Choice as a strategy to enhance engagement in a color occupation in children with autism spectrum disorders

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Choice as a Strategy to Enhance Engagement in a Coloring Occupation in Children with Autism Spectrum Disorders

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This scholarly project reflects individualized, original research conducted in partial fulfillment of the requirements for the Occupational Therapy Doctorate Program, The University of Toledo.
Abstract

This study investigated the effect of choice on a coloring occupation in children with Autism Spectrum Disorders (ASD). The effect of choice on occupational performance has been investigated in several other populations; however, no study has addressed this with children with ASD. Children with ASD typically have difficulty engaging in purposeful occupation, which makes it difficult for adaptation of skills to occur in a therapeutic or educational setting. The hypotheses for this study are as follows: 1) there will be an increase in the quality of coloring in the choice condition versus the no choice condition, and 2) there will be an increase in the duration of the coloring in the choice condition versus the no choice condition. The participants in this study were 26 male and female children with ASD, ranging from 8 to 15 years old. This study used a counterbalanced design with the participants yoked into dyads. Each participant completed a coloring occupation in a no choice and a choice condition. Completed pictures were scanned into the computer and analyzed by the amount of pixels colored onto the page. No significant difference of the amounts of pixels colored in the choice condition versus the amount of pixels colored in the no choice condition \( (p = 0.498) \) with no effect size, however, there was a significant difference \( (p = .005) \) in the amount of time children colored in the choice versus the no choice condition. There was a small effect size. While the results of this study did not support the hypothesis that children with ASD would color with a higher degree of quality in the choice condition versus the no choice condition, they did support the hypothesis that children with ASD would color for a longer amount of time in the choice condition versus the no choice condition. This study has demonstrated that by offering a choice in a coloring occupation, children with ASD will participate and engage in the coloring task for a longer period of time.
The Effect of Choice in a Coloring Occupation in Children with Autism Spectrum Disorders

Promotion of choice is one of the keys to the uniqueness of the occupational therapy process (Yerxa, 1967). In occupational therapy, self-initiated occupation is our “stock and trade” because we cannot force an individual to initiate occupation unless he or she chooses to do so (Yerxa, 1967, p. 3). Occupational therapists have an active role in providing opportunities to help a client reach a larger goal; however, the client should be an active participant in the treatment process by choosing to complete specific occupations that have personal significance. Several researchers have investigated the effect of choice in various populations (e.g., Taber, Baron, Blackwell, 1953; Henry, Nelson, & Duncombe, 1984; Rice & Nelson, 1988; LaMore & Nelson, 1992; Schroeder Oxer & Kopp Miller, 2001; Roth, 2003); however, there is need for research about the effect of choice in children with Autism Spectrum Disorders (ASD). Occupational therapy is a profession that commonly uses interventions to assist children with ASD. The ability of children with ASD to complete day-to-day occupations can be enhanced by the occupational therapy process. Children with ASD show delayed or abnormal functioning by the age of three with social interaction, language used in social communication, or social play (Morrison, 2006). Many children with ASD have difficulty with engagement in occupation secondary to decreased communication and interaction skills. Occupational therapy is an intervention that can assist children with development in these areas.

Occupational therapy is a service many schools provide for children with ASD. This is particularly true if the child has an individualized education plan (IEP) that specifies the need for occupational therapy services. Occupational therapists work with individuals with ASD in schools on skills that will facilitate their educational goals as much as possible. To this end, one of the skills occupational therapists work on with children with ASD is fine motor coordination.
Fine motor coordination is especially important during pre-handwriting, handwriting, and self-care occupations. For adaptation to occur, the child must be an active participant when working on these skills with the occupational therapist. This can be a challenge because of the decrease in engagement commonly seen in children with ASD.

The etiology of ASD is very complex and largely unknown (Newschaffer et al., 2007). There have been many theories regarding the cause of autism (Bernard et al., 2001; Costa e Silva, 2008; Previc, 2006); however, no formal etiology has been discovered. Various theories have focused on genetics and environmental factors (Costa e Silva, 2008), prenatal stress (Previc, 2006), and vaccinations (Bernard, Enayati, Redwood, Roger, & Binstock, 2001). There have been recent implications of the anatomical differences found in the brains of children with autism as compared with typically developing children; however, there are many theories regarding this issue (Amaral, Mills Schumann, & Wu Nordahl, 2008; Hazlett, Poe, Gerig, Smith & Piven, 2006; Hadjikhani, Joseph, Snyder, & Tager-Flusberg, 2006; Hardan, Muddasani, Vemulapalli, Keshavan, & Minshew, 2006; Hardan, Minshew, Harenski, & Keshaven, 2001; Yip, Soghomonian, & Blatt, 2007; Juraneck, Filipeck, Berenji, Modahl, Osann, & Spence, 2006; Munson, Dawson, Abbott, Faja, Webb Friedman, et al., 2006; Sparks, Friedman, Shaw, Aylward, Echelard, Artru, et al., 2002).

