

Seating That Makes ‘Sense’:
A Sensory-Based Classroom Technique

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Abstract

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This study's purpose was to provide evidence regarding inflated seat cushions' effect on seating behaviors in a typical third grade classroom. An across subjects time series design was used with baseline, novelty, mandatory use, and optional use phases. Students were observed during language arts, and data was collected using a behavior rating scale. Results demonstrated non-significant trends of increased in-seat and fidgety behaviors for the low and medium frequency groups, as well as decreased noisy, poor posture, and out-of-seat behaviors for the medium and high frequency groups. Pre and post profile surveys completed by students and parents demonstrated increased student scores and significantly increased parent scores, indicating perceived improvements in seating behaviors and academic performance. Post questionnaires completed by the teacher and students for social validity showed that 100% of the students would recommend seat cushions to other students, the teacher would have her class use the cushions again, and the teacher would recommend the seat cushions to other teachers. Educators may benefit from increased awareness of the sensory needs of students, of a technique used by occupational therapists to address these needs in the classroom, and of changes that may be elicited by sensory techniques such as seat cushions.

Key Words; Seating Alternatives, Elementary Classroom, Occupational Therapy, Sensory Techniques, Seat Cushions

The current American education system typically assumes that students must be seated quietly in their chairs in order to learn (Lohrmann & Talerico, 2004). Consequently, out-of-seat

behavior and other motor, verbal, or passive off-task behaviors may prevent a student from remaining engaged in academic instruction (Junod, DuPaul, Jitendra, Volpe, & Cleary, 2006) or may distract other students from their work (Felmlee, Eder, & Tsui, 1985; Stahr, Cushing, Lane, & Fox, 2006). Recently, there has been an increased focus on seating alternatives that may help alleviate such classroom disruptions (Schilling, Washington, Billingsley, & Deitz, 2003). These seating alternatives, such as therapy ball seating (Schilling et al., 2003; Schilling & Schwartz, 2004) and standing classrooms (Puliti, 2007), have prompted some educators to move away from traditional models of learning, which require upright sitting posture at a student's desk (Lohrmann & Talerico).

Experimentally controlled research on the use of therapy balls as a seating alternative for specific populations has been performed; however the use of seat cushions as another seating alternative has not been studied. Recent changes in law require occupational therapists in the school system to use evidence to support practice (U.S. Department of Education, 2004), and the lack of evidence currently available in the area of seating alternatives for typical students is problematic. Documenting the use and effectiveness of seating alternatives for typical students will provide therapists greater access to knowledge about interventions which may significantly impact students' classroom behavior and ability to access the curriculum.

Nearly 30 percent of current occupational therapists are working in schools to help meet the educational needs of children (American Occupational Therapy Association, 2006). While much of school-based therapy is centered on special education students, it is becoming more frequent for therapists to be called upon to address the needs of children who do not have some type of diagnosis. Moreover, these children are commonly referred to occupational therapy services in schools as a result of problems paying attention in the classroom. The inattentive and

often disruptive behaviors these students exhibit may result from the requirements placed on them to remain seated for large portions of the school day (Lohrmann & Talerico, 2004).

It is commonly assumed that a child's ability to access learning opportunities at school is affected by his or her capacity to pay attention and demonstrate active or passive on-task behaviors (Jellison, 2002; Junod et al., 2006). Active on-task behaviors are identified as activities (i.e. speaking to the teacher or writing) that are visible behaviors indicating participation and engagement (Coyle & Cole, 2004; Junod et al.; Stahr et al., 2006). Conversely, passive on-task behaviors are identified as quiet activities such as solitary reading and looking at the teacher while listening in class (Junod et al.; Steinberg & Cazden, 2001). Regardless of whether a child is actively or passively engaged, on-task behavior is associated with learning because it is believed that when students are attentive and engaged during class, they have more opportunities to learn from the curriculum (Junod et al.).

