sessions. Inter-rater reliability was determined prior to the study and aligned with prior research studies

that examined on- and off-task behaviors. Kappa values ranged from .75 to .80, which is in alignment with prior studies that have examined off-task behaviors in the classroom. The value also exceeded the .75 threshold, which Fleiss (1981) indicated as excellent in field settings. During each observation period, coders were assigned the same set of students based on proximal distance. Coders observed the students using their peripheral vision or side glances, to deter from looking directly at students. This procedure has proven reliable in previous work that assessed student behavior (Baker, Corbett, & Wagner, 2006; Baker, D'Mello, Rodrigo, & Graesser, 2010; Ocumpaugh, Baker, & Rodrigo, 2012). Observations were documented on a self-created on- and off-task behavior chart (See Appendix A).

For the present study, behaviors were coded as either on-task or off-task. Subcategory codes for on-task behaviors were Actively Engaged Time (AET) or Passively Engaged Time (PET). Actively engaged behaviors were inclusive of, but not limited to reading aloud, raising a hand, and talking to a peer about assigned work. Passively engaged behaviors were inclusive of, but not limited to silently reading, listening to a lecture, and looking at the board during instruction. Subcategory codes for off-task behaviors were Off-Task Motor (OFT-M), Off-Task Verbal (OFT-V), or Off-Task Passive (OFT-P). Off-task motor behaviors were inclusive of, but not limited to fidgeting in seat while not on-task, drawing or writing not related to the material, and manipulating objects not related to class. Behaviors for off-task verbal were inclusive of, but not limited to talking to other students about unrelated material, calling out answers when the teacher had not called on them, and making unauthorized comments or remarks. Off- task passive behaviors were inclusive of, but not limited to looking around aimlessly, starting out the windows, and passively listening to others talk about things unrelated to the assigned material.

The duration of each observation period was thirty minutes (8:10 a.m. – 8:40 a.m.) and each period was divided into two fifteen-minute consecutive segments (8:10 a.m. – 8:25 a.m. and 8:25 a.m. – 8:40 a.m.) with 6 five- minute coding intervals. During the first fifteen-minute segment of mathematics instruction, students did not utilize the disc 'o' sit cushions and sat in their normal classroom chair. During the second fifteen-minute segment of mathematics instruction, students utilized the disc 'o' sit cushions by placing them in their chairs. The teacher signaled to students verbally when it was time to place the disc 'o' sit cushions in their chairs at 8:25 a.m. For each five-minute interval of the 30-minute observation, coders documented whether students were on-task or off-task a majority of the 5 minutes. This was determined by analyzing the behavior that was exhibited a majority of the 5- minute interval. For example, if a participant spent a majority of the 5-minute interval (more than 2.5 minutes) whispering with another student about non-academic work, the code for "off-task verbal" was circled. If a participant spent the majority of the 5-minute interval focused on completing assigned work, the code for "actively engaged" was circled.

Data collected from the observations were compiled into two charts before data analysis was conducted. The first chart had two columns, which consisted of the mean time on-task across all observations for each student while seated in a chair and while seated in a disc 'o' sit cushion. The second chart had two columns, which consisted of the mean time off-task across all observations for each student while seated in a chair and in a disc 'o' sit cushion. These data sets were utilized to answer research questions one through three with inferential statistics. To determine if the mean time on-task and time off-task for all students when seated in a chair compared to a disc 'o' sit was statistically significant a repeated measures ANOVA was conducted. A two-way factorial ANOVA was also conducted to determine if there was statistical significance for the average time on-task, as compared by gender.

DOI: 10.20429/ger.2018.140204

At the end of the six-week data collection, a Classroom Seating Rating Scale (CSRS) adapted from Harvey and Kenyon (2013) was administered to 100% of the participants on the last day of observations (See Appendix B). This quantitative survey included eight likert-type questions. Participants answered the CSRS questions by circling strongly agree, agree, neutral, disagree, or strongly disagree. Survey responses aided the researcher in answering research question four to determine the participants perspectives on using disc 'o' sit cushions as a form of alternative seating while learning in the classroom.

Results

Results of the present study align with previous research that suggests alternative seating increases on-task behavior and decreases off-task behavior. (Fedewa & Erwin, 2011; Schilling & Schwartz 2004). However, a majority of the aforementioned research has focused on students utilizing alternative seating in an occupational therapy setting. Much less is known about the benefits of alternative seating for students in the general education classroom. Thus, this study aimed to garner new insights into benefits that may arise from alternative seating in the general education classroom. As the findings below indicate, alternative seating had a significant impact on students' time on- and off-task during mathematics instruction.

