An Experimental Evaluation of the Introduction of Bodyfurn Chairs on On-Task and Disruptive Behaviour in the Classroom.

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Abstract

Research has shown that academic achievement is positively correlated with improved employment opportunities, social skills, well-being, standard of living, and overall quality of life. One variable that has been shown to significantly influence academic achievement are the seats that are used by students in the classroom. The aim of the current study was to investigate the impact that Bodyfurn chairs had on academic achievement by evaluating the effect that they had on-task and disruptive behaviour of students compared to the regular classroom chairs. It was hypothesized that Bodyfurn chairs would increase the on-task behaviour and decrease disruptive behaviours of students. The study included three separate groups of five primary school students and implemented a multiple baseline design. All three groups used the regular classroom chairs during the baseline phase and Bodyfurn chairs were introduced in a staggered fashion once stable baselines were established. The results showed that the introduction of Bodyfurn chairs resulted in immediate and noticeable increases in on-task behaviour for two of the groups, with on-task behaviour increasing by 27.4% and 15.7% relative to the regular classroom chairs, while a ceiling effect prevented any noticeable experimental effect from occurring in the third group. The results also showed marked decreases in disruptive behaviour across all three groups when Bodyfurn chairs were used with occurrences of disruptive behaviour decreasing by 49.1%, 47.8%, and 59.5% compared to the regular classroom chairs. The findings of this study suggest that Bodyfurn chairs could improve academic achievement of students.

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Literature Review

Importance of Academic Achievement

Formal education is an important part of human development that significantly contributes to life satisfaction (Ng et al., 2015), well-being (Lv et al., 2016) and overall quality of life (Edgerton et al., 2012). Academic achievement/attainment is positively correlated with improved employment opportunities, social skills, knowledge, physical and emotional well-being, standard of living, and personal relationships (Edgerton et al., 2012). Lv et al. (2016) showed that academic achievement has a significant positive correlation with positive affect (i.e., positive emotions) and a significant negative correlation with negative affect (i.e., negative emotions). Positive affect is associated with increased joy, pleasure, happiness, well-being, and physical health (Watson et al., 1988; Watson & Naragon, 2009), while negative affect is associated with increased guilt, shame, distress, anxiety, irritability, fear, and depressive symptoms (Watson et al., 1988). This research suggests that increased academic achievement can significantly improve well-being and quality of life and that tools/techniques that can be used to improve academic achievement are of great importance.

Predictors of Academic Achievement

While academic achievement can be measured directly in the form of test scores and academic progression, there are also many different variables that can be used to reliably predict academic achievement.

Academic Engagement

One of the most common and accepted predictors of academic achievement is the amount of time students are actively engaged in learning (i.e., academic engaged time) (Gettinger, 1986; Gettinger & Walter, 2012; Rosenshine & Berliner, 1978). Academic engaged time, also referred to as time-on-task, could be defined as the portion of instructional time that students spend directly involved in learning activities (Johns et al., 2008).

According to Walker and Severson (1992) academic engaged time includes three different components: the student is attending to the material and the task, the student is making appropriate motor responses (e.g., writing), and the student is asking for assistance in an acceptable manner.

Lei et al. (2018) conducted a meta-analysis, which included 69 independent studies and a total of 196,473 participants, that analysed the relationship between student engagement and academic achievement. The results of the meta-analysis showed a significant, moderately strong positive relationship between student engagement and academic achievement (Lei et al., 2018). A separate meta-analysis that included 58 articles also showed that student engagement had a significant positive relationship with academic achievement (Chang et al., 2016).

Interestingly both studies broke down student engagement into three components: behavioural engagement (i.e., students' levels of participation in their learning, including their involvement in learning activities), cognitive engagement (i.e., cognitive and self-regulation strategies used by students in their learning processes) and emotional engagement (i.e., students' emotional reactions to teachers, students, learning, and school in general). Both studies found that behavioural engagement had the largest effect size on academic achievement (Chang et al., 2016; Lei et al., 2018). Lei et al. (2018) showed that behavioural engagement alone had a greater effect on academic achievement than overall engagement (i.e., behavioural, cognitive, and emotional engagement), with behavioural engagement having an effect size of r =.350 (p < .001) compared to overall engagement that had an effect size of r =.269 (p < .001). These findings suggest that behavioural engagement is the most accurate form of student engagement to measure the academic achievement of students.

Disruptive Behaviour

Another common factor used to predict academic achievement in classrooms is disruptive behaviour. Disruptive behaviour could be defined as any behaviour that causes interference to teaching or learning in the classroom (Harrell, 2009). Examples could include talking out of turn (i.e., talking when not appropriate or interrupting others), disturbing or hindering other students, fighting, or verbal/physical abuse or threats (Arbuckle & Little, 2004; Harrell, 2009). Evidence suggests that disruptive behaviour is negatively associated with the academic performance of not only the students who display those disruptive behaviours (Finn et al., 1995; Kremer et al., 2016) but also the classmates of students who display disruptive behaviours (Blank & Shavit, 2016; Kristoffersen et al., 2015).

Finn et al. (1995) investigated the effect of disruptive behaviour on comprehensive test scores and showed significant negative correlations between disruptive behaviour and test scores of basic skills in reading (r = -.21, p < .001), language (r = -.28, p < .001), mathematics (r = -.29, p < .001), science (r = -.18 p < .001), and social studies (r = .20, p < .001).

Blank and Shavit (2016) studied the effects of disruptive behaviour on Hebrew test scores of 2422 Israeli students. The results of the study showed that disruptive behaviour in the classroom was negatively correlated with mean classroom achievement (r = -.293, p < .01). These results suggest that disruptive behaviour in the classroom can disrupt learning and significantly lower the academic achievement of the entire class.

Impact of Seats on Academic Achievement

Seats are a regular part of most classrooms and the available literature seems to suggest different types of seats can have a significant impact on the academic achievement of students.

Stapp (2018) investigated the impact of two different types of seats on time on-task and time off-task of students. The study used a removed-treatment group design (i.e., treatment condition was used first, followed by the baseline condition) and included 25 students. The types of seats used were the regular classroom chairs (i.e., existing chairs in the classroom) and the regular classroom chairs with disc 'o' sit cushions that are designed to be placed on traditional chairs. A repeated measures ANOVA was conducted to compare the average time on-task and time off-task when using a disc 'o' sit cushion and a regular chair. The results showed that there was a significant increase in average time on-task at the $p < .05$ level for the two conditions $F(1,24) = 15.94$, $p = .0005$. The mean score for time on-task in minutes with the disc 'o' sit cushion ($M = 19.84$, $SD = 2.27$) was significantly larger than the average time on-task with the regular chair ($M = 16.4$, $SE = 3.67$). Eta-squared (η^2) was calculated to measure effect size. The results showed that $\eta^2 = .25$, indicating that 25% of all the variability in the analysis came from the effect of the treatment. Results of the test also showed that there was a significant decrease in average time off-task at the $p < .05$ level for the two conditions $F(1,24) = 16.31$, $p = .0004$. The mean time off-task with the disc 'o' sit cushions ($M = 7.8$, $SD = 5.07$) was significantly less than the average time off-task with the regular chairs ($M = 12.65$, $SD = 6.58$). The results also showed an effect size of $\eta^2 = .15$, indicating that 15% of all the variability came from the treatment effect. Additionally, a classroom seat rating scale was administered to all 25 participants to measure students' perceptions of the seats. Results showed that 76% of the students agreed or strongly agreed that they can participate more actively while using disc 'o' sit cushions (i.e., compared to the traditional seats that were offered) and 68% percent of students agreed or strongly agreed that they can concentrate better/more easily when using disc 'o' sit cushions (Stapp, 2018). The results of this study suggest that different types of seats can significantly impact student engaged academic time, and hence have a significant impact on academic achievement.

Matin Sadr et al. (2017) investigated the effect of three alternative types of classroom seats including regular classroom chairs, therapy balls, and air cushions, on students' classroom behaviour. 15 students with autism participated in this A-B-A-C multiple treatments study where students' sitting times and on-task behaviour were recorded by momentary time sampling across four phases: regular classroom chairs in phase A, air cushions in phase B, and therapy balls in phase C. The results showed that there was a significant increase ($p < .001$) in mean sitting time (i.e., in-seat behaviour) between regular chairs ($M = 43.6$, $SD = 17.7$) and therapy balls ($M = 51.2$, $SD = 13.6$). Out-of-seat behaviour is often considered to be a disruptive behaviour that disrupts learning in the classroom (Patterson, 2009; Sun & Shek, 2012) and decreases in out-of-seat time (i.e., increases in in-seat time) could suggest a decrease in disruptive behaviour in the classroom. The results of Matin Sadr et al. (2017) suggest that different types of seats can reduce disruptive behaviours in the classroom and hence potentially have a significant impact on academic achievement.