If on-task behavior and attention lead to greater access to the curriculum and learning opportunities, then off-task behaviors may threaten these opportunities. Off-task behaviors can be active motor or verbal interruptions (Clark & Ward, 1999), or passive behaviors such as looking around the room, both of which prevent a student from remaining engaged in academic instruction (Junod et al., 2006) and furthermore may distract other students from their work (Felmlee et al., 1985; Kaplan, Gheen, & Midgley, 2002; Stahr, et al., 2006). Out-of-seat behavior is one such motor activity that can interfere with attention and engagement (Junod et al.). This inability to remain seated and attentive during instruction is contrary to traditional classroom expectations (Lohrmann & Talerico, 2004). Finding an accurate measure of attention that encompasses these behaviors and expectations, considers a student's sustained attention, ability to focus, and is appropriate for the school setting and entire student population is quite difficult

(Bakker & Anderson, 1999; Steinberg & Cazden, 2001). Extensive searches of the current literature produced few measures of attention for children that were relevant to the natural classroom setting.

In typical third grade classrooms, teachers require students to spend most of the day paying attention in whole group instruction or doing individual seatwork (National Institute of Child Health and Human Development Early Child Care Research Network [NICHD ECCRN] 2005). These third grade students should be proficient at printing, learning cursive (Asher, 2006), and spending increased time writing while sitting at their desks (Dennis & Swinth, 2001; Denton, Cope, & Moser, 2006; Woodward & Swinth, 2002). Elementary school students, including third graders, were found to use writing skills in nearly every subject for as much as 31% to 60% of the school day according to Hammerschmidt and Sudsawad (2004), or up to 50% of the school day according to Tseng and Chow (2000). The ability to remain in-seat for 60 minutes out of any 90 minute period is a typical behavioral expectation in a third grade classroom (Knight & Noyes, 2000). Participating appropriately within these traditional classroom expectations may often be difficult for students, therefore educators use various methods to manage classroom behavior and help students meet expectations.

Teachers often manage in-seat behavior through the use of specific behavior programs (Lohrmann & Talerico, 2004) or by altering student positions within the classroom (Kalinowski & Taper, 2007; Schwebel & Cherlin, 1972). For example, Lohrmann & Talerico identified a behavioral intervention program, called “Anchor the Boat”, which taught a classroom of students with learning disabilities about the expected classroom behaviors, and used modeling and positive reinforcement to manage behaviors. Results of a study by Schwebel and Cherlin (1972) noted differences in the behavior of typical elementary students between those sitting near the

front of the class versus those in the middle or back. Their study found that students in the front of the classroom were more attentive and on-task than those in other areas of the classroom, as measured by behavioral observation and teacher rating.

In addition to behavior intervention programs and altering seating location, teachers have also utilized movement activities to manage classroom behavior. Bass (1985) completed a study in which six children with learning deficits engaged in running for 45 minutes in the morning before school. This increased sensory and motor input was associated with increased attention when participating in class work, as measured by a ten item behavioral checklist. Glover (cited in Knight & Noyes as personal communication, 2000) made a general recommendation for classroom seating that allowed movement within the seating, based on the argument that traditional expectations requiring children to sit still for long periods of time are developmentally unrealistic.

Participating appropriately within traditional classroom expectations may be difficult for children with sensory processing needs, and these sensory needs should be considered (Baranek, 2002) when implementing methods to manage classroom behavior. A child must be able to take in, process, and react appropriately to sensory input in order for him or her to function at their highest capacity (Baranek; Bumin & Kayihan, 2001; Olson & Moulton, 2004; Reid, Trout, & Schwartz, 2005; Stagnitti, Raison, & Ryan, 1999). Schilling and Schwartz (2004) discussed the importance of maintaining an appropriate level of arousal in order for a child to remain engaged and attentive in the classroom. The often unpredictable environment of a classroom (Baranek) may make it difficult for children to respond appropriately to stimuli (Ermer & Dunn, 1998; Schilling et al., 2003) and can influence a child's arousal level (Schilling et al.).

One alternative to traditional classroom seating that allows movement and increased sensory input is removing chairs from a typical classroom and having students stand during instruction (Puliti, 2007). This alternative was developed by physicians at the Mayo Clinic, and it was initially implemented in an elementary school classroom. The original purpose of a standing classroom was to provide children with needed opportunities for movement, which in turn could increase activity level and decrease obesity. To date, no supporting literature in peer-reviewed journals could be found regarding the effectiveness of this intervention for increasing student activity or decreasing obesity (Puliti). Additionally, no literature was found regarding the effectiveness of this type of intervention in providing students with movement and sensory input to help them maintain an appropriate level of arousal.

