The implications of desk arrangement on social interaction in a third grade classroom

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Abstract

Numerous studies have illustrated that participation in occupations—defined as

meaningful life activities—is essential to wellness (AOTA, 2014). Social interaction is an important area of

occupational participation for children in their roles as students. (AOTA, 2014). Classroom design can impact

student social participation; however, there is a lack of current research focused on effects of classroom design

on social interaction for *all* students. Rather, research has examined factors affecting social participation of

certain subgroups of students in the classroom, such as those with chronic illness or deafness (Martinez, Carter

& Legato, 2011; Martins & Gaudiot, 2012). While literature provides information about various

subpopulations, in this paper we emphasize that social participation based on classroom design can facilitate or

inhibit overall occupational participation for all children in the role of student.

Introduction

Literature has examined relationships between social interaction and daily functioning

among children and adolescents as well as consequences of factors that impede social interaction. Crowe,

Beauchamp, Catroppa, and Anderson (2011) suggested that social functioning can provide the capacity to form

relationships that are not only satisfying and lasting, but that are also essential for physical and psychological

well-being. They suggest that relationships are crucial for appropriate child development and, if lacking, could

affect adaptation to school, home, and community environments (Crowe et al., 2011). One of the main

occupations children possess is the role of a student, thus many of children's social interactions occur by

attending school and

engaging with peers (Ghaziani, 2008). On average, children spend around six hours a day and over one thousand hours a year at school, an environment that affects students' health, work, leisure, and emotions (Ghaziani, 2008).

Research by January et al., (2011) has suggested that school-based interventions can positively influence social behavior, and that a lack of social skills has adverse effects on students' abilities to develop relationships at school. Some of the adverse effects resulting from poor social skills included decreased academic performance, lack of social responsibility, poor peer relationships, and fewer self-regulatory processes. General functioning is also affected and can result in social withdrawal, extreme feelings of isolation, and extreme feeling of rejection, which are all precursors to aggressive and violent behavior. Additionally, strong social skills predicted fewer internalizing and externalizing problems in the classroom, while poor social skills have been related to increased vulnerability of mental health issues including depression, loneliness, and social anxiety. The classroom environment can provide a foundation for social interaction for elementary aged students (Lim, 2012).

Researcher Lei (2010) considered the influence of physical environmental elements of classroom design on students' ability to learn. Lei (2010) defined the physical perspectives of a classroom by size, shape, seating arrangement, technology system arrangement, interior lighting, thermal condition, color selection, and noise level. Light colors were reported as suggesting calmness and relaxation while bright colors encouraged activity and kept students awake (Lei, 2010). Additionally, uncomfortable desks and chairs shift students' attention away from the teacher or learning material (Veltri, Banning, & Davis, 2006). While desks in rows and columns have promoted students to ask more questions and semi-circle formations may encourage more social interaction among students (Purwaningrum et al. 2015).

A study by Wannarka and Ruhl (2008) summarized previous studies that analyzed academic or behavioral outcomes depending on different desk arrangements. After analyzing the

literature, the researchers found that rows and groups (or clusters) of desks were popular arrangements when measuring academic or behavioral outcomes, such as on-task behavior and quality of student work. The researchers found that desks arranged in rows, compared to a grouped desk arrangement, were beneficial for increasing on-task behavior during individual assignments. In contrast, the researchers found that when wanting to increase student collaboration or brainstorming, teachers should use grouped desk arrangement. They concluded that characteristic of the classroom task and desired student behaviors should influence how a teacher positions desks (Wannarka & Ruhl, 2008).

Gremmen, van den Berg, Segers, and Cillessen (2016) investigated how teachers manage classroom social dynamics including social status patterns and social affiliation patterns, through seating arrangements, recognizing that teachers' beliefs influence how and where they may place a student. Moreover, researchers concluded that a well devised seating plan influences academic and social behaviors. Teachers from this study reported physical, academic, classroom management, academic, personal characteristics, and social considerations as aspects to placing children in certain areas and seats in the classroom. Specifically, teachers reported using small groups more frequently to promote cooperation while choosing rows to establish a quiet atmosphere (Gremmen et al. 2016). Quantifying such factors in classroom social interaction is key to measuring outcomes.