Mead et al. (2016) investigated the effect of two different seats, stability balls and regular classroom chairs, on the academic achievement of a group of third grade students. Academic achievement was measured by two different tests; the Minnesota Comprehensive Assessments (MCAs) which is a state achievement test that assesses mathematics, reading, and science, and the Measures of Academic Progress (MAP) which is a standardized test that assesses reading, mathematics, and language. An independent group pre-test post-test design was used. Pre-test MCA and MAP results showed no significant difference in test scores between the two groups. However, post-test MCA and MAP scores showed that there was a significant increase ($p = .016$) in test scores when stability balls ($M = 11.6$, $SD = 6.9$) were used compared to students that sat on regular chairs ($M = 5.5$, $SD = 7.0$). Cohen's d was calculated between the stability ball and regular chair groups, with the results finding a large effect size $d = .88$, suggesting that seat type had a large effect on academic achievement. The

results of Mead et al. (2016) strongly indicate that chairs in the classroom can have a large and significant impact on the academic achievement of students.

Fedewa and Erwin (2011) investigated the effects of stability balls and regular classroom chairs on in-seat and on-task behaviour (i.e., time spent seated and time on-task) of students. A total of 8 participants were included in the study and a single-subject A–B continuous time-series design was used. Regular classroom chairs were used during phase A and stability balls were used during phase B. The results revealed that students were seated 45% of the time when using the regular chairs, while students spent 94% of the time seated when using stability balls. Students were on-task only 10% of the time when using regular chairs compared to spending 80% of the time on-task when using stability balls. The results of Fedewa and Erwin (2011) demonstrate that different types of seats can have a marked effect on student engagement and the disruptive behaviours (i.e., out-of-seat behaviours) of students in the classroom, and hence influence the academic achievement of these students.

Seat Variables that Impact Academic Achievement

Although there is a growing amount of evidence that seems to strongly indicate that different seats can have significant effects on academic achievement in the classroom, in order to make progress and improvements to the academic achievement of students we need to understand what seat variables influence the academic achievement of students. The current research seems to suggest that there are several factors that can significantly influence the impact that seats have on the academic achievement of students in the classroom.

Pain and Discomfort

One factor that could significantly influence the impact of seats on academic achievement is pain/discomfort. Research has shown that inadequate or mismatched seats (i.e., mismatched to student physical dimensions) is significantly related to increased neck, back and musculoskeletal pain, musculoskeletal disorders, poor posture, and discomfort

(Assunção et al., 2013; Saes et al., 2015; Valikhani at al., 2015). Research has shown that pain is significantly negatively associated with the academic achievement of students (Grimby-Ekman et al., 2018; Kosola et al., 2017). This suggests that seats that reduce the pain and increase comfort of students would lead to increased academic achievement.

Blood Flow and Circulation

Another factor that could significantly influence the impact of seats on academic achievement is blood flow/circulation. Sitting has been shown to significantly decrease lower limb blood flow by up to 77% (Antle et al., 2018) with prolonged sitting being associated with increased pain and discomfort (Antle et al., 2018; Benzo et al., 2018). Fidgeting has been shown to increase blood flow in lower limbs when seated (Morishima et al., 2016) suggesting fidgeting could be a response to reduced blood flow caused by prolonged sitting (Hagger-Johnson et al., 2016; Morishima et al., 2016). Research has shown that fidgeting is associated with decreased attention, and hence decreased academic achievement and retention of lecture material (Farley et al., 2013). The available literature seems to suggest that pressure/weight distribution, posture, and the mismatch of furniture dimensions such as seat height can all contribute to the restriction of blood flow to the lower limbs while sitting (Łastowiecka-Moras, 2017; Moes, 2000; Pheasant & Haslegrave, 2005). Seats that promote good posture, weight distribution, and match the physical measurements of the student will reduce restricted blood flow and fidgeting and in turn increase academic achievement of students in the classroom.

Ergonomic Chairs

One of the most popular tools used to aid academic achievement and improve the health of students are ergonomic chairs. Ergonomic chairs are chairs that are designed to improve comfort, promote good posture, reduce pain, and promote healthy blood flow. Ergonomic chairs are usually adjustable and flexible to enable the chair to match the

measurements and body shape of the student. There seems to be no end of online articles, websites and companies that claim that ergonomically designed furniture will improve the academic performance/achievement of students. However, there is a distinct lack of empirical evidence to support these claims.

As discussed earlier, the evidence suggests that different types of seats can affect academic achievement. Research also suggests that furniture that promotes good posture, reduces discomfort, and promotes blood flow will likely reduce pain and fidgeting, resulting in increased academic engagement and academic achievement. Despite this solid theoretical framework that suggests ergonomically designed chairs will result in improved academic achievement, there is limited research that directly compares the impact of ergonomic chairs and traditional chairs on academic achievement and the limited findings appear to be inconclusive.

Wingrat (2013) showed that an ergonomically designed chair did not significantly improve on-task behaviour, math scores or handwriting legibility of students when compared to appropriately sized traditional furniture. However, the results did show that the ergonomic chair significantly impacted sitting behaviours, with students who sat in ergonomic chairs displaying more positive sitting behaviours (i.e., better posture) (Wingrat, 2013) which has been shown to have a significant positive correlation with on-task behaviour (Wingrat & Exner, 2005). Knight and Noyes (1999) showed a small but significant improvement in on-task time when an ergonomic chair was used, while Wingrat and Exner (2005) showed that a chair described as ‘ergonomic’ resulted in improvements in time on-task and sitting behaviours, however very little information was provided about this chair besides it’s measurements.

One thing to remember is that it is important not to generalize these results. Just because one type of ergonomic chair improves the academic achievement of students it does

not mean that other ergonomic chair designs and brands will and vice-versa. Products should be tested on their own merit and sweeping generalisations like ‘ergonomic furniture will improve academic performance’, which have become increasingly common, could be misleading and should be avoided. Schools and teachers need to know that the learning tools that they are investing in are evidence based and worthwhile.

Bodyfurn Chairs

Furnware is a New Zealand based company that is one of the leading international furniture designers and manufacturers, specialising in educational furniture for over 60 years (Furnware, n.d.-f). In 2003 Furnware set out to develop a well-designed ergonomic chair that could enhance concentration and learning in the classroom (Furnware, n.d.-a, n.d.-e). Furnware travelled across New Zealand and collected data on the age, year level, gender, ethnicity, height, and weight of 19,000 New Zealand school pupils to inform furniture size requirements for the pupils in every New Zealand classroom (Kane at al., 2006). The research also revealed that a significant proportion of New Zealand students were being seated in mismatched furniture with results finding that 96% of students in three New Zealand secondary schools were seated in furniture that was unsuitable for their body size (Kane et al., 2006). These findings suggest that there is a great need for adequately sized and adjustable furniture in New Zealand schools that can fit many different body sizes and shapes of New Zealand students.

While regular classroom chairs inhibit movement and restrict blood flow resulting in unproductive fidgeting and reduced time on-task, Bodyfurn chairs are designed to promote healthy blood flow and move dynamically with the user (Furnware, n.d.-a). Bodyfurn chairs are designed to move with the student by having an independently pivoting seat and backrest, which allows students to sit forward or lean back in comfort while supporting the body and improving posture (Furnware, n.d.-a, n.d.-e). Bodyfurn chairs can also be resized to correctly

match the height of the student ensuring their feet are placed firmly on the floor for optimal comfort and posture (Furnware, n.d.-a). The hypothesis behind this Bodyfurn design is that it will reduce fidgeting and off-task behaviour and in turn enhance learning in the classroom (Furnware, n.d.-d). There is plenty of social validity data and anecdotal evidence that supports this hypothesis with numerous teachers and principals stating that the introduction of Bodyfurn chairs has resulted in improved academic engagement, time on-task, quality of work, in-seat time, posture, comfort, student satisfaction, safety, concentration and reduced disruptive behaviours (Furnware, n.d.-g, n.d.-h). However, there is a need for objective empirical evidence to make any substantial claims/conclusions about the impact of Bodyfurn chairs.

The Wilf Malcolm Institute of Educational Research (2006) conducted an exploratory study on the effect that Bodyfurn chairs had on movement (i.e., leaning, moving, turning) and off-task behaviour (i.e., fidgeting/distracted behaviour) of students. The study used a comparative approach by using video to record the number of instances and duration of movement and off-task behaviour during sessions with Bodyfurn chairs and sessions with existing classroom chairs across three groups. All three groups showed decreased movement during sessions where students used Bodyfurn chairs. Two groups showed reduced fidgeting/distracted behaviour with Bodyfurn chairs and one group showed increased fidgeting/distracted behaviour in sessions with Bodyfurn chairs. Despite the study seemingly demonstrating a link between Bodyfurn chairs and a decrease in movement there were many limitations in the study that restrict the validity of the data. These limitations include; the camera angles used to record the Bodyfurn and existing furniture were different, there were approximately twice as many students in the classroom when Bodyfurn chairs were being used, the types of classroom activities students were engaging in were different during Bodyfurn and existing furniture conditions, and finally the number of sessions recorded for

Bodyfurn and existing furniture were different for each group and also greatly limited (i.e. only a few sessions for each group). The first group had two sessions with existing furniture and one session with Bodyfurn, the second group had only one session with existing furniture and four sessions with Bodyfurn and the third group also had just one session with existing furniture and two with Bodyfurn. Despite the findings of the study suggesting that Bodyfurn chairs reduce movement and potentially off-task behaviour the limitations of this study restrict the ability to make any valid conclusions about these findings. To be able to draw any significant conclusions about the effect of Bodyfurn furniture, there will need to be more robust research and a more valid and reliable approach to collecting data.