Other options for classroom seating, such as the use of seating alternatives which provide students appropriate in-seat movement opportunities, have been found to have little supporting evidence. Two studies that have begun to address such seating alternatives tested the effectiveness of therapy balls as classroom seating in addressing the underlying sensory issues that may cause a lack of attention and engagement as well as behavioral problems (Schilling & Schwartz, 2004; Schilling et al., 2003). Schilling and Schwartz used therapy ball seating with four males, three to four years old, diagnosed with autism. Results of this study indicated improved classroom engagement and in-seat behavior when the students sat on the therapy balls rather than their typical classroom seating, as measured by time-sampled behavioral observations. In addition, surveys completed by the classroom teachers indicated that both teachers and students preferred using the therapy balls. Schilling et al. performed a similar study using therapy ball seating for an entire fourth grade classroom, which included three students identified as having Attention Deficit Hyperactivity Disorder (ADHD). Results of this study

showed the students with ADHD had increased in-seat behavior and legible word productivity when they sat on the therapy balls. Surveys for social validity completed by the teacher and students indicated that the teacher and three students with ADHD all preferred the therapy ball seating, while 17 out of the 21 remaining typical students preferred therapy balls.

Like therapy ball seating, the use of inflated seat cushions on chairs is an alternative seating that, according to sensory integration theory, may help students to regulate their arousal level through movement and increased sensory input to the brain (Mauer, 1999; Wheble & Hong, 2006). This movement, increased sensory input, and regulated arousal level, in theory may improve classroom behaviors such as attention and the amount of time students are capable of staying in-seat (Mauer; Wheble & Hong). The purpose of this current study was to determine the effect of inflated seat cushions on sitting behavior of all children in a typical third grade classroom. The null hypothesis of this study stated that the use of inflated seat cushions would not change the incidence of in-seat behaviors for third grade students in one classroom during a 30 minute language arts period as measured by time sampling every 20 seconds.

Methods and Procedures

The research design employed in this study was an across subjects, time-series design. The experimental intervention and independent variable was the inflated seat cushion, specifically the FitBALL® SeatingDisc Jr., which Ball Dynamics International provided for use in the study. The dependent variables were the in and out-of-seat behaviors of the third grade students. This study involved a convenience sample of one typical class of 24 third grade students at a public elementary school located in a suburb of a large Midwestern city. All students on the teacher's class list were invited to participate in this study. This typical classroom was comprised of 8- and 9-year-old students, of which 17 were male and 8 were female. The

classroom was part of a school at which the ethnicity of students was 94.5% Caucasian, 4.2% African American, and 1.3% were of another race; 4.7% of the students at this school were considered economically disadvantaged (Ohio Department of Education, 2007). Researchers were blinded as to whether or not any children in this class had a specific educationally related diagnosis. This research study was approved by the host institution's Institutional Review Board as well as the superintendent and principal of the elementary school. After an initial letter explaining this study was sent home to parents, parental permission and student assent to participate in the study was received from all parents and students.

Data collection occurred in the early afternoon during a specified language arts period, four out of five days per school week, during the fall semester of one school year. Data were collected via time sampled observations of the seating behaviors of students in the classroom. During these time sampled observations, a data collector walked slowly around the back and/or perimeter of the room while wearing headphones and listening to a compact disc. The compact disc provided a beep every 20 seconds to signal the data collector to record data on the observation of one participant, and begin observing the next participant. During the 30-minute period each participant was observed three times and corresponding data points were collected. Data collectors (authors one, two, and three, and a certified occupational therapy assistant from the participating school district) recorded data on a sheet created by authors one through three, which defined in-seat and out-of-seat behaviors (See Table 1), and diagrammed the seating formation of the students in the classroom. Prior to collecting baseline data, reliability among and between all data collectors was established by viewing a previously recorded video of the third grade students and analyzing the seating behaviors of each student. An average kappa value of 0.722 correlating with substantial agreement was established for intra-rater reliability,

while a kappa value 0.584 in the moderate agreement range was established for inter-rater reliability of data collection (Viera & Garrett, 2005).