Several formal assessments have been used to measure children's social skills. A systematic review by Crowe et al. (2011) found the Social Skills Rating System (SSRS), the Friendship Quality Questionnaire, and the Social Information Processing Interview to be most common. Of these, the SSRS is most relevant to the current study aims in that it allows for the collection of objective, measurable, and social behavior data as it pertains to different classroom designs. The SSRS is a valid and reliable assessment tool used with elementary and secondary education students to measure areas such as problem behavior, academic competence, and social

skills. The results of the SSRS assist educators in understanding how daily social interactions are affecting the daily functioning of children within the educational system.

Griswold and Townsend (2012) added to the research on social skills assessments by examining the sensitivity of the Evaluation of Social Interaction (ESI) tool when used with children. The ESI, they suggest, allows participants to "rate both verbal and nonverbal behaviors that support social interaction" (Griswold & Townsend, 2012, p. 711). Researchers determined that the ESI was responsive to social interaction differences between children with and without disabilities, could be used to measure quality of social interaction, and had good validity and reliability when used to evaluate children's social interactions.

The SSRS and the ESI provided solid foundation for the original survey design of this study however were no parts of the SSRS or ESI were used in part or in full. Researchers of this study used created classroom surveys for the students and a teacher survey, specific to the elementary age and teacher expectations to gather outcome measures.

Current research provides evidence that social interaction is an essential component of child development and participation in the occupational role of student (January et al., 2011). While studying classroom design and social interaction among varying groups does provide valuable information, limited research exists in examining the impact of the physical design of the classroom on social interactions and shifting needs of all types of students. Occupational therapists, consulting with school professionals, could provide knowledge that promotes an ideal learning environment for all students in this area. Further research to understand the impact of classroom physical design on the social interactions of elementary school students is necessary. We suggest that the design of the classroom has not evolved to meet the needs of elementary school students, and/or the increased use of project based learning and collaborative learning approaches, which influences social interactions.

Occupational therapists as consultants can enhance the classroom setting through their knowledge of ergonomic design, sensory considerations, and understanding of how environment may affect a student's participation in occupations. Currently, an occupational therapist within a school system focuses on modifying the design of the classroom to meet the occupations of students with disabilities, chronic illnesses, or obesity that affect school function. The purpose of this study is to determine if manipulating desk arrangement, one factor in classroom design, impacts social interaction among third grade students.

Methods

Participants

Twenty-four students enrolled in a large metropolitan school, selected through a convenience sample, participated in this study. Communication involving recruitment included email correspondence and a face-to-face meeting with the principal and teacher. To be included, participants must be students enrolled in a third grade classroom at the beginning of 2014-2015 school year. Students whose parent/guardian chose to "opt-out" their child from the study were excluded. All 24 students' parents "opted in" allowing for the entire class of students to participate; one student moved school systems halfway through the research study. The researchers received informed consent from the classroom teacher to complete the research project by obtaining her signature on the consent form approved by the appropriate university institutional review board, and consent was also established via a letter of collaboration received from the principal of the elementary school prior to the beginning of the study. Researchers presented the opt-out form to parents, which was read line-by-line at the classroom's back-to-school parent night. The form was provided to parents to take home for additional review upon the end of the presentation and was also mailed to the parents who were not in attendance to ensure that all parents were aware of the study and consent was received.

Study Design

       This survey design study contained both quantitative and qualitative components. By collecting quantitative and qualitative data, researchers gained insights, perspectives, and findings helping to confirm quantitative statistics while also adding depth to the information received (MacKenzie, Van Teijlingen, & Pitchforth, 2014). In this study, the independent variable manipulated by the researchers was the desk arrangement, while the dependent variables measured by surveys were the students' ability to pay attention, physical mobility, verbal communication with peers, and accessibility to peers for academic needs (see Appendix A Table A1). Dependent variables in regard to the teacher included student behaviors, verbal communication, accessibility to peers, student mobility, teaching ability, and desk arrangement (see Appendix B Table B1). Extraneous variables included teaching style, students' personality, disabilities, and classroom decorations.

Instruments

       The researchers designed an original student and teacher survey based on two widely used assessments, the Social Skills Rating System (SSRS) and the Evaluation of Social Interaction (ESI), although as previously stated these assessments were not used directly in part or in full. According to research studies previously conducted by Crowe et al. (2011) and Griswold and Townsend (2008), these assessments have been established as valid and reliable when used to measure social interaction with both the pediatric and adult populations. Thus, providing a framework for the original surveys used.