Summary

As discussed, academic achievement/attainment improves employment opportunities, social skills, knowledge, physical and emotional well-being, life satisfaction, standard of living, positive affect, personal relationships, and overall quality of life. Great value should be placed on tools and techniques that can significantly improve academic achievement. There are many predictors of academic achievement, however two of the most reliable and accepted predictors are academic engaged time (i.e., time on-task) and disruptive behaviour.

Research has shown that seats can significantly impact the academic achievement of students in the classroom. There are numerous factors that influence the impact of chairs on academic achievement including the mismatch between furniture and the users body dimensions, restriction of movement/flexibility, weight distribution and a design that supports good posture. These factors can influence pain, discomfort, attention, engagement, and disruptive behaviours which are associated with academic achievement.

The design and production of ergonomic furniture has become a big industry to help improve comfort, promote good posture, reduce pain, improve health, and promote healthy blood flow. There have been many claims made about the impact that ergonomic furniture

has on improving the academic achievement/performance of its users in the classroom. However, there is very limited research that directly compares ergonomically designed chairs and other traditional classroom chairs and the findings of these studies have been inconclusive.

Bodyfurn chairs are one of the most used ergonomic chairs in New Zealand schools and are designed to improve the comfort, posture, and blood flow of users. Despite an abundance of social validity and anecdotal evidence that supports the claim that Bodyfurn chairs improve academic performance, there is still a lack of valid empirical evidence to support these claims.

Current Study

The aim of the current study was to examine the effects of Bodyfurn chairs on the on-task and disruptive behaviour of students in the classroom. It was hypothesized that Bodyfurn chairs would increase on-task behaviour and decrease disruptive behaviours in the classroom when compared to the regular classroom chairs.

Method

Participants

A total of 15 students and three teachers participated in the study, with all participants belonging to the same class at a Bay of Plenty primary school. The students were in years four to six and aged between 9 and 11 years old.

School

The school that participated in the study was selected because they expressed great interest in being a part of the study, had adaptable classes (i.e., large classes with multiple teachers), and were willing to accommodate and make changes to fit in with the research requirements. Several different classes were considered to be part of the study but the class

that was eventually chosen was deemed the best choice because the teachers showed enthusiasm in taking part in the study, they had a flexible schedule/timetable, and they had the best classroom design/facilities (i.e., rooms available) to conduct the research in. The class included three teachers and approximately 70 students.

Groups of Participants

The study included three separate groups of five students (i.e., Groups A, B, and C). The main reason for choosing five students per group was the limited availability of resources (i.e., Bodyfurn chairs available) and the difficulty in observing a larger number of students across the classroom (i.e., data was collected remotely and only allowed for a small space to be observed at one time by the video camera). Each group of students had a different teacher who remained with them throughout the study. Each group also had a different school subject which remained constant throughout the study. These subjects were maths, writing and reading for Groups A, B and C, respectively.

Participant Selection

Due to the small sample size, participants were selected using purposive sampling (i.e., when the sample of participants is selected by the judgement of the researchers that can be logically assumed to be representative of the population). The selection criteria used to select participants included good attendance and average/middling performance in the target behaviours relative to the class population (i.e., students that had an average level of on-task and disruptive behaviour).

Good attendance was included in the selection criteria to minimize participant absences which could significantly impact the results of the study given the small sample size. The purpose of selecting participants with middling/average performance in the target behaviours was to select a representative sample from the classroom and to try and avoid ceiling or floor effects which is at an increased risk for small groups.

Each of the three teachers then selected five students for their group that best fit the selection criteria based on their own experience and knowledge of the students.

Participant Recruitment

Information sheets that explained what would be involved in that study and what their role would be in the study were provided to teachers (Appendix A), students (Appendix B) and the parents/guardians of the students (Appendix C). Consent forms were given to teachers (Appendix D) while the students were given assent forms (Appendix E) that they were required to sign and return to the researcher before they could be included in the study. Parents/guardians of the students were given withholding consent forms (Appendix F) which gave them the option to withhold consent (i.e., prevent their student from participating in the study). All parents/guardians of students were contacted by either email or phone to check that they had received the information sheets and withholding consent forms.

Materials

Materials used in the study included a video camera and tripod, laptop, external hard drive, Bodyfurn chairs, regular classroom chairs, worktable, and data collection sheets.

Electronic Equipment

All data was collected remotely by recording sessions with a Sony HDR-CX405 Handycam on an Inca I3530D 3-way tripod. Collecting behavioural data remotely allowed for a more accurate replication of the regular/normal classroom setting (i.e., having a researcher present in the room could influence/alter the students and teacher's behaviour). Secondly, observing all five students' behaviour simultaneously in person is very difficult for a single researcher to do accurately, so having recordings of the sessions meant that all five students' behaviour could be observed at the same time. And finally, because the study took place during the COVID-19 pandemic it was recommended to practice social distancing where possible. All video recordings were later transferred to a password protected computer

for analysis and then later transferred to an external hard drive that was kept in a secure location for storage.

Furniture

The worktable used by the participants in the study was Furnware's flower table, a large round table with six concave indentations that allow for six people to sit around the table with adequate space. The flower table used in the study was a size five and had a height of 660mm and a diameter of 1276mm (Furnware, n.d.-c). It should be noted that although the table was designed by Furnware it was not supplied by Furnware specifically for this study. The students had been using this table prior to the study with their regular classroom chairs and it was part of the normal classroom setting. An image of the type of table used in the study can be seen below in figure 1.

Figure 1

Furnware Flower Table with Bodyfurn Chairs

Note. From Furnware (n.d.-c).

A total of five Bodyfurn sled chairs were used in the study and supplied by Furnware. The size and measurements of the chairs were determined by Furnware as the appropriate sizes after being given the table height that the students would be using. The Bodyfurn sled

chair has an independently moving polypropylene seat and back connected to a high tensile steel frame with sled shaped legs that form the base (Furnware, n.d.-b). All the Bodyfurn chairs were size five and had a seat height of 410mm (i.e., the seat of the chair was 410mm off the ground) and the seat size was 350mm wide (i.e., side to side) by 380mm deep (i.e., front to back) (Furnware, n.d.-b). An image of the type of Bodyfurn sled chair that was used in the study can be seen below in figure 2.

Figure 2

Bodyfurn Sled Chair

Note. From Furnware (n.d.-b).

The regular classroom chairs that were used in the study were supplied by the school and were the chairs that the students normally used in the classroom. The regular chairs were a solid polypropylene chair without any independently moveable or adjustable parts. The seat of the regular classroom chairs was 430mm off the floor while the chair leg width was 450mm and 520mm deep (Lethaby, 2020). An image of the type of chair the was used for the regular classroom chairs can be seen below in figure 3.

Figure 3

Regular Classroom Chair

Note. From Lethaby (2020).

Data Collection Sheets

Data collection sheets were developed by the researchers specifically for this study. Each data collection sheet had two tables, one for recording on-task behaviour and one for recording disruptive behaviour. Each table had eight different columns which included interval, starting time of each interval, a column for each of the five students and a total tally column. Each table included a total of 50 rows for 50 intervals (Appendix G).

Design

The study implemented a multiple baseline across groups design. All groups started in the baseline phase where they used the regular classroom chairs and then the intervention (i.e., Bodyfurn chairs) was introduced in a staggered fashion after stable baselines were established. This design approach was used so that any potential experimental effects from the intervention could be replicated three times and demonstrate a functional relationship between the chairs used by the students and the target behaviours.

Independent Variables

The independent variable of the study were the chairs being used by the participants, the regular classroom chairs and Bodyfurn chairs.

Dependent Variables

The dependent variables in the study were on-task behaviour and disruptive behaviour.

On-Task Behaviour. On-task behaviour was defined as behaviour where students are actively engaged in learning activities. This included attending to the task and/or task material, making appropriate motor responses (e.g., writing) and asking for assistance or asking appropriate questions that were relevant to the task.

For a student to be marked as on-task there needed to be direct evidence that the student was attending to or engaged in the task either visually (e.g., looking at teacher, speaker, or task material), verbally (e.g., asking or answering question) or physically (e.g., writing). The only exception to this rule was when the teacher gave instructions to the contrary (e.g., “sit there and wait quietly” or “can you go and close that window please”). If the student was following the instructions given by the teacher then the student was marked as on-task.

Disruptive Behaviour. Disruptive behaviour was defined as any non-task related behaviour that causes interference to the teaching of the teacher or on-task behaviour of other students. It was the function (i.e., disruption) of the behaviour and not the behaviour itself that was being recorded. If the student was not already on-task (i.e., they are off task) and then their attention was diverted because of the disruptive behaviour (i.e., they look at the disruptive behaviour), then that was NOT recorded as a disruptive behaviour.

Disruptive behaviours could include a wide range of different behaviours from fighting/tantrums to tapping their foot on the floor or fidgeting. For example, if a student

stops writing in their book and looks up at another student tapping their pencil on the table, the pencil tapping would qualify as a disruptive behaviour. Regardless if a disruptive behaviour disrupted one student or multiple students, it was still only recorded as one occurrence of disruptive behaviour.

Asking questions appropriate to the task was not considered disruptive behaviour even if it attracted the attention of another student. For a question to be appropriate it not only needed to be relevant to the task but also needed to be asked in an appropriate manner, as determined by the classroom norms and teacher's judgement. For example, it was considered acceptable to call out an answer or question without putting your hand up first, but not when someone else was talking. Making comments about the task such as 'this is easy' or 'finished!' were not considered questions and could be recorded as disruptive behaviour.