In addition to collecting data via behavioral observations, a clinical tutor and an occupational therapist working with the host institution collaborated to develop pre and post profiles for the students, teacher, and parents. These profiles were surveys which collected data on the initial perceptions of the students' seating behaviors and academic performance, and any changes in these perceptions throughout the study. These surveys created by Mun-Bryce and Frank (2007a; 2007b; 2007c) were adapted from the second edition of the School Version Rating Form Profile Sheet (McCarney, 1995). Preliminary review of the surveys for question relevance was conducted by therapists and teachers, and revisions were made accordingly. To obtain further social validity information at the conclusion of the study, additional questionnaires were given to the students and a separate questionnaire was given to the teacher.

After parental permission and student assent was received, the aforementioned surveys were given to the teachers, students, and parents to assess the students' seating behaviors and academic performance. The classroom teacher then introduced the study to the subjects using a script written by authors one through three, which kept the subjects blind to study purpose. Data collectors continued observing in a consistent manner throughout the study duration, and during the five different phases of data collection only the absence or presence of the seat cushion changed. During phase I, students adjusted to the presence of data collectors; however the seat cushion was not used and only practice data collection occurred to familiarize the data collectors with the classroom and the data collection process. During phase II, no cushions were used and formal data collection began to create a baseline. In phase III, the students used the cushions and data collectors maintained consistent presence in the classroom, but data were not collected in

order to control for behavior that may have resulted from the novelty of cushion use. Phase IV served as the intervention phase during which seat cushions were used by all students and data were collected. In phase V, students chose whether or not to use the seat cushion and data were collected. Students were free to choose to use or not use the seat cushions each day during phase V, but were asked to maintain their choice for the entire language arts class period. At the conclusion of the study, the surveys completed at the beginning of the study were administered as post-measures to the students and parents. The students also completed the Student Post Questionnaire at this time. The teacher's post survey was replaced by the Teacher Post Questionnaire, which was much shorter than the initial teacher survey. Upon collecting all data, various methods were employed to analyze behavioral observations and profiles to determine the statistical significance of changes identified. An Analysis of Variance (ANOVA) was run on behavioral observation data, and paired t-tests were run on the results of the student and parent pre and post surveys.

Results

The null hypothesis of this study stated that the use of inflated seat cushions would not change the incidence of in-seat behaviors for third grade students in one classroom during a 30 minute language arts period as measured by time sampling every 20 seconds. Behaviors recorded during data collection were coded and transposed and frequencies of each behavior were calculated for each student and the class as a whole for phases II (baseline phase), IV (mandatory cushion use phase), and V (optional cushion use phase). Individual student's frequencies were graphed on a scatter plot for each behavior. Natural divisions between groups of students were identified to divide the students into three groups, according to how often they exhibited in-seat, poor posture, fidgety, noisy, and out-of-seat behaviors. These high, medium, and low frequency

groups for each behavior were then compared at phase II (baseline phase) and phase IV (mandatory cushion use phase), and the analysis completed compared groups rather than individuals in order to strengthen the results. Changes in the frequency of each behavior from baseline phase to mandatory phase were determined for the low, medium, and high groups (See Figures 1, 2, and 3). A one-way analysis of variance (ANOVA) was used to identify the significance of these changes in frequency for each behavioral category group. Although several behavioral changes were clinically evident, only the increase in fidgety behaviors for the low group was determined to be statistically significant ($F(29) = 5.773, p < 0.05$). During Phase V students had the option of using or not using the seat cushion. Students chose to use the cushions approximately 63% of the time.