       The student survey questions were developed to further uncover any possible correlation between social interaction and desk arrangement. The qualitative questions were developed based on important elements of social interaction and classroom design as specified by Lim (2012), including social interaction, non-verbal communication, and verbal conflicts. The quantitative component consisted of a five-question survey administered to the students via Microsoft

PowerPoint slides and Turning Technologies clickers. Turning Technologies clickers are remote

controls that allow students to select an answer from multiple choices that are numbered or

labeled with a corresponding letter. Researchers determined that five questions would be a low

enough number to keep the students interested, but high enough for quantifiable results. The

answer choices to the survey questions included: never, sometimes, and always in a Likert Scale

format. Before the actual survey, students practiced answering trial questions with the clickers.

One example of the trial questions was, "How often do you play sports?" Following the

administration of the two trial questions, the researchers administered the actual quantitative five-

question survey. Questions administered to the students are in Appendix A.

The qualitative component consisted of 10 open-ended questions administered to the

teacher via an electronic survey management system, Qualtrics, on a secured and encrypted

researcher's laptop. The qualitative survey questions can be referenced in Appendix B.

Procedure

The third grade elementary students started the 2014/2015 academic school year on

August 25, 2014. The desk arrangement, chosen by the teacher to begin the school year was a

cluster formation of five to six desks, with students facing inward towards each other. Gremmen

et al., (2016) found teachers most frequently use small groups, i.e. clusters, to promote

cooperation and that 48% of teachers in their study used small group desk formation in the

beginning of the year. The students remained in this cluster formation for two and a half weeks.

The five-question Turning Technologies® clicker survey was administered to the students on

September 10, 2014. Simultaneously on this date the teacher completed the first five qualitative

survey questions through Qualtrics®, and completed the last five qualitative questions in Qualtrics

at the end of the school day due to classroom time restrictions. On September 12, 2014 at the end

of the school day the desk were rearranged into five horizontal rows facing the front of the

classroom, with desks not touching each other. Gremmen et al., (2016) found teachers most

frequently used rows, to promote a quiet environment to promote academics and that 40% of

teachers in their study used rows as preferred seating arrangement. The students remained in this

row formation for two and a half weeks. The five-question Turning Technologies® clicker survey

was administered to the students on October 1, 2014. Simultaneously on this date the teacher

completed the first five qualitative survey questions through Qualtrics®, and completed the last

five qualitative questions in Qualtrics at the end of the school day due to classroom time

restrictions. Two students were absent the day of the second quiz. On October 3, 2014 at the end

of the school day the desk were rearranged into the original cluster formation from August 25,

2014. The students remained in this formation for two and a half weeks. The five-question

Turning Technologies® clicker survey was administered to the students on October 29, 2014.

Simultaneously on this date the teacher completed the first five qualitative survey questions

through Qualtrics®, and completed the last five qualitative questions in Qualtrics at the end of the

school day due to classroom time restrictions. The third grade students and the teacher completed

three surveys total.

Data Analysis

Data analysis was completed with Turning Technologies, Microsoft Excel, and Statistical Package

for the Social Sciences (SPSS) version 22. Two-step data analysis was completed. Descriptive

analysis was used to report findings and synthesize survey question answers from the student

survey. Pre- and post- outcome scores, as well as change scores, were reported from the student

survey. Researchers manually inputted the student survey data into Microsoft Excel and exported

to SPSS for analysis. Statistical analysis including mean, median, mode, Friedman's and Wilcox-

Signed Rank tests were completed. Significance was set at $p<.05$. Seven researchers analyzed data

and developed themes independently, and triangulated responses as a group to create new

correlational themes, which then produced descriptive quantitative findings.

Results

Survey completion rate was 94.2% for the students and 100% for the teacher. Descriptive statistics were obtained and revealed a nonparametric distribution as skewness was found to be -1 or greater than 1 in most data sets (see Table 1). For the quantitative student surveys, questions 2, 3, and 5 were found to be statistically significant from baseline to follow-up (p <.05) using Freidman's Chi-Squared Test based on nonparametric findings. (see Table 2). A Wilcoxon Signed-ranks test indicated that "where my desk is makes it easier for me to pay attention in class" (question 2), was preferred in initial cluster desk arrangement (*Z* =-3.606, *p = 0.000)*. Similarly for question 3, "the placement of the desks makes it easy for me to move around the classroom" significance was preferred in the cluster formation, indicating mobility improved in this formation (*Z* =-2.646, *p = 0.008)*. Detailed results are in Table 3.