Procedure

Setting

The research took place in a break-out room**,** a side room adjoined to the main classroom**,** that was used regularly by the teachers to teach smaller groups of children. The room was set up with the worktable in the centre and the five student chairs and one teacher's chair placed evenly around the table. The video camera was set up on the tripod and placed in a corner of the room. The video camera was always placed in the same corner.

Sessions

A weekly schedule was developed with the teachers where the researcher would come in and have a data collection session with each group several days a week. Class sessions generally lasted around 30 to 40 minutes and mostly took place in the morning between 9am and noon. All materials (i.e., furniture and recording equipment) were set up and turned on before each session and then reset before the next group came in for their session.

Behavioural Data Collection

Behavioural data collection only began once all the participants were seated and the teacher began the lesson (i.e., the class had officially begun) as judged by the researcher. The next 25 minutes from the start of the lesson was the observation period during which behavioural data was recorded using the data collection sheets.

On-task behaviour was recorded using momentary time sampling at 30-second intervals, with every participant being marked as either on-task or off-task at the end of each 30 second interval. There was a total of 50 30-second intervals over the 25-minute observation period. If a student was not present at the 30 second mark of an interval (e.g., they went to the bathroom) they were marked as absent.

Disruptive behaviour was recorded using event recording with each occurrence of disruptive behaviour being tallied over the observation period. Disruptive behaviours were tallied in the column of the student that exhibited that behaviour and in the interval in which it occurred. A student would be marked as absent only if they were absent for the entire interval (i.e., entire 30 seconds).

Schedule

Baseline data was collected for each group over the first four sessions after which the group with the most stable data for both on-task and disruptive was moved into the intervention phase (i.e., Group A). Once Group A had three consecutive stable sessions during the intervention phase then the next most stable group was moved into the intervention phase (i.e., Group B). The same pattern was used before the third group (i.e., Group C) was moved into the intervention phase. Once Group C had three stable data points for both target behaviours, data collection was concluded. In total each group had 13 sessions with Group A having four baseline sessions and nine intervention session, Group B had seven baseline

sessions and six intervention sessions, and Group C had 10 baseline sessions and three intervention sessions.

Data Analysis

On-Task Behaviour

On-task behaviour was converted to a percentage (i.e., percentage of intervals where the student was on-task) by dividing the number of intervals the student was on-task by the total number of intervals, multiplied by 100. For example, if the student was on-task for 40 out of 50 intervals then the on-task percentage would be calculated using the following calculation: (40 ÷ 50) × 100 = 80%. Group on-task percentage was calculated by adding together the total on-task intervals for all students in the group and dividing it by the total number of intervals, e.g., (200 ÷ 250) × 100 = 80%.

Disruptive Behaviour

The total number of disruptive behaviour occurrences were tallied for each student and then added together to produce the group total. Because disruptive behaviour was recorded by total number of occurrences and not a percentage, totals needed to be adjusted whenever a student was absent to allow for comparisons between sessions (i.e., if one student was absent for several intervals of the session, this would mean that their total number of behaviour occurrences was collected from a smaller observation window and hence would not allow for accurate comparison between sessions).

When a student was absent for one or more intervals (e.g., they went to the bathroom) their individual total number of disruptive behaviour occurrences was adjusted by multiplying the average number of disruptive behaviour occurrences per interval (i.e., number of disruptive behaviour occurrences ÷ number of intervals present) by the total number of intervals in the session (i.e., 50). For example, if a student was present for 45 intervals during the session and during those 45 intervals, they exhibited 9 occurrences of disruptive

behaviour then their individual total would be adjusted using the following calculation: (9 ÷ 45) × 50 = 10.

When one student was absent for the entire session the group total, represented by the four students that were present, was adjusted by multiplying the group total by 5/4 (i.e., 1.25). For example, if there were only four students present during a session and the total number of disruptive behaviour occurrences for these four students was 20, then the group total would be adjusted using the following calculation: 20 × 1.25 = 25.

Visual Analysis

Group on-task percentage and disruptive behaviour occurrences were graphed for each session. Visual analysis of the graphed data was conducted by comparing differences in the trend, level, and variability of data between the baseline and intervention phases of each group.

Descriptive Statistics

Mean group on-task percentage and disruptive behaviour occurrences per session were calculated for baseline and intervention phases for each group. The difference in means between baseline and intervention conditions was expressed in terms of the absolute difference (i.e., exact numerical change between two values) and the relative change (i.e., the ratio by which the initial value changed in terms of a percentage).

The absolute difference was calculated by subtracting the initial value (i.e., baseline mean) from the final value (i.e., intervention mean). The relative difference was calculated by dividing the absolute difference by the initial value, multiplied by 100. For example, if the mean number of disruptive behaviour occurrences per session was 30 during the baseline phase and 20 during the intervention phase, the absolute change would be 20 – 30 = -10 (i.e., the mean number of disruptive behaviour occurrences was lower by 10 occurrences per session during the intervention phase) and the relative change would be (-10 ÷ 20) × 100 = -

50% (i.e., the mean number of disruptive behaviour occurrences decreased by 50% from the baseline phase to the intervention phase).

Effect Sizes

Effect sizes were calculated using Tau-U, which uses the overlap of data between two phases (e.g., baseline and intervention) to calculate a coefficient that gives an indication of the size of an experimental effect (Parker et al., 2011). Tau-U values less than 0.65 indicate a small effect, values from 0.66 to 0.92 indicates a medium to high effect, and values from 0.93 to 1 indicate a strong effect (Riden et al., 2020).

Social Validity Data

Once behavioural data collection had concluded, social validity data was collected in the form of informal discussions with each of the groups. The informal discussions were led by the researcher and included discussing which chairs the students preferred to sit in and why, and if the students felt that the Bodyfurn chairs made it easier to do their schoolwork.

Reliability Data

The reliability of data collection was assessed through interobserver agreement (IOA). A second observer, another Master of Applied Psychology in Behaviour Analysis student from the University of Waikato, completed data collection for 9 out of the 39 sessions (i.e., 23% of sessions). This student was given access to video of three randomly selected sessions from each group (i.e., 9 sessions in total) and given the starting time of each 25-minute observation period corresponding to the time on the video (e.g., ‘start observations at 2-minute mark of video’). After being given detailed instructions and data collection sheets they independently measured on-task and disruptive behaviour during these sessions.

On-task behaviour IOA was assessed using Total Agreement (or Exact Agreement) IOA. Total Agreement IOA was calculated by dividing the total number of agreements by the total number of opportunities for agreement, multiplied by 100. Considering each of the five

participants' on-task behaviour is assessed 50 times over a session (i.e., 50 intervals), the total number of opportunities for agreement was 250 per session. For example, if the total number of agreements between the researcher and the second observer was 200 for the session, then the total agreement IOA would be (200 ÷ 250) × 100 = 80%.

Disruptive behaviour IOA was assessed using Exact Count Per Interval IOA. Exact Count Per Interval IOA was calculated by dividing the number of intervals where both observers recorded the exact same number of disruptive behaviour occurrences by the total number of opportunities for agreement (i.e., 250), multiplied by 100. For example, if both observers recorded the exact same number of disruptive behaviour occurrences for 225 intervals then the Exact Count Per Interval IOA would be (225 ÷ 250) × 100 = 90%.

The mean IOA for on-task and disruptive behaviour was calculated over the nine sessions that were included. IOA above 80% is considered acceptable (Cooper et al., 2013).

Ethics

Ethical approval was gained from the University of Waikato Human Ethics Research Committee before commencement of any data collection in this study.