Student and parent pre and post profiles were coded and analyzed to identify changes in average scores from beginning to end of the study. These profiles were coded by identifying and reversing negative statements and their corresponding scores, and using an inverse scoring strategy so that high scores consistently represented desirable behaviors. The average student scores increased by 4.36% and average parent score increased by 20.7% from beginning to end of the study. A t-test was used to determine significance of these changes. Changes in the average parent survey score were found to be significant [$t(20) = -3.214, p < 0.01$]. In the teacher post questionnaire, each student's seating behavior was rated as having improved, declined, or remained the same when using the seat cushion, in order to identify any changes perceived by the teacher. The classroom teacher reported that the seating behavior of 12.5% of the students in the study improved with use of the cushion, and 66.7% remained consistent throughout the study. She was unsure of how the seat cushion affected 20.8%, and believed that none of the students' behavior declined as a result of the seat cushion.

When asked via student post questionnaires, “Would you use the seat cushion again?” 90.9% (n=22) stated they would, and 100% of students responded that they would recommend the seat cushions to other students. The classroom teacher responded that she would have her class use the seat cushions again and would recommend their use for other teachers.

Discussion

The results of this study did not show the statistical significance needed to reject the null hypothesis of this study. While not statistically significant, trends of increased in-seat and fidgety behavior for the low and medium frequency groups, as well as decreased poor posture, noisy, and out-of-seat behaviors for the medium and high frequency groups are promising. These trends of increased in-seat behavior and decreased out-of-seat behaviors correlate with findings from a study on the use of therapy balls as a seating alternative for children with autism performed by Schilling and Schwartz (2004). In the current study, the frequency of both in-seat and fidgety behaviors increased while students were seated on seat cushions. Similarly, in a study on the use of therapy balls as seating for students with ADHD, in-seat behaviors increased for all students as measured by behavioral observations (Schilling et. al, 2003). These in-seat behaviors are noteworthy to educators and other professionals in school settings due to the potential to increase a child’s access to the curriculum and learning opportunities (Jellison, 2002; Junod et al., 2006).

Fidgety behaviors have been commonly viewed as an opposition to in-seat behavior and a distraction to attention and learning (Felmlee et al., 1985). The increase in these behaviors with the use of seat cushions for two out of three groups in this study, and with the use of therapy balls in a study by Schilling and Schwartz (2004), may initially be viewed as a negative result of seating alternatives in the classroom. However, as discussed by Schilling and Schwartz, these changes in in-seat movements may be a result of each student’s self-modulation of their sensory

input. The repeated movements allowed by the seat cushions may have helped each student to maintain his or her optimal state of arousal and enable more effective learning (Schilling & Schwartz). This modulation of sensory input may also have contributed to the decreases in two out of three groups in inappropriate seating behaviors such as being noisy, displaying poor posture, and getting out-of-seat (Schilling & Schwartz).

In addition to the trends identified from the behavioral observation data, pre and post profiles were completed by the students and parents, and post questionnaires were completed by the teacher and students. Student post profiles reflected that students perceived an increase in their own positive behaviors in the classroom. Parent post profiles demonstrated a statistically significant increase in parental perceptions of positive behaviors. At the study's conclusion, the classroom teacher reported in her post questionnaire that she perceived positive changes in 12.5% of students' seating behavior, and believed that the seat cushions produced no negative changes in seating behavior. The teacher also expressed that while each student may not have actually benefitted from the sensory aspect of the use of the seat cushion, their positive perceptions of their own seating behavior validated seat cushion use in the classroom.

Social validity findings from this study demonstrated overall approval of the seat cushions as a classroom seating alternative. All students in the third grade classroom reported that they would recommend seat cushions to other students, and a majority stated that they would use the cushions again. Studies by Schilling et. al (2003) on therapy ball seating for children with ADHD, and Schilling and Schwartz (2004) on therapy ball seating for children with autism, both used similar social validity questionnaires. Schilling et. al found that 17 out of 24 students preferred the therapy balls. Schilling and Schwartz found that all classroom staff strongly supported using therapy ball seating.

The purpose of this study was to provide evidence of the effectiveness of alternative seating methods in a typical classroom. Strong social validity data from the teacher and students supported the use of seat cushions as an alternative to traditional seating methods. Another strength of this study was its implementation in a naturally-occurring classroom environment. Successfully implementing the use of seat cushions into a typical language arts class provided a very accurate look at the many positive features and challenges of this intervention. It also granted the opportunity to see how this intervention could be successfully put into practice in a classroom. Further research should be performed to determine if results similar to or stronger than those in this study can be replicated in other classrooms. Replication of results could support the significance of the link between the increases in fidgety behavior and the students' need for movement to modulate their sensory input and state of arousal.