Qualitative Results.

Themes among teacher survey questions are located in Table 3. Themes were determined by reading the teacher responses to the first survey and noting similar patterns and quotations. This continued for the next two surveys. Question six on the teacher survey did not save and thus no information was gathered from this question. Finally, all three surveys were compared question by question and themes were triangulated. According to the teacher, when desks moved into rows, "controlled chaos turned into chaos" and she was "not able to teach to the best of [her] abilities." When desks were located in clusters, students were able to "socialize and discuss with neighbors easily."

Discussion

Ghaziani (2008) noted the importance of looking at the school environment not just as a place of learning, but also a place for socialization. The current study's results demonstrated that desk arrangement affects both teacher and students' perceptions of some aspects of students' social interactions, and that a clustered arrangement was more beneficial in promoting positive social interaction than rows in this classroom setting. However, this does not imply that all

classrooms would function best with a clustered design. The teacher in this study preferred the

cluster arrangement in her classroom thus the teacher might have seen more negative implications

in the row formation. Gremmen et al., (2016) reported rows to promote a quieter environment and

thus selected as the intervention to this design. Rows for this classroom did not provide a quieter

environment in this classroom as reported by the teacher. The results of this study cannot be

separated from the complex relationships between specific contexts such as the personalities of

the teacher and students, other environmental factors such as visual aids and lighting, learning

styles, and personal preferences. The optimal classroom design will likely need to be determined

for individual classrooms which vary in the multiple contextual factors that influence classroom

sociality and function.

Implications

Occupational therapists can be a valuable asset to school systems as consultants, where

they can promote an optimal learning environment for all students through their professional

knowledge of ergonomic design, sensory considerations, and how environment may affect a

person's participation in occupation. The occupational therapy scope of practice includes diverse

activities to "maximize participation in valued occupations, programming to maintain wellness,

and interventions to restore function and reduce the impact of impairments" that other health

professions do not consider (Case-Smith, Page, Darrah, Rybski, & Cleary, 2014, p. e56).

Additionally, occupational therapists are experts in combining concepts of universal design,

ergonomics, environmental modification, and energy conservation to promote health in all types

of settings and populations (Case-Smith, et. al, 2014). Finally, occupational therapists are skilled

in utilizing evidence-based practice, leading interprofessional teams, and advocating for clients

(Case-Smith, et. al, 2014). By incorporating research into practice and effectively communicating

with team members, occupational therapists are able to employ best practice techniques to

advocate for their clients who may not receive skilled services otherwise. Together, all of these

skills could allow occupational therapists in the school systems to not only provide consultation

on desk arrangements and work individually with children with disabilities, but to be consultants

for other aspects of the school system to enhance learning for all students.

Future Research

Future studies could determine if desk arrangement affects social interaction in other areas of education such as high schools, middle schools, other elementary schools, and preschools. Future studies could also look at smaller metropolitan or rural area schools to determine if desk arrangement affects social interaction in those areas as well. More research is needed on the role of occupational therapy in school systems to determine to what extent their skills could further be utilized and other areas of the classroom that could be modified to enhance student's overall learning environment.

While seating arrangement was the focus of this study, other aspects such as lighting and color need to be considered and researched. These are aspects on which occupational therapists can provide client-centered consultation to both the classroom teachers and school building designers, as there is a current disconnect between the physical classroom design and the clients that it serves (Lei, 2010). The classroom environment affects students' ability to fulfill their roles as students and successfully perform their education-based occupations. The education system needs occupational therapists to broaden their school-based practice and fulfill roles as consultants on physical classroom design aspects to provide an optimal learning environment with the most potential for student success. Other aspects of consultancy within the education system could include, but are not limited to, sensory integration and processing, movement patterns, vestibular input, and social participation. A case study about a boy with Autism Spectrum Disorder by Schaaf, Hunt, and Benevides (2012) measured changes in sensory processing following 10 weeks of occupational therapy intervention sessions. Occupational therapists used a sensory integration approach and after the 10 weeks, the child's teacher reported no issues interacting with his peers socially and improved attention in class to the extent

that he did not need any assistance from the aide to complete his homework (Schaaf, Hunt, & Benevides, 2012). Occupational therapists as consultants can assist teachers in developing sensory activities that would fulfill the needs of sensory seeking students in order to increase their ability to function independently in their education-based occupations. Occupational therapists as consultants in the school system could assist teachers in designing their classrooms to meet their students' needs.