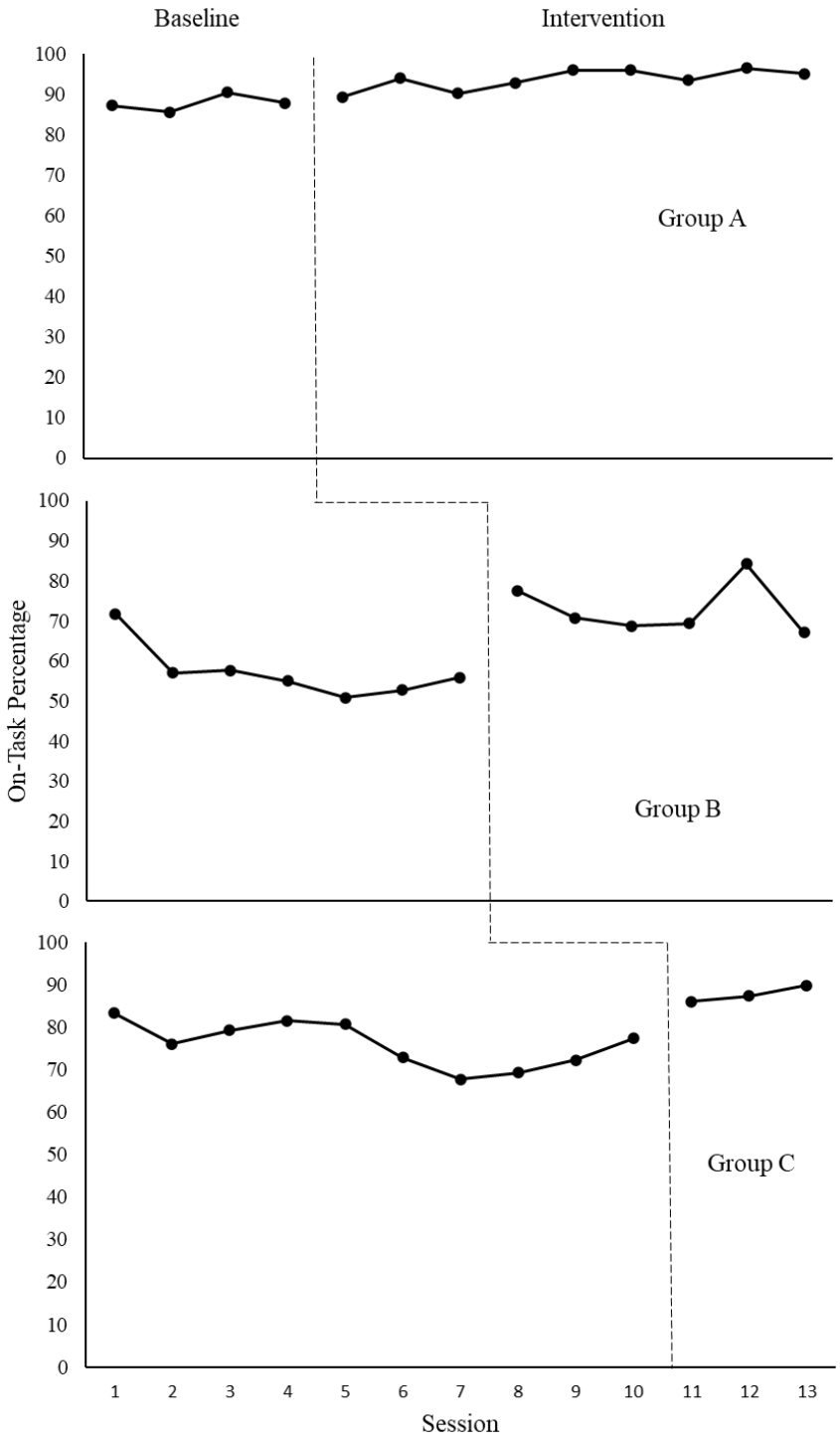
Results

On-Task Behaviour

Figure 4 displays group on-task percentages across all 13 sessions for each group. The introduction of the intervention is illustrated by the dotted line. There was a noticeable increase in on-task behaviour with the onset of the intervention condition for Groups B and C. However, Group A displayed clear signs of a ceiling effect that prevented the demonstration of an experimental effect.

Figure 4

Percent of On-Task Behaviour for Baseline and Intervention Sessions across Groups.



As seen in figure 4, the baseline data of Group A is stable and shows a slight increasing trend with the on-task percentages ranging from 85.6% to 90.5% and a mean of 87.79%. Likewise, data in the intervention phase of Group A is stable and shows a slight

increasing trend with on-task percentages ranging from 89.29% to 96.50% and a mean of 93.69%. The slightly increasing on-task percentage baseline trend appeared to continue into the intervention phase, with no noticeable increases in on-task behaviour coinciding with the introduction of the intervention condition. This suggests that the intervention had no effect on on-task behaviour. However, there appears to be a clear ceiling effect that would limit any considerable increases in on-task behaviour during the intervention phase, hence preventing the demonstration of a positive intervention effect. Mean on-task percentage in the intervention phase was 5.9% higher than in the baseline phase, with a relative increase of 6.72%. Despite visual analysis indicating that there was no experimental effect, Tau-U calculations found an effect size of 0.89 ($p < 0.05$), indicating that the intervention had a significant, medium to high positive effect on on-task behaviour.

The baseline data of Group B is stable, with the exception of session 1, and shows a slight decreasing trend with on-task percentages ranging from 50.8% to 71.72% and a mean of 57.24%. Likewise, data in the intervention phase of Group B is stable, with the exception of session 12, and shows a slight decreasing trend with on-task percentages ranging 67% to 84.27% and a mean of 72.92%. The introduction of the intervention in Group B resulted in an immediate and noticeable increase in on-task percentage, suggesting that the intervention had a positive effect on-task behaviour. Mean on-task percentage in the intervention phase was 15.68% higher than in the baseline phase, with a relative increase of 27.39%. Tau-U calculations for Group B found an effect size of 0.81 ($p < .05$), indicating that the intervention had a significant, medium to high positive effect on on-task behaviour.

The baseline data of Group C is stable and shows a slight decreasing trend with on-task percentages ranging from 67.72% to 83.20% and a mean of 75.79%. Data in the intervention phase of Group C is stable and shows a slight increasing trend with on-task percentages ranging from 86% to 89.7% and a mean of 87.67%. The slightly decreasing trend

of on-task percentage in the baseline phase did not continue into the intervention phase as there was a noticeable increase in on-task percentage with the introduction of the intervention condition, indicating that the intervention had a positive effect on on-task behaviour. Mean on-task percentage in the intervention phase was 11.88% higher than in the baseline phase, with a relative increase of 15.73%. Tau-U calculations for Group C found an effect size of 1.0 ($p < .05$), indicating that the intervention had a significant, strong positive effect on on-task behaviour.

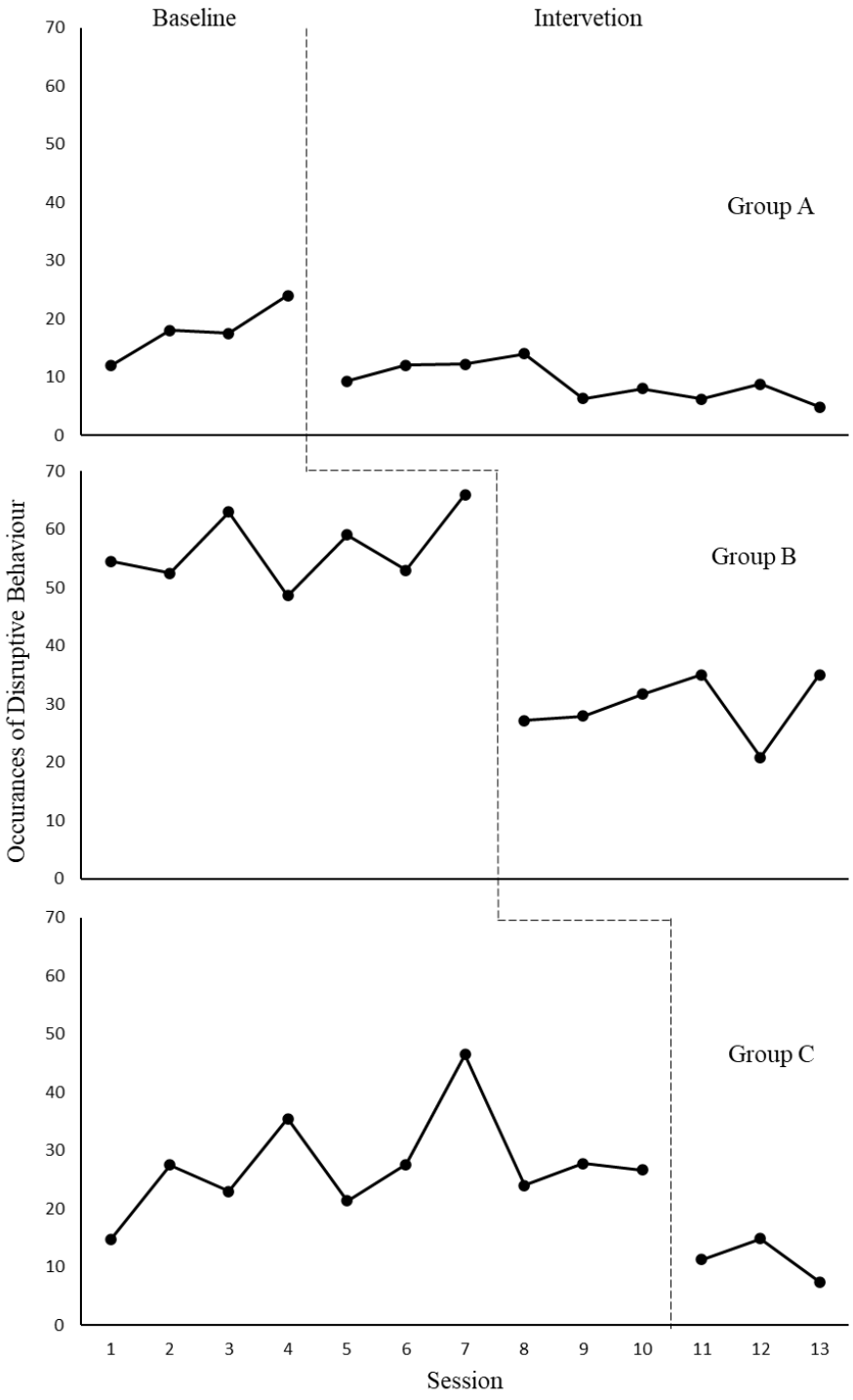
Unfortunately, Group A showed clear signs of a ceiling effect than prevented a noticeable increase in on-task behaviour from occurring, limiting the conclusions that can be drawn for the Group A results. However, Group B and Group C showed immediate and noticeable increases in on-task percentage, suggested that Bodyfurn chairs increased the on-task behaviour of students compared to the regular classroom chairs.