Results for research question 1.

To determine if the average minutes of time on-task increased significantly for participants when disc 'o' sit cushions were utilized, a repeated measures ANOVA was conducted to compare the average time on-task sitting with a disc 'o' sit cushion to the average time on-task sitting in a regular chair. Data indicated that there was a significant increase in average time on-task at the $p < .05$ level for the two conditions [$F(1,24) = 15.94$, $p = .0005$] (See Table 1). Post hoc comparisons using the Tukey HSD test indicated that the mean score for time on-task with the disc 'o' sit (M = 19.84, SD = 2.27) was significantly different than the average time on-task with the regular chair (M = 16.4, SE = 3.67). To measure effect size, Eta squared was calculated. Data revealed that $\eta 2 = .25$, indicating that 25% of all the variability in the analysis came from the treatment effect.

Table 1
Results of Repeated Measures ANOVA for Average Time On-Task

Source	*df*	*SS*	*MS*	*F*	*p*
Between groups	1	148.09	148.09	15.94	.0005
Within groups	50	447.26	9.31		
Total	49	595.36			

Results for research question 2.

A repeated measures ANOVA was also utilized to determine if the average minutes of time off-task was significant for participants when disc 'o' sit cushions were utilized compared to sitting in a regular chair. Results of the test concluded that there was a significant decrease in average time off-task at the $p < .05$ level for the two conditions [$F(1,24) = 16.31$, $p = .0004$] (See Table 2). Post hoc comparisons conducted with the Tukey HSD test indicated that the mean time off-task with the disc 'o' sit (M = 7.8, SD = 5.07) was significantly different than the average time off-task with a regular chair (M = 12.65, SD = 6.58). To measure the effect size, Eta squared was calculated. Data revealed that $\eta 2 = .15$, indicating that 15% of all the variability

in the analysis came from the treatment effect.

Table 2
Results of Repeated Measures ANOVA for Average Time Off-Task

Source	*df*	*SS*	*MS*	*F*	*p*
Between groups	1	294.27	294.27	16.31	.0004
Within groups	50	1655.28	34.49		
Total	49	1949.56			

Results for research question 3.

To answer research question 3, a two-way factorial ANOVA was conducted to determine if there was a significant effect on the average time on task between females and males when disc 'o' sit cushions were utilized during mathematics instruction. Results of the test indicated that when compared, the average minutes of time on- task for females and males sitting in a disc 'o' sit were not statistically significant, $p = 1$ (See Table 3). Thus, utilizing disc 'o' sit cushions did not have a significant effect on the on-task behaviors of one gender more than the other in this study.

Table 3
Two Way Factorial ANOVA Comparing Female and Male Average Time On-Task

Source	*df*	*SS*	*MS*	*F*	*p*
Between Groups	12	58.61	4.88	.0000	1
Within Groups	0	7.42			
Total	25	172.78			

Results for research question 4.

A classroom seating rating scale was also administered to all 25 participants in the study to determine if students' perceptions of the alternative seating were mostly positive or negative. To collect the most authentic data possible all surveys remained anonymous. Responses from the eight likert-type questions indicated that 77% of the participants responded positively to all of the questions (See Appendix B). Questions seven and eight asked students about their ability to concentrate and actively engage in class utilizing disc 'o' sit cushions. Results showed that 76% of the students agreed or strongly agreed that they can participate more actively while using disc 'o' sit cushions and 68% percent of students agreed or strongly agreed that they can concentrate better/more easily when using disc 'o' sit cushions. The majority of students responded positively to all eight of the questions on the survey, indicating that the majority of students perceive the disc 'o' sit cushions as beneficial to their learning.

Discussion

As educators attempt to improve the learning environment by identifying research-based practices that counter off-task student behaviors and increase academic achievement, research on alternative seating in the classroom continues to increase. Even though there is ample research on alternative seating in the form of therapy balls, bike or standing desks, and foot fidgets, disc 'o' sit cushions have not been thoroughly examined. Therefore, this study examined the effect of disc 'o' sit cushions on a fifth grade general education classroom to determine its effect on time on- and off-task and as compared by gender.

With respect to Research Question 1 and 2, results showed that the average time on-task increased when disc 'o' sit cushions were used and the average time off-task decreased when

DOI: 10.20429/ger.2018.140204

disc ‘o’ sit cushions were utilized during mathematics instruction. Data indicated that the results were statistically significant for both sets of data, $p <$ .05.