Application

This study supports the need for further research to establish other aspects of school-based occupational therapy consultancy, including the physical parameters of classroom design, in order to provide an optimal learning environment that works toward all children's successful occupational performance as they fulfill their roles as students.

Many school systems across the United States are implementing a systematic approach to early intervention practice in order to identify struggling students and provide supports needed for successful student participation in the classroom (American Occupational Therapy Association [AOTA], 2014). This multi-tiered approach called Response to Intervention (RtI) creates opportunities for occupational therapists as consultants in school systems to provide skilled services to all students as preventative and proactive measures (American Occupational Therapy Association Response to Intervention Workgroup, 2012). The three tiers divide the student population into groups based on need for special services. The largest, tier one, consists of 80-90% of the student population who may not require individualized services, but may benefit from proactive measures to ensure their continued success in school (AOTA, 2014). The smaller tiers, two and three, represent the students that need more individualized assistance.

This study has implications for tier one, in which occupational therapists would focus on suggesting or implementing interventions to support the whole classroom population, such as educating school professionals to develop classroom curricula, assisting with screening to identify struggling students, and applying universal design principles, among others (AOTA, 2014). Overall, the growing use of the RtI approach in schools allows occupational therapists to offer population-based interventions in the classroom as well as individualized and small group therapy to increase the successful participation of all students.

Limitations

There were multiple limitations to this study. The principal investigator's daughter was a student in the classroom studied. This could have caused a bias of the daughter trying to answer how her mother thought she should answer the questions. Another limitation was that Turning Technologies® took a long time to set-up, which caused the students to be distracted and restless. The students also yelled out answers each time they pushed a button, which may have influenced the other student's answers. Additionally, clicker power could not be individually monitored and some students were absent on survey days. For this reason, the researchers received 22/24 answers on the first survey and 21/23 answers on the second, which reduced the student sample size. The teacher completed the survey in two parts due to time constraints, with the second half of the survey completed five hours after the first half of the survey, which may have influenced the quality of answers provided by the teacher, resulting in another limitation. Also, in question one of the teacher survey the question states for the teacher to think about the past month when desks were altered every two and a half weeks. Students were not always sitting in the same position during each survey (students changed locations in the classroom with each new desk

arrangement) presenting another limitation. Depending on where or who they were sitting by, the students' perspective of social interaction may have been altered, producing skewed results. The surveys administered to both the teacher and students were created to gather information specific to the relationship between the variables of classroom design and social interaction, indicating construct validity. No administration of the surveys occurred prior to use in the study, and the surveys are not standardized. Finally, the survey lacks reliability, as the results of the survey may not be generalizable to different school settings or to the classrooms of alternate grade levels.

Conclusion

This study demonstrated that desk arrangement does affect social interaction in the elementary school setting of third grade students in a large metropolitan school. This survey design provided in-depth information from teachers and students regarding desk formation and its impacts. Occupational therapists as consultants in school systems could apply evidence-based practice in many areas beyond traditional practice. The profession of occupational therapy must begin to document emerging areas of practice in order to provide clinicians with greater understanding of how a consultancy role can provide for the general population.

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Appendix A

Table A1

Students' Survey Questions

Question Number	
Trial 1	How often do you play sports?
Trial 2	I like to eat ice cream.
1	Where my desk is makes it easier for me to pay attention in class.
2	The placement of the desks makes it easy for me to move around the classroom.
3	I talk to my friends a lot during the day while sitting at my desk.
4	I think that the location of my desk makes it easier to work with my classmates.
5	I am not paying attention to the teacher because I am talking to my friends or desk neighbors.

Appendix B

Table B1

Teacher's Survey Questions

Question Number	
1	During the last month, describe any student interactions that have prompted or would prompt you to move or rearrange desk placement.
2	How do you handle problem behaviors such as excessive talking?
3	Based upon this current desk arrangement, describe at what point within the day the children are more likely to interact with each other.
4	When considering this current desk arrangement, do you feel behaviors need to be corrected more or less frequently? Please describe.
5	How do your lesson plans include station rotations/movement activities?
6	How do you utilize this desk arrangement to encourage group work between the students?
7	Do you think the classroom decorations sometimes are a distraction to the students? Please describe.
8	How does the current desk arrangement influence your teaching presence?

9   How do you feel the students responded to this desk arrangement?

10   How do you feel about this desk arrangement?