The short duration of this study limited the ability to observe relationships between use of inflatable cushions and long term improvement of in-seat behaviors. The small sample size from one school and geographical area limited the socioeconomic, ethnic, and gender differences, and thus prohibited generalization of the results of this study to a larger population. Although behaviors measured were defined to include concrete, observable actions, data collection remained somewhat subjective, as evidenced by initial difficulty in achieving adequate levels of inter-rater reliability amongst data collectors. Reliability testing was completed several times. It is impossible to predict the many variations of behaviors that students may exhibit in the classroom; therefore some degree of interpretation in categorizing behaviors is unavoidable, but definitions of behaviors should be altered in the future to be as specific as possible. Although changes in the frequency of behaviors were apparent, statistical significance was not achieved for most of these changes. Finally, because the profiles used were created specifically for this study,

a full degree of internal validity was not established. In the future, new profiles should be created which are less time consuming and address only the most relevant behaviors.

Conclusions and Clinical Implications

Trends of decreased noisy, poor posture, and out-of-seat behaviors for the medium and high frequency groups, and increases of in-seat and fidgety behaviors for the low and medium frequency groups were desirable, but were not found to be statistically significant. Although these results were not statistically significant, the trends discovered provide valuable information to occupational therapy clinicians and classroom teachers. These trends demonstrated that the seat cushion can be used as a classroom tool that may contribute to decreasing negative seating behaviors and increasing positive behaviors in order to increase students' ability to learn. The trends also provide clinicians with information on specific changes that they may see in students who use seat cushions, and therefore may help clinicians identify individual students who could benefit from this or a similar intervention. Additionally, the significant increase in fidgety behaviors for the low group may lead occupational therapy clinicians in schools to recognize students' need for movement and modulation of the sensory input in their environment to improve their ability to learn. Classroom teachers would benefit from a better awareness of the sensory needs of students, an available technique to address these needs in the classroom, and the types of changes that may be elicited by sensory techniques such as the use of seat cushions.

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Table 1: Seating Behavior Definitions and Hierarchy

Out of Seat: student buttocks not on seat surface, 4 chair legs not on floor.
In-Seat (Hierarchy:Top to Bottom)
In-Seat: Buttocks on seat surface, 4 chair legs in contact with floor.
Noisy: Hums, taps, burps, talks to others without permission, interrupts others.
Fidgety: Playing with objects, hair; excessive movement in seat, squirms.
Poor Posture: Sliding out of chair, head on desk or forearm, or held up by hand.