Disruptive Behaviour

Figure 5 displays total occurrences of disruptive behaviour across all 13 sessions for each group, with the introduction of the intervention being illustrated by the dotted line. There were noticeable and immediate decreases in disruptive behaviour occurrences with the onset of the intervention across all three groups, demonstrating a clear functional relationship between the chairs and disruptive behaviour.

Figure 5

Disruptive Behaviour Occurrences during Baseline and Intervention Sessions across Groups.



As shown in figure 5, the baseline data of Group A is stable and shows a moderate increasing trend with disruptive behaviour occurrences ranging from 12 to 24 per session with a mean of 17.89. In contrast data in the intervention phase of Group A depicts a stable

but slight decreasing trend with occurrences of disruptive behaviour ranging from 5 to 14 per session with a mean 9.10. The introduction of the intervention resulted an immediate and noticeable decrease in disruptive behaviour with the mean occurrences of disruptive behaviour decreasing by 8.79, or 49.13%, from the baseline phase to the intervention phase, suggesting that the intervention was effective at decreasing disruptive behaviour. It is also worth noting that despite strong indications of an experimental effect in Group A there appears to be a floor effect that could be limiting the true size of the experimental effect. Tau-U calculations for Group A disruptive behaviour found an effect size of -0.83 ($p < .05$) indicating that the intervention had a significant, medium to large negative effect on disruptive behaviour.

Baseline data of Group B shows moderate variability and a slight increasing trend with disruptive behaviour occurrences ranging from 40 to 70 per session with a mean of 56.65. The intervention phase data of Group B also shows moderate variability and a slight increasing trend with occurrences disruptive behaviour ranging from 21 to 35 and a mean of 29.59. The introduction of the intervention coincided with an immediate and noticeable decrease in disruptive behaviour with the mean occurrences of disruptive behaviour decreasing by 27.06, or 47.77%, from the baseline phase to the intervention phase, suggesting that the intervention was effective at decreasing disruptive behaviour. Tau-U calculations for Group B disruptive behaviour found an effect size of -1 ($p < .01$), indicating that the intervention had a significant, strong negative effect on disruptive behaviour.

Group C baseline data shows high variability and a slight increasing trend with disruptive behaviour occurrences ranging from 14 to 46 per session with a mean of 27.42. In contrast, Group C intervention data shows moderate variability and a slight decreasing trend with disruptive behaviour occurrences ranging from 7 to 15 per session with a mean of 11.14 occurrences. The introduction of the intervention phase resulted with an immediate and

noticeable decrease in the level disruptive behaviour with mean occurrences of disruptive behaviour decreasing by 16.28, or 59.37% during the intervention phase, suggesting that the intervention was effective at decreasing disruptive behaviour. Tau-U calculations for Group C disruptive behaviour found an effect size of -0.93 ($p < .05$) indicating that the intervention had a significant, strong negative effect on disruptive behaviour.

There were noticeable and immediate decreases in disruptive behaviour occurrences with the onset of the intervention across all three groups. This demonstrates a clear functional relationship between the chairs used by the students and disruptive behaviour, with Bodyfurn chairs decreasing disruptive behaviour of students compared to the regular classroom chairs.

Interobserver Agreement

The total agreement IOA for on-task behaviour was 89.8% and the exact count per-interval IOA for disruptive behaviour was 94.1%, indicating good IOA for both on-task and disruptive behaviour data.

Social Validity Data

13 out of the 15 participants reported that they preferred to sit in the Bodyfurn chairs when doing their schoolwork while two preferred the regular classroom chairs. 14 out of the 15 participants reported that they felt that the Bodyfurn chairs made it easier to do their schoolwork while one student said that they felt it made no difference.

Reasons given for why the students preferred the Bodyfurn chairs included: they were more comfortable, not as hard as the regular chairs which one student complained gave them a sore back, the chair was stable and there was no fear of it tipping over, they are nicer to look at, and they liked how the backrest and seat were manoeuvrable and allowed them to lean back and adjust position with ease. The students reported that the increased comfort, safety, and efficacy of the Bodyfurn chairs made it easier to concentrate on their work.

Of the two students who preferred to the regular classroom chairs, one student preferred them because they did not like the colour of the Bodyfurn chairs. The other student said they preferred the regular classroom chairs because they liked to lean back on the back legs of the regular chairs but were not able to do so on the Bodyfurn chairs because of the sled base. This same student also reported that they felt that Bodyfurn chairs made it easier to do their schoolwork due to not having the distraction of rocking back on their chair.

Discussion

The aim of the current study was to examine the effects of Bodyfurn chairs on the on-task and disruptive behaviour of students in the classroom. It was hypothesized that Bodyfurn chairs would increase on-task behaviour and decrease disruptive behaviours in the classroom when compared to regular classroom chairs. Overall, the results of the study supported the hypotheses.

Effect of Bodyfurn Chairs on On-Task Behaviour

Unfortunately, a ceiling effect limited the ability to draw accurate conclusions about the changes in on-task behaviour for Group A. However, there were immediate and noticeable and increases in on-task percentage when Bodyfurn chairs were introduced for Group B and Group C. When Bodyfurn chairs were introduced, on-task behaviour increased by 27.39% for Group B and 15.73% for Group C relative to the regular classroom chairs. Groups A and B also had significant effect sizes of 0.81 ($p < .05$) and 1.0 ($p < .05$), respectively. These findings indicate that the on-task behaviour of students increases when students are seated in Bodyfurn chairs compared to the regular classroom chairs.

These results replicate the findings of several studies that found that alternative seating options resulted in increased on-task behaviour over regular classroom chairs (Fedewa & Irwin, 2011; Knight & Noyes, 1999; Stapp, 2018; Wingrat & Exner, 2005).

Effect of Bodyfurn Chairs on Disruptive Behaviour

Despite a slight floor effect for disruptive behaviour in Group A, all three groups showed immediate and noticeable decreases in disruptive behaviour when Bodyfurn chairs were introduced, demonstrating a clear functional relationship between chairs and disruptive behaviour. Occurrences of disruptive behaviour decreased by 49.13%, 47.77% and 59.37% for groups A, B, and C respectively, when students used Bodyfurn chairs compared to the regular classroom chairs. Tau-U calculations found significant effect sizes of -0.83 ($p < .05$), -1.0 ($p < .01$) and -0.93 ($p < .05$) for Groups A, B, and C, respectively. These results indicate that the disruptive behaviour of students decreases when students are seated in Bodyfurn chairs compared to the regular classroom chairs.

It is important to acknowledge that this study used a functional definition for recording disruptive behaviour (i.e., a behaviour was only recorded as a disruptive behaviour if it actually disrupted/distracted another student's on-task behaviour or the teacher's teaching). This means it could be possible that disruptive behaviours were not actually decreasing but rather students were less likely to be disrupted/distracted by other students' behaviour because the Bodyfurn chairs made it easier for students to concentrate on their work.

Effect of Bodyfurn Chairs on Academic Achievement

As previously mentioned, on-task behaviour has been shown to have a significant positive correlation with academic achievement (Chan et al, 2016; Gettinger, 1986; Gettinger & Walter, 2012; Lei et al, 2018; Rosenshine & Berliner, 1978) and disruptive behaviour in the classroom has been shown to have a significant negative correlation with academic achievement (Blank & Shavit, 2016, Finn et al., 1995; Kremer et al., 2016; Kristoffersen et al., 2015). Considering the results of this study showed that Bodyfurn chairs increase the on-task behaviour of students and decrease disruptive behaviour of students, the findings of this

study suggest that Bodyfurn chairs could significantly improve that academic achievement of students in the classroom compared to the regular classroom chairs.

Social Validity Data

The informal discussions revealed that 13 of the 15 participants preferred to sit in Bodyfurn chairs over the regular classroom chairs for numerous reasons including comfort, safety, and efficacy. 14 of the 15 participants in the study reported that they felt Bodyfurn chairs made it easier to do their schoolwork over the regular classroom chairs because the increased comfort, safety, and efficacy made it easier to concentrate on their work. These results are consistent with the findings of Furnware that numerous teachers and principals reported that the introduction of Bodyfurn chairs resulted in improved academic engagement, time on-task, comfort, student satisfaction, safety, concentration and reduced disruptive behaviours (Furnware, n.d.-g, n.d.-h).

One of the students who preferred the regular chairs over the Bodyfurn chairs stated it was because they could rock back on the regular chairs but not Bodyfurn chairs. This is due to a safety design feature of Bodyfurn chairs that does not enable rocking back due to its sled base. Even though this is a feature that the student did not enjoy about the Bodyfurn chairs it is very likely decreasing the chance that this student could have a potentially dangerous accident by the chair falling over. This same student also reported that they felt Bodyfurn chairs made it easier to do their schoolwork due to not having the distraction of rocking back on their chair. This suggests that even though this student may have preferred the regular chairs, Bodyfurn chairs likely had a positive effect on the student's learning and safety.