Based upon existing MRI studies, Amaral et al. (2008) discusses the theory that suggests that young children with autism have a 5%-10% abnormal enlargement in total brain volume. There is also some evidence of abnormal growth of gray and white matter in the frontal, temporal, and parietal lobes, with the abnormal enlargement in the frontal lobe being the most common (Hazlett et al., 2006). Other studies have focused on the cortical areas of the brain, noting abnormalities such as thinning or thickening of the frontal cortex (Hadjikhani et al, 2006;
Hardan et al., 2006). Research in this area has also focused on the enlargement of the cerebellum, which in several studies showed abnormal enlargement or a decrease of Purkinje cells (Hardan et al., 2001; Yip et al., 2007). There has also been evidence of a 13%-16% enlargement in the amygdala of children with autism, which has been an area recently associated with severe anxiety and decreased social/communication skills (Juranek et al., 2006; Munson et al., 2006; Sparks et al., 2002). There is a need for further research regarding the etiology of ASD as well as what types of interventions are the most successful to use when working with children with such a unique disorder.

One of the challenges occupational therapists face when working with children with ASD is finding a method to increase engagement in occupation. One of the most striking characteristics of children with ASD is the relative lack of affective engagement and communication with others (Wimpory, Hobson, & Nash, 2006). Many children with ASD display stereotypic behaviors such as hand flapping, body rocking, head rolling, oral/vocal repetitions, repetitive object manipulations, or self injurious behaviors (Lee, Odom, & Loftin, 2007). Stereotypic behaviors such as this may prevent children with ASD from engaging fully in occupation.

One strategy occupational therapists can use to increase engagement when working on fine motor coordination is to allow the children to make a choice regarding the occupation they will complete. When an occupation holds a special interest to a child, there is a greater opportunity for adaptation to occur on the child’s part (Nelson, 1984). To promote choice in a treatment session, an occupational therapist can synthesize different occupations that are similar in some ways to each other but are different in terms of interest to the child (Nelson, 1984). This
is a way that occupational therapists can structure the environment while continuing to provide choice for the child.

Meaning to the child is an important aspect of occupational therapy treatment in schools. “Meaning is the entire interpretive experience engaged in by an individual encountering an occupational form” (Nelson & Thomas, 2003, p. 101). If an occupation holds meaning for the child, he or she may be more willing to participate. If the child is given a choice, the occupation selected is assumed to have more meaning to the child. If the occupation has more meaning to the child, a higher level of purpose will occur. Purpose is the experience of desiring an outcome; in other words, after a person perceives an occupational form and ascribes meaning to it, he or she wants to do something about it or with it (Nelson & Thomas, 2003). “Adaptation is the effect of occupational performance on the person’s developmental structure” (Nelson & Thomas, 2003, p. 119). Having a high level of purpose can increase the level of adaptation that occurs in a child’s developmental structure. “A person’s developmental structure consists of sensorimotor, cognitive, and psychosocial abilities and characteristics” (Nelson & Thomas, 2003 p. 99). The adaptations that occur in a person’s developmental structure are dependent upon the capacities of the person and the person’s the choice to use those capacities (Yerxa, 1967). This can be achieved by allowing the child to have a choice in the treatment process. Several researchers have investigated the effect of choice during a variety of occupations (e.g., Taber, Baron, Blackwell, 1953; Henry, Nelson, & Duncombe, 1984; Rice & Nelson, 1988; LaMore & Nelson, 1992; Schroeder Oxer & Kopp Miller, 2001; Roth, 2003)

One way to understand the process of choice in children with ASD is to analyze the process in steps. The model presented in a study of task preference and quality of reach in healthy adult women (Rice & Renock, 2006) can be applied to the effect of choice in children
with ASD (see Figure 1). For instance, in an occupation where the child is asked to choose a picture from a number of potential choices, an array of pictures is presented to the child. As the child looks at the pictures, perception of them occurs. As the child perceives the pictures, he or she ascribes meaning to them. After the meaning is ascribed to the pictures, the perception of the picture may change. The meaning of each picture is influenced by the affinity the child has for each picture. The affinity is formed based on the child’s memories, mood, goals, and other cognitive influences. The child then develops a preference for a specific picture. This preference is influenced by the level of affinity the child has for each picture. Purpose is formed, and the decision is made to act in response to a specific picture. The choice is made and the movement pattern occurs. At this point, the child indicates his or her preferred picture.

Taber, Baron, and Blackwell (1953) investigated the effects of a free choice craft group versus a task directed craft group in 50 patients living in a psychiatric facility. The dependent variables in this study were social attitude, work tolerance, work quality, organization, impulsiveness, directability, interestedness, and cooperativeness. The midpoint of the scale for each of the variables was considered the “normal limit.” Any deviation in either direction was considered to be away from the norm. The participants in this study were matched based on diagnoses by the therapist and separated into a directive and non-directive craft group. The results of this study suggest that patients who participated in the free choice craft group demonstrated work tolerance and psychosocial behaviors close to the norm.