Figure 1: Baseline to Mandatory Changes for Low Frequency Group

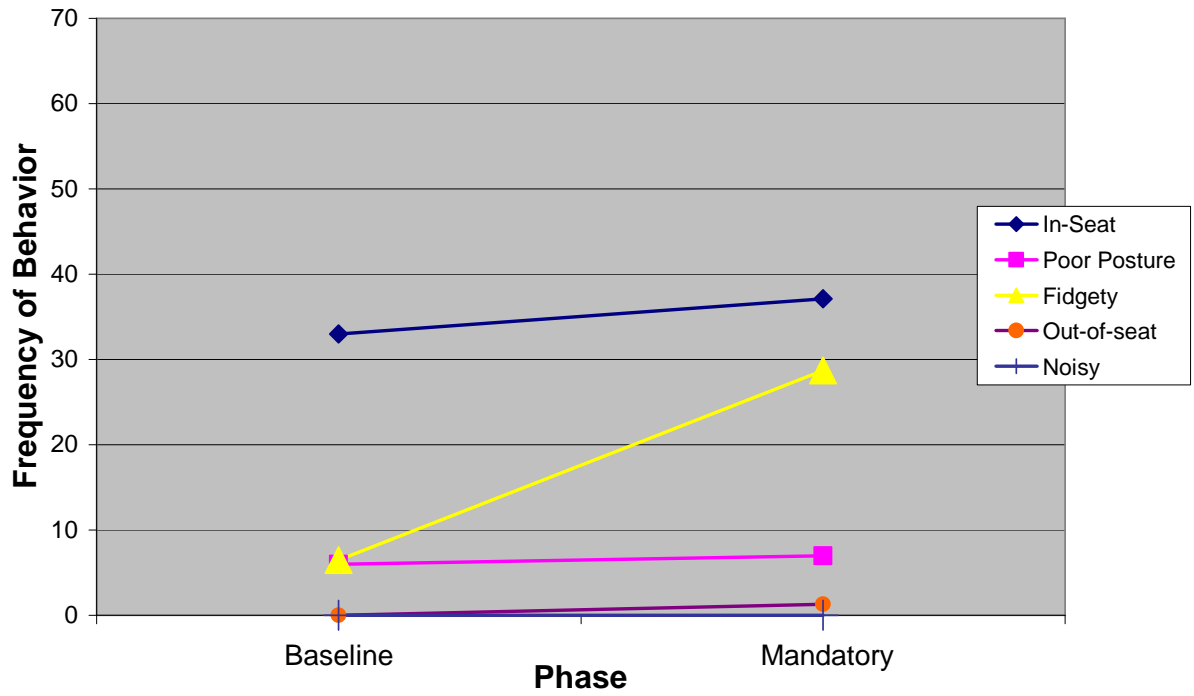


Figure 2: Baseline to Mandatory Changes for Medium Frequency Group