Implications of Findings

The findings of the current study highlight the importance of chairs in the classroom and the impact that they can have on the learning of students. Although several studies have shown that alternative seating options such as stability balls and specially designed cushions

can significantly affect the academic engagement and achievement of students, there is limited research that experimentally compares the effect of ergonomically designed chairs and regular classroom chairs on academic achievement. Bodyfurn chairs are one of the most commonly used ergonomic chairs in New Zealand schools and are designed to improve the comfort, posture and blood flow of users. It was hypothesized that these improvements would reduce fidgeting and off-task behaviour of students, leading to improved academic outcomes. Despite a strong theoretical framework and an abundance of social validity and anecdotal evidence to support the claim that Bodyfurn chairs improve academic performance, there was still a lack a valid empirical evidence to support these claims. The findings of this study suggest that Bodyfurn chairs significantly increase on-task behaviour and decrease disruptive behaviour of students and hence may significantly improve the academic achievement of students. The importance of academic achievement spreads far beyond the classroom and is associated with improved employment opportunities, social skills, knowledge, physical and emotional well-being, standard of living, and personal relationships (Edgerton et al., 2012). The findings of this study suggest that Bodyfurn chairs could be a valuable learning tool that could improve the academic achievement and overall quality of life of students.

Limitations and Future Research

Despite the success of the study there are still several areas that can be improved upon to increase the validity and the generalizability of the findings.

Sample Size and Sampling Method

One limitation of the study was the sampling method that was used. As discussed earlier, due to the small sample size used in the study participants were selected using purposive sampling (i.e., when the sample of participants is selected by the judgement of the researchers that can be logically assumed to be representative of the population) to try and avoid ceiling and floor effects. However, despite this Group A still experienced a ceiling

effect for on-task behaviour and a slight floor effect for disruptive behaviour. Although this selection criterion was determined by the researchers, participants were ultimately selected by the teaching staff which potentially introduced a selection bias. Using larger sample sizes would increase the validity of the findings and allow for random sampling which would eliminate potential sampling biases, decrease variation between groups and decrease the likelihood of floor and ceiling effects.

Regular Classroom Chairs

Another limitation of the study was that Bodyfurn chairs were only compared to one type of regular classroom chair. Although changes in the on-task and disruptive behaviour of students were shown across several different teachers, school subjects and groups of students, the changes in students' behaviour were only demonstrated in comparison to one type of chair. Conclusions about changes in student behaviour due to Bodyfurn chairs can only be drawn in comparison to the one type of chair used in the study, not all 'regular' classroom chairs. However, it is important to note that this type of chair is a commonly used chair in New Zealand schools (Lethaby, 2020) and was considered to be representative of a regular non-ergonomic style classroom chair. Including different types of regular classroom chairs or even other types of ergonomic furniture would improve the generalizability of the findings.

Setting

Another limitation was that the study took place in a specific setting of a breakout room and in small groups. Although this was a regular part of the students schedule this setting did not represent where the majority of their learning took place. Most of their day was spent in the main classroom with approximately 70 other students and several teachers that moved around the classroom helping students. This set up is more representative of modern classrooms in New Zealand with students spread out over a large classroom and a

teacher to student ratio of approximately one teacher to 20-30 students. This potentially brings up concerns about the generalizability of the results.

Disruptive Behaviour

Another aspect that could be investigated is what types of disruptive behaviours are being affected. As previously discussed, many different behaviours could qualify as disruptive behaviour from severe and significant disruptive behaviours such as fighting and tantrums to tapping your foot on the floor or fidgeting. The size and impact of a disruptive behaviour could vary greatly depending on what the disruptive behaviour is. One type of disruptive behaviour could disrupt another student for just a couple of seconds, while another type of disruptive behaviour could disrupt the entire class for minutes on end. Because the results do not clarify what type of disruptive behaviours are being affected it is important not to generalize that Bodyfurn chairs decrease all disruptive behaviours as it could be possible that Bodyfurn chairs may just be decreasing certain types of disruptive behaviour such as fidgeting. Recording what the types of disruptive behaviours are occurring and how these change between Bodyfurn and regular classroom chairs could provide important insight into what behaviours are being affected and what other potential disruptive behaviours could be targeted for greater improvement.

Sitting Behaviours

One more aspect that could be included in future study is recording different sitting behaviour measures alongside on-task and disruptive behaviours. Differences in sitting behaviour between Bodyfurn chairs and the regular classroom chairs were very apparent during observations. Participants appeared to spend much more time seated when using Bodyfurn chairs compared to the regular chairs. When students were seated in the regular chairs, they seemed much more likely to get up out of their seats, walk around, stretch, or spend extended periods of time standing up hunched over the table while doing their

schoolwork. Another aspect where there seemed to be a significant difference in sitting behaviours was the difference in 'correct/proper' sitting behaviour (i.e., sitting with correct upright posture and feet on the floor), which appeared to be much more prevalent when students were seated in Bodyfurn chairs compared to regular classroom chairs. When students were seated in the regular classroom chairs, they would often sit up on their knees in the chair and would regularly rock back on the chairs back legs in what could be considered dangerous behaviour.

Sitting behaviours that could potentially be included in future research could be in-seat time (i.e., the amount of time students spends seated), correct sitting behaviour (i.e., sitting with correct upright posture and feet on the floor), and dangerous sitting behaviours (i.e., rocking back on chair). These measures could be used to gain empirical evidence to support the health and safety benefits of Bodyfurn chairs.

Social Validity Data

Another change to future research could include collection of more robust and in-depth social validity data by potentially including questionnaires and formal interviews that could investigate what aspects/design features of the Bodyfurn chairs participants felt impacted the learning and satisfaction.

Sitting behaviours that could potentially be included in future research could be in-seat time (i.e., the amount of time students spends seated), correct sitting behaviour (i.e., sitting with correct upright posture and feet on the floor), and dangerous sitting behaviours (i.e., rocking back on chair). These measures could be used to gain empirical evidence to support the health and safety benefits of Bodyfurn chairs.

Conclusion

The current study provides important empirical evidence that supports the theoretical framework and design of Bodyfurn chairs and adds credibility to the claims about the impact

that they have on learning in the classroom. This study also serves and a base for future research that could lead to a greater understanding of ergonomics and the learning environment which could have a significant impact on the learning and well-being of many students.

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Appendix A

School of Psychology

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Information Sheet – Teachers

Associate Professor Angelika Anderson
School of Psychology
The University of Waikato
Phone: 07 838 4466 ext 9209
Email: angelika.anderson@waikato.ac.nz

Isaac Martin
Phone: 0277148020
Email: im47@students.waikato.ac.nz

To whom it may concern,

You are invited to participate in a research project conducted by Isaac Martin, under the supervision of Associate Professor Angelika Anderson from School of Psychology at the University of Waikato. This project is part of the requirement for the completion of my Masters of Applied Psychology in Behaviour Analysis at the University of Waikato. Please read this information sheet in full before deciding if you would like to participate in the project. If you have any questions about the project, please do not hesitate to contact myself or Angelika via the contact details above.

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What is the research about?

The research project will focus on two aspects; the first will be to determine whether Bodyfurn Chairs, specially designed ergonomic chairs, improve concentration and learning in the classroom. The second aspect of the project is to explore how changes in certain environmental factors in the classroom, such as noise and air quality, affect the movement of students and alter the learning environment.

Information about the chairs that will be used in the study can be found at https://www.furnware.co.nz/products/bodyfurn/bodyfurn-sled-chair.

What will be involved?

The study will involve a total 15 students who will be divided into three groups of 5. Testing will take place in a breakout room where observation equipment and the chairs/room set-up will be already pre-set and then reset for every session. The classroom will be set-up in a way that is suitable for learning and that the teaching staff is comfortable with. The observational equipment includes video recording (to observe behaviour changes of students), motion sensors, noise recorders and environment sensors (to measure carbon dioxide levels etc). Students will engage in their regular work task for the session that will last approximately 15-20 minutes. When one group has finished their session, the next group will then begin their session. A weekly schedule will be organised that works for the students and teaching staff several days a week. The length of time of testing will likely be over a couple of months. All groups will begin using existing classroom chairs and then Bodyfurn chairs will be introduced at different times for each group. Data collection of movement and environmental

measures will be recorded from the beginning to the end of the testing period (i.e. every session). Recording equipment will be set up in a way as to not interfere with students, teachers or learning in the classroom. The goal of the study is to replicate normal classroom conditions, so I will not be involved or interfering in any of the classroom activities.

What will your role be in the project?

The behaviour and movement of the teaching staff is not being observed as part of the project. The role of the teachers is to replicate a normal learning environment and to conduct classroom activities as usual. However, the teaching staff is encouraged to give any input into what activities they feel would be best suited to the study and would work well in the designated learning environment. At the end of testing teachers and students will be given the opportunity to give feedback on the Bodyfurn chairs and the project as a whole.

Results

The results of the study will be presented in my master's thesis. It is also possible that results will be published in a journal article and/or presented at a conference. Upon request, a summary of the results can be forwarded to you, the school, students, and parents/guardians of participating students.

Confidentiality

Any details of students and teachers will be treated with a high level of confidentiality and all data collected will be done so anonymously. No participants will be identifiable in the presentation of any results.

Right to withdraw

Participation in this project is voluntary and all participants have the right to withdraw from the project at any time, even after signing a consent form.

What happens now?

If you would like to be a part of this project, please complete the consent form and return to me. If you have any questions regarding the project, please do not hesitate to contact me on the details at the top of this form.