Research Question 3 addressed the use of disc ‘o’ sit cushions as it related to the difference between gender time on- and off-task during mathematics instruction. Data revealed that the results were not statistically significant, $p > .05$. However, it is important to note that despite the lack of significance when compared between genders, the disc ‘o’ sit cushions did have an overall significant effect for time on- and off-task during mathematics instruction.

Research Question 4 sought to determine students’ perceptions of the disc ‘o’ sit cushions through an anonymous self-reported likert-type survey with eight questions. Previous research studies have examined the effect of alternative seating in very isolated cases and on students who are diagnosed with ADD or ADHD. On the contrary, this survey elicited responses from general education students about their perceptions of using disc ‘o’ sit cushions in the classroom. Data collected from the survey was divided into two categories. Comfort of the disc ‘o’ sit cushion was the first category. On average, 80% of students agreed that the seats were not uncomfortable and they were more comfortable than other types of seating in classrooms. Questions related to participating and engaging at a higher level while using the disc ‘o’ sit cushions elicited an average of 77% from participants. Overall, participants responded very positively to using disc ‘o’ sit cushions in the classroom. One reason for this is that students are comfortable with using the seats, as they are used on a daily basis. If the survey were administered at the beginning of the school year, results could have differed. Since this study took place three months into the school year, students could have also responded positively to ensure that they were able to continue utilizing the disc ‘o’ sit cushions in the classroom. The researcher could not identify any other studies that had quantified self-reported surveys about alternative seating from an elementary student’s perspective. Additionally, most research on alternative seating has examined qualitative outcomes of alternative seating with students who have SPD. Overall, this study significantly contributes to current research, as it examined a new form of alternative seating that has not been thoroughly examined. Results indicated that both the observations and survey data led to positive conclusions for the learning environment during mathematics instruction.

Limitations and Future Research

Even though this study yielded positive results, there were some limitations. One limitation was that there were a few days participants were absent from school. This posed a limitation, as data could not be collected from students on those particular days. Another limitation was the time of day that students were observed. All observations occurred at the beginning of the school day. If observations had occurred towards the end of the day, the results could have potentially been different. The sample group was also very small, as it only encompassed 25 fifth grade students. Students in a different grade level may have also yielded different results. Additionally, participants in the study used disc ‘o’ sit cushions on a daily basis by placing them in their chairs at the beginning of the day. This study asked students to place the cushions in their chairs after a fifteen minute time period. Thus, students went from having to use disc ‘o’ sit cushions to not using them. This limitation could have had a different effect on their on- and off-task behaviors than if the researcher was documenting an entire class period of use and comparing it to a class that did not use the disc ‘o’ sit cushions at all.

Conclusion

In summary, this study adds to the limited, albeit growing body of knowledge that supports the benefits of alternative seating in the classroom. As one of the leading contributors to

effective teaching and learning, time on- task is an imperative topic of research for educators. Results of the present study indicated that physical factors of the learning environment, inclusive of alternative seating have a positive impact on time on-task. However, further research might examine disc 'o' sit cushions within different academic subjects and/or across different grade levels. Thus, there are further questions left to be answered that may reveal additional benefits of alternative seating for students in the academic classroom.

References

Al-Eisa, E., Buragadda, S., & Melam, G.R. (2013). Effect of therapy ball seating on learning and sitting discomforts among Saudi female students. *BioMed Research International*, 1-4. doi: 10.1155/2013/153165.

Ayres, J. A. (1972). Treatment of sensory integrative dysfunction. *Australian Occupational Therapy Journal*, *19*(2), 88. doi: 10.1111/j.1440-1630.1972.tb00547.x

Bagatelli, 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*(6), 895-903.

Baker, R. S., Corbett, A. T., & Wagner, A.Z. (2006). Human classification of low-fidelity replays of student actions. Proceedings of the Educational Data Mining Workshop at the 8th International Conference on Intelligent Tutoring Systems, 29-36.

Baker, R. S., D'Mello, S.K., Rodrigo, M. M. T., & Graesser, A. C. (2010). Better to be frustrated than bored: The incidence, persistence, and impact of learners' cognitive- affective states during interactions with three different computer-based learning environments. *International Journal of Human-Computer Studies*, *68*(4), 223-241.

Baker, R. S. (2007). Modeling and understanding students' off-task behavior in intelligent tutoring systems. Proceedings of ACM CHI 2007: Computer-Human Interaction, 1059-1068.