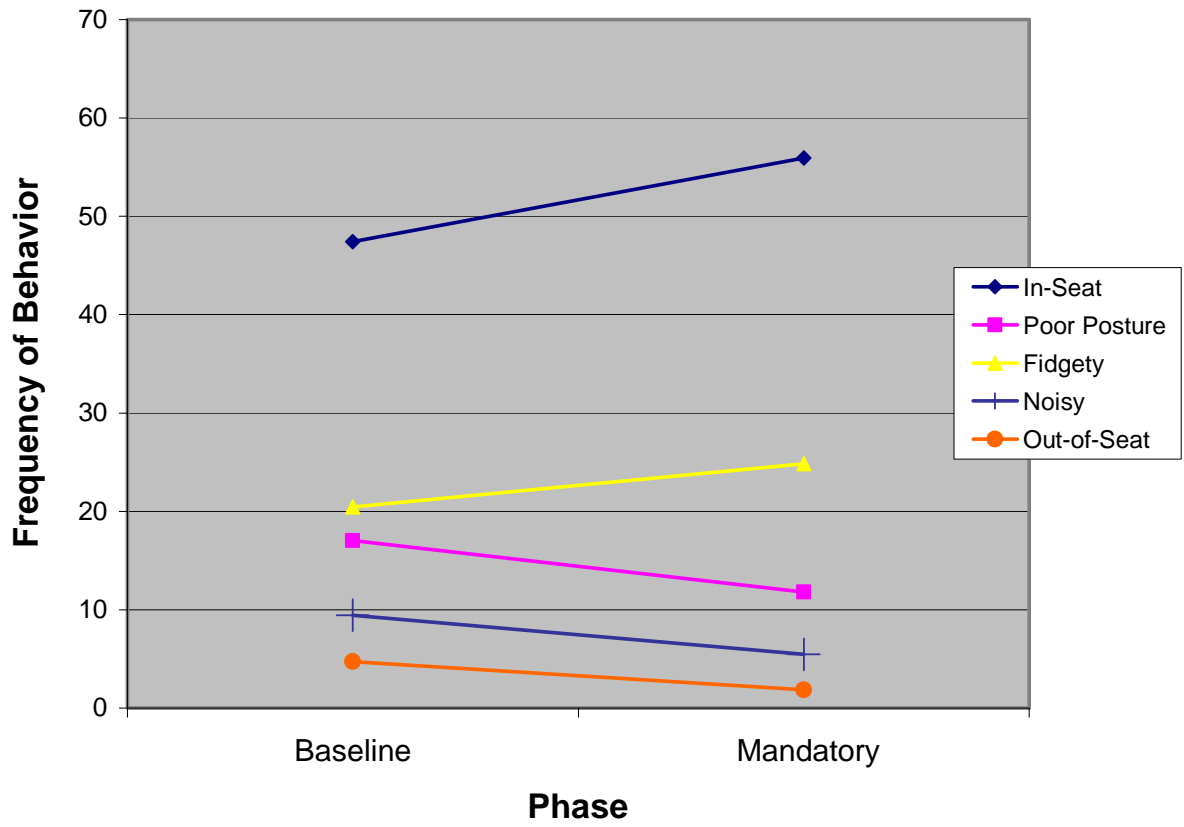
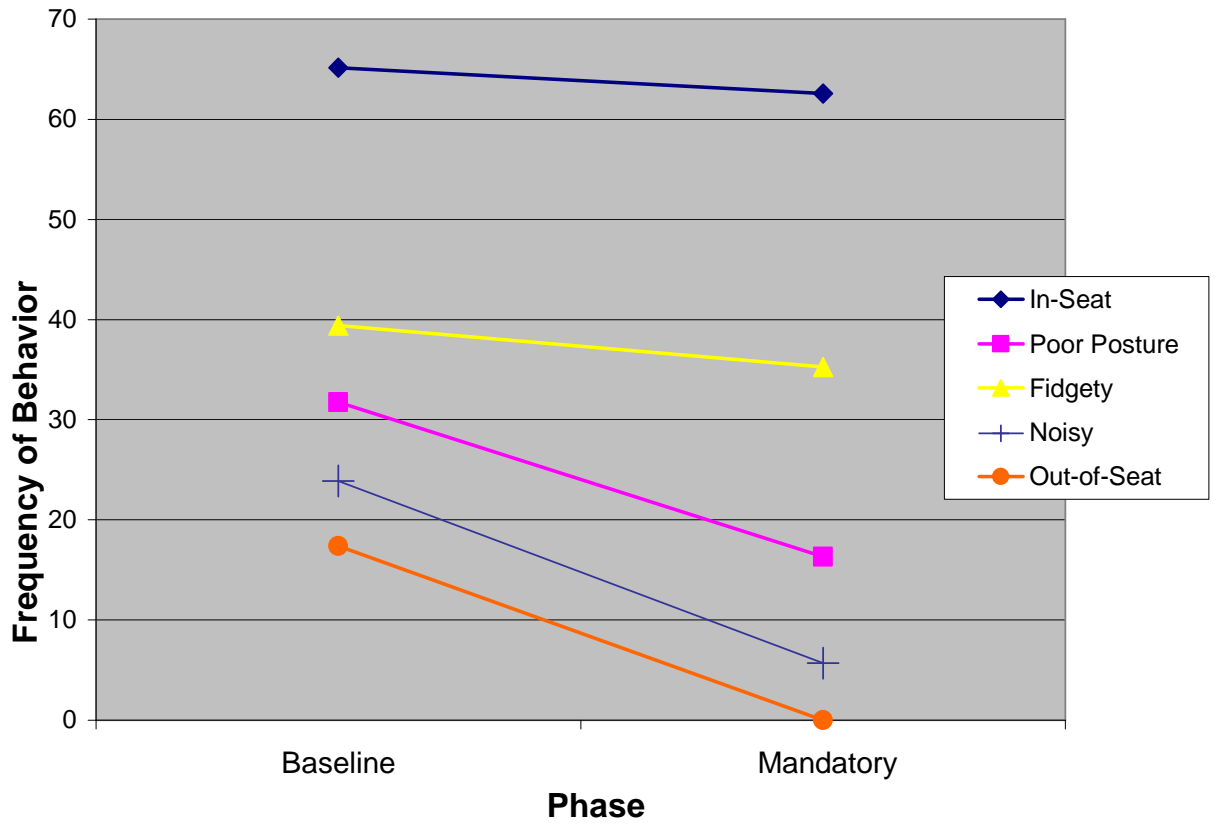


Figure 3: Baseline to Mandatory Changes for High Frequency Group



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