Yours Sincerely,

Isaac Martin

This research project has been approved by the Human Research Ethics Committee at the University of Waikato. Any questions or concerns about the ethical conduct of this research may be sent to the Secretary of the Committee, email humanethics@waikato.ac.nz, postal address, Human Research Ethics Committee, University of Waikato, Te Whare Wananga o Waikato, Private Bag 3105, Hamilton 3240.

Appendix B

School of Psychology

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Information Sheet – Students

Associate Professor Angelika Anderson
School of Psychology
The University of Waikato
Phone: 07 838 4466 ext 9209
Email: angelika.anderson@waikato.ac.nz

Isaac Martin
Phone: 0277148020
Email: im47@students.waikato.ac.nz

Dear Student

You are invited to be a part of a research project at your school. Isaac Martin is a student at the University of Waikato and is doing a study as part of his coursework under the supervision of Associate Professor Angelika Anderson. Please read the entire information sheet before deciding if you would like to take part in the project. If you have any questions about the project, you can ask Isaac, your teacher or ask a parent/caregiver to contact Isaac or Angelika.

What is the research about?

The research project will investigate if specially designed Bodyfurn chairs are more comfortable to sit in and make it easier for you to do your schoolwork. Also, we will investigate if different things like noise make it more difficult to sit still in the classroom.

If you want to learn more about the Bodyfurn chairs that you will get to test out, you can visit this website: https://www.furnware.co.nz/products/bodyfurn/bodyfurn-sled-chair.

What will I do?

Testing will take place during your regular class time in one of the breakout rooms. The breakout room will have some equipment set-up in it, like video cameras and motion sensors. You will have several classes in the breakout room every week next term at school. Each class will be 15-20 minutes long. Some of you will get the chance to test out the new Bodyfurn chairs while the others will continue to use regular classroom chairs. When the testing is finished you will have a chance to talk about the new chairs and if you think they helped or not.

What if I don’t want to be in the project anymore?

If at any time you decide that you don’t want to be in the study anymore, you can tell Isaac, a teacher or a parent/caregiver and you will be allowed to return to class as normal.

What will happen when the study is finished?

I will write a report about the results of the study as part of my University work. No personal details like your name will ever appear in the results or anywhere else. No one will be able to identify you in from this study. If you want to know what happened in the study you can ask Isaac, your teacher or a parent/caregiver to contact me and I will send you a summary of the results.

What happens now?

If you would like to be a part of this project, please fill out the assent form and return it to your teacher or directly to me.

Yours Sincerely,

Isaac Martin

This research project has been approved by the Human Research Ethics Committee at the University of Waikato. Any questions or concerns about the ethical conduct of this research may be sent to the Secretary of the Committee, email fass-ethics@waikato.ac.nz, postal address, Human Research Ethics Committee, University of Waikato, Te Whare Wananga o Waikato, Private Bag 3105, Hamilton 3240.

Appendix C

School of Psychology

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Information Sheet – Parents/Guardians

Associate Professor Angelika Anderson
School of Psychology
The University of Waikato
Phone: 07 838 4466 ext 9209
Email: angelika.anderson@waikato.ac.nz

Isaac Martin
Phone: 0277148020
Email: im47@students.waikato.ac.nz

Dear Parents/Guardians,

Your child has been chosen to participate in a research project conducted by myself, Isaac Martin, under the supervision of Associate Professor Angelika Anderson from School of Psychology at the University of Waikato. This project is part of the requirement for the completion of my Masters of Applied Psychology in Behaviour Analysis at the University of Waikato. Please read this information sheet in full before deciding if you consent to your child participating in the project. If you have any questions about the project, please do not hesitate to contact myself or Angelika via the contact details above.

What is the research about?

The research project will focus on two aspects; the first will be to determine whether Bodyfurn Chairs, specially designed ergonomic chairs, improve concentration and learning in the classroom. The second aspect of the project is how do changes in certain environmental factors in the classroom, such as noise and air quality, affect the movement of students and alter the learning environment.

Information about the chairs that will be used in the study can be found at https://www.furnware.co.nz/products/bodyfurn/bodyfurn-sled-chair.

What will be Involved?

Testing will take place in a breakout classroom where observation equipment will be set-up. The observational equipment includes video recording (to observe behaviour changes of students), motion sensors, noise recorders and environment sensors (to measure carbon dioxide levels etc). It should be noted that small groups splitting off into breakout rooms is a regular part the classroom schedule. Students will engage in their regular work task for the session that will last approximately 15-20 minutes. When one group has finished their session, the next group will then begin their session. A weekly schedule will be organised that works for the students and teaching staff several days a week. The length of time of testing will likely be over a couple of months. Observational equipment will be set up in a way as to not interfere with students, teachers or learning in the classroom. The goal of the study is to replicate normal classroom conditions, so I will not be involved or interfering in

any of the classroom activities. It is important to emphasize that data will be collected during regular classroom activities and will not interfere with your students learning or education.

Results

The results of the study will be presented in my master's thesis. It is also possible that results will be published in a journal article and/or presented at a conference. Upon request, a summary of the results can be forwarded to you, the school, students, and teachers.

Confidentiality

Any details of students and teachers will be treated with a high level of confidentiality and all data collected will be done so anonymously. No participants will be identifiable in the presentation of any results. None of the video footage will be published, it will only be seen by the researchers involved and will be used for observation and data collection purposes only.

Right to withdraw

Participation in this project is voluntary and all participants have the right to withdraw from the project at any time, even after signing a consent form. If at any point you wish to withdraw your student from the project, please contact myself, the school or your child's teacher and they will be removed immediately from the study.

What happens now?

If you would **NOT** like your child to be a part of this project, please complete the withdrawing of consent form and return to the school. If you have any questions regarding the project, please do not hesitate to contact me on the details at the top of this form.

Yours Sincerely,

Isaac Martin

This research project has been approved by the Human Research Ethics Committee at the University of Waikato. Any questions or concerns about the ethical conduct of this research may be sent to the Secretary of the Committee, email fass-ethics@waikato.ac.nz, postal address, Human Research Ethics Committee, University of Waikato, Te Whare Wananga o Waikato, Private Bag 3105, Hamilton 3240.

Appendix D

School of Psychology

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Consent Form – Teachers

Please retain a copy of this form for your personal records.

Research Project: An Experimental Evaluation of the Introduction of Bodyfurn Chairs on On-Task and Disruptive Behaviour in the Classroom.
Name of participant:
_____

I have received a copy of the Information Sheet describing the research project and have been given sufficient time to read it. Any questions that I have, relating to the research, have been answered to my satisfaction. I understand that I can ask further questions about the research at any time during my participation, and that I can withdraw my participation at any time (up to two weeks) after completion of data collection.
I understand that I can ask to have the observations stopped at any time.
When I sign this consent form, I will retain ownership of the collected data, but I give consent for the researcher to use the data for the purposes of the research outlined in the Information Sheet.
I understand that my identity will remain confidential in the presentation of the research findings.

Please complete the following checklist. Tick [✓] the appropriate box for each point.	**YES**	**NO**
I have the right to decline to participate in any part of the research activity.		
I know who to contact if I have any questions about the study in general.		
I understand that the information supplied by me could be used in future academic publications.		
I consent to completing a questionnaire near the end of the study, as a post-intervention measure on my thoughts about the intervention.		
I wish to receive a copy of the findings		

Participant:	_____	Researcher:	_____
Signature:	_____	Signature:	_____
Date:	_____	Date:	_____
Contact Details:	_____	Contact Details:	_____

Appendix E

School of Psychology

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Assent Form - Students

I _____ have read and understand the attached Information Sheet describing the research project. Any questions that I had about the study have been answered. I understand that I can stop participating in the project at any time. I am happy for the researcher to use the data collected during the project for their research as described in the Information Sheet. I understand that my identity will be kept hidden from the results of the study, and that my name will never be mentioned in any report.

Date:

Signature:

Appendix F

School of Psychology

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Withholding Consent Form – Parents/Guardians

Associate Professor Angelika Anderson
School of Psychology
The University of Waikato
Phone: 07 838 4466 ext 9209
Email: angelika.anderson@waikato.ac.nz

Isaac Martin
Phone: 0277148020
Email: im47@students.waikato.ac.nz

Research Project: An Experimental Evaluation of the Introduction of Bodyfurn Chairs on On-Task and Disruptive Behaviour in the Classroom.

I have read and understood the Information Sheet regarding the above research project and do **NOT** give consent for my child to participate in this research project.

Participant's name (please print): _____

Signature: _____ Date: _____

Appendix G

Data Collection Sheet

Date: **Group**: **Session**:
Start time: **End time**:

Momentary Time Sampling of On-Task Behaviour

Interval time: 30 seconds
Behaviour: On-task Behaviour

✓= On-task behaviour present
✖ = On-task behaviour <u>not</u> present (i.e., off-task behaviour)
A= Absent

Interval	Start Time	Student 1	Student 2	Student 3	Student 4	Student 5	Group Total
1							
2							
3							
4							
5							
6							
7							
8							
9							
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45							
46							
47							
48							
49							
50							
Total							
% On-Task							

Event Sampling of Disruptive Behaviour

Behaviour: Disruptive Behaviour

✓= Indicates one instance of disruptive behaviour
A= Absent

Interval	Start Time	Student 1	Student 2	Student 3	Student 4	Student 5	Total
1							
2							
3							
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Total							
Adjusted Total							