Benden, M. E., Blake, J. J., Wendel, M. L., & Huber, J. C. (2011). The impact of stand-biased desks in classrooms on calorie expenditure in children. *American Journal of Public Health*, *101*(8), 1433–1436. http://doi.org/10.2105/AJPH.2010.300072

Bicard, D. F., Ervin, A., Bicard, S. C., & Baylot-Casey, L. (2012). Effect of seating arrangement on disruptive behavior of fifth grade students during independent seatwork. *Journal of Applied Behavioral Analysis*, *45*(2), 407-411. doi: 10.1901/jaba.2012.45-407

Brekke-Sisk, N. (2015). Standing-room only in classroom of the future. Mayo Clinic Magazine. Retrieved from http://www.mayo.edu/pmts/mc4400-mc4499/mc4409- 0906.pdf Center for Disease Control and Prevention (2012). Attention-Deficit/Hyperactivity Disorder (ADHD). Retrieved from https://www.cdc.gov/ncbddd/adhd/data.html

Daily, J. A., & Suite, A. (2015). Classroom seating choice and teacher perceptions of students. *The Journal of Experimental Education*, *50*(2), 1981. Retrieved from http://dx.doi.org/10.1080/00220973.1981.11011803

Dixon, W. E. & Salley, B. J. (2007). "Shh! We're tryin' to concentrate": Attention and environmental distractors in novel word learning. *The Journal of Genetic Psychology, 167*(4), 393-414. http://www.mayo.edu/pmts/mc4400-mc4499/mc4409-0906.pdf

ESSA (2015). Every Student Succeeds Act of 2015, Pub. L. No. 114-95 § 114 Stat. 1177 (2015-2016)

Fedewa, A. L., & Erqin, 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*(4), 393-399.

Fleiss, J. L. (1981). *Statistical methods for rates and proportions* (2nd ed.). New York: John Wiley.

Halm, D. S. (2015). The impact of learning on student engagement. *Educational Journal of Education and Social Science, 2*(2), 22-33. Retrieved from http://www.ijessnet.com/wp

DOI: 10.20429/ger.2018.140204

content/uploads/2015/02/3.pdf
Hanscom, A. (2014). Nature is the ultimate sensory experience: A pediatric occupational therapist makes the case for nature therapy. Retrieved from http://www.childrenandnature.org/2014/05/12/nature-is-the-ultimate-sensory-experience pediatric-occupational-therapist-makes-the-case-for-nature-therapy/
Hartanto, T. A., Kraft, C. E., Losif, A.M., & Schweitzer, J. B. (2015). A trial-by-trial analysis reveals more intense physical activity is associated with better cognitive control performance in attention-deficit/hyperactivity disorder. *Child Neuropsychology, 22*(5), 618-626. doi: 10.1080/09297049.2015.1044511.
Hunsberger, M., McGinnis, P., Smith, J., Beamer, B. A., & O'Malley, J. (2014). Elementary School children's recess schedule and dietary intake at lunch: A community-based Participatory partnership pilot study. *BMC Public Health*, *28*(14), 156. doi: 10.1186/ 1471-2458-14-156
Jensen, E. (2000). Brain-based Learning: A reality check. *Educational Leadership*, *57*(7), 76–80.
Knight, G., & Noyes, J. (1999). Children's behaviour and the design of school furniture. *Ergonomics*, *42*(5), 747-760.
Lee, S. W., Kelly, K. E., & Nyre, J. E. (1999). Preliminary report on the relation of students' on-task behavior with completion of school work. *Psychological Reports*, *84*, 267-272.
Lemov, D. (2010). Teach like a champion: 49 techniques that put students on a path to college. San Francisco, CA: Jossey-Bass.
Levine, J. (2015). Sick of sitting. *Diabetologia*, *58*(8), 1751-1758. doi:10.1007/s00125-015-3624-6
Mahar, M. T., Murphy, S. K., Rowe, D.A., Golder, J., Shields, T., & Raedege, T. D. (2006). Effects of a classroom-based program on physical activity and on-task behavior *Journal of the American Sports College and Medicine,38*(12), 2086-2094. doi: 10.1249/01.mss.0000235359.16685.a3
McManus, A. M., Ainslie, P. N., Green, D. J., Simair, R. G., Smith, K., & Lewis, N. (2015). Impact of prolonged sitting on vascular function in young girls. *Experimental Physiology*, *100*(11), 1379-87. doi:10.1113/EP085355
McCurdy, M., Skinner, C. H., Grantham, K., Watson, T. S., & Hindman, P. M. (2001). Increasing on-task behavior in an elementary student during mathematics seatwork by interspersing additional brief problems. *School Psychology Review*, *30*(1), 23.
Merritt, J. M. (2014). Alternative seating for young children: Effects on learning. *American Journal of Contemporary Research*, *4*(1), 12-18. Retrieved from http://www.aijcrnet.com/journals/Vol_4_No_1_January_2014/3.pdf
Minges, K. E., Chao, A. M., Irwing, L. I, Owen, N., Park, C., Whittemore, R., & Salmon, J. (2016). Classroom standing desks and sedentary behavior: A systematic review. *American Academy of Pediatrics*, *137*(2), 1-18. doi: 10.1542/peds.2015-3087
Ocumpaugh, J., Baker, R.S., & Rodrigo, M.M. (2012). Baker-Rodrigo Observation Method Protocol (BROMP) 1.0. Training Manual version 1.0. Technical Report. Manila, Philippines: Ateneo Laboratory for the Learning Sciences.
Patrick, H., Ryan, A., & Kaplan, A. (2007). Early adolescents' perceptions of the classroom social environment, motivational beliefs, and engagement. *Journal of Educational Psychology*, *99*, 83–98.
Pfeiffer, B., Henry, A., Miller, S., & Witherell, S., (2008). Effectiveness of disc 'o' sit cushions on attention to task in second-grade students with attention difficulties. *American Journal Of Occupational Therapy*, *62*(3), 274-81. doi:10.5014/ajot.62.3.274
Polcyn, P., & Bissell, J. (2005). Flexible models of service using the sensory integration framework in school settings. *Sensory Integration Special Interest Section Quarterly*, *28*(1), 1-4.
Ramaswamy, C. (2015). Is your child sitting uncomfortably? Then we'll begin. Retrieved from https://www.theguardian.com/lifeandstyle/shortcuts/2015/apr/19/children-bad-backs-uncomfortable-school-chairs-campaign

Reynolds, G. (September, 2015). Sitting is bad for children, too. The New York Times. Retrieved from https://well.blogs.nytimes.com/2015/09/23/sitting-is-bad-for-children-too/?_r=0

Sarver, D. E., Rapport, M.D., & Kofler, M. J. (2015). Hyperactivity in attention-deficit/hyperactivity disorder (ADHD): Impairing deficit or compensatory behavior? *Journal of Abnormal Child Psychology, 43*(7), 1219-1232. doi:10.1007/s10802-015-0011-1

Schilling, D. L. & Schwartz, I. S. (2004). Alternative seating for young children with autism spectrum disorder: Effects on classroom behaviors. *Journal of Autism Developmental Disorders, 34*(4), 423. doi:10.1023/B:JADD.0000037418.48587.f4

Strauss, V. (September, 2015). The decline of play in preschoolers and the rise in sensory issues. The Washington Post. Retrieved from https://www.washingtonpost.com/news/answer-sheet/wp/2015/09/01/the-decline-of-play-in-preschoolers-and-the-rise-in-sensory-issues/?utm_term=.517e68b065c2

Suleman, Q., & Hussain, I. (2014) Effects of classroom physical environment on the academic achievement scores of secondary school students in kohat division, Pakistan, *International Journal of Learning and Development, 4*(1), 71-81. doi: 10.5296/ijld.v4i1.5174

Summer, R. (1969). Personal Space. Englewood Cliffs, NJ. Prentice Hall, 1969.

DOI: 10.20429/ger.2018.140204

Appendix A

On-and Off-Task Frequency Chart

Without Disk	AET	PET	OFT-M	OFT-V	OFT-P
8:10-8:15	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
8:15-8:20	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
8:20-8:25	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

With Disk	AET	PET	OFT-M	OFT-V	OFT-P
8:25-8:30	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

8:30-8:35	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
8:35-8:40	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

DOI: 10.20429/ger.2018.140204

Appendix B

Classroom Seating Rating Scale (CSRS) Survey for Students

This survey is designed to gather information from students at Lafayette Upper Elementary School to determine students' opinions on the disc 'o' sit cushions after a six-week study. Participation is voluntary, anonymous and poses no risk to participants.

DIRECTIONS: Please circle the answer that best describes how you feel about the statements below. Your choices are strongly agree, agree, neutral, disagree, and strongly disagree. When you are finished please turn over your survey and I will collect it.

These seats are uncomfortable.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I can concentrate well while sitting in these seats.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I can not focus well while sitting in these seats.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
These seats are more comfortable than other types of seats in other classrooms.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
It is easier to talk to other students when sitting in these seats.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
These seats bother or disrupt other students.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I could engage in learning better/more easily while sitting in these seats.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I can participate more actively in classroom activities using these seats.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

Harvey, E.J., Kenyon, M.C. (2013). Classroom seating considerations for 21st century students and faculty, *Journal of Learning Spaces, (2)*1. Retrieved from http://libjournal.uncg.edu/jls/article/view/578