Henry, Nelson, and Duncombe (1984) investigated the effect of choice on 40 college-aged females in group and individual settings during an origami occupation. Participants were randomly assigned to one of four conditions 1) individual-choice, 2) individual-no choice, 3) group-choice, and 4) group-no choice. Participants were yoked into pairs (e.g. a participant
choose a certain origami occupation, and the participant paired with him or her was automatically assigned the origami occupation that he or she chose. This study examined the self-perception of the participants in each condition. The results of this study showed that there was a significant difference in self-perception in the choice and no choice groups. This suggests that allowing choice can particularly affect self-perception in college-aged females.

Amabile and Gitomer (1984) investigated the effect of choice in task materials on children’s artistic creativity. This study used a matched-pairs design to compare the choice condition to the no choice condition in regards to creativity. Participants were between the ages of 2 and 6 years. The children were presented with a total of 10 boxes containing different types of supplies used when making a collage. In the choice condition, the child was asked to select 5 of the boxes to use for the collage. The remaining 5 boxes were removed. The participants were randomly yoked into pairs, so the corresponding child in the no choice condition was automatically given the 5 boxes of supplies the child selected in the choice condition. The occupation completed was a collage. The results suggest that creativity was enhanced when the children had a choice of which materials to use for their collage.

Rice and Nelson (1988) investigated the effect of choice during an ironing occupation. The participants in this study were 24 adolescent and adult males with mental retardation. The participants were yoked into pairs in a counterbalanced design. The choice condition consisted of a participant choosing a t-shirt with a sports team logo. The second member of the pair automatically received the t-shirt with the logo the first member chose. The shirts were systematically wrinkled and sprayed with water. The results of the study demonstrated that the participants ironed more thoroughly in the choice condition. This was measured by weighing the shirt pre and post occupation to see how much water had evaporated from the heat of the iron.
This showed that having a choice in an ironing occupation enhanced the level of participation in adolescent and adult males with mental retardation.

LaMore and Nelson (1992) completed a study that examined the effect of choice on performance of an art project in 22 adults with mental disabilities ranging from severe to mild. The craft completed was painting a ceramic figure. The results showed that the participant painted significantly more in the choice condition than in the no choice condition. This suggests that choice making can enhance occupational performance.

Schroeder Oxer and Kopp Miller (2001) also investigated the effect of choice in an art occupation. This study involved 32 adolescents diagnosed with psychiatric conditions. The occupation completed was painting a plaster figure. The amount of dips into the paint and the time spent painting were significantly higher in the choice condition than in the no choice condition. The authors concluded that having a choice at the beginning of an art project can enhance the performance of adolescents with psychiatric conditions living in a residential facility.

In a study by Roth in 2003, the effect of choice on quality of movement in 20 adults with mental retardation was examined. A counterbalanced repeated measures design was used to look at the quality of movement when reaching for a preferred can of soda. The quality of movement was measured by motion analysis technology equipped to measure movement units, movement time, displacement, peak velocity, and percentage of time to peak velocity. In this study, no significant differences were found; however, there were several limiting factors to this study. For instance, the researchers stated that soda, regardless of type, was such a high motivator to the individuals in this study, that it was difficult to get a clear picture of the effect of choice.
While there have been several studies regarding the effect of choice, there has not been research regarding the effect of choice in school aged children with ASD. The purpose of this study is to investigate the effects of choice on the quality and duration of a coloring occupation in children with Autism Spectrum Disorders. The hypotheses for this study are as follows: 1) there will be an increase in the quality of coloring in the choice condition versus the no choice condition, and 2) there will be an increase in the duration of the coloring in the choice condition versus the no choice condition.

Method

Participants

The participants in this study were male and female children with ASD from local area schools with ages ranging from 8 to 15 years. All participants had a primary or secondary diagnosis of autism. They were required to have the cognitive skills necessary to follow directions and make a choice to participate in this study as determined by the child’s parent or teacher. Participants were required to have the ability to grasp and color with markers.

Apparatus

Each participant completed a coloring occupation in a no choice and a choice condition. Depending on the condition, participants either chose from three pictures or were assigned which picture to color. The pictures templates were available on an 8 ½” by 11” sized piece of paper. The pictures were colored using Crayola Broadline Markers-Classic-8 count (55-7708). The colors included were red, orange, yellow, green, blue, purple, black, and brown. The templates offered to each participant were developed with the same amount of surface area. The pictures offered were four faces with different facial expressions. See Figures 2-5. To calculate the
amount colored, each picture was scanned into Photoshop with a resolution of 300 pixels per inch. The scanner was an Epson Perfection, model number 4180 (Nagano-Ken, Japan).

Procedure

This study used a counterbalanced design with the participants yoked into dyads. Counterbalancing was achieved by allowing the first member of the dyad to select one of the pictures to color, and subsequently assigning the choice of the first member of the dyad to the second member. In each condition, participants were seated in a chair with large markers in front of them. The child was then given a choice out of three template pictures on paper. After the child indicated his or her choice, the picture chosen was placed in front of him or her. The participants were given verbal instructions to take as much time as needed to color the picture with the markers. They were provided with pictures of a red light and a green light to use for indicating if they are still coloring or all finished throughout the occupation. They were instructed to get up from the table when they were finished coloring the picture. The participants were timed with the use of a stopwatch throughout the coloring occupation. The start time began as soon as the marker touched the paper. If the participant stopped coloring, he or she was asked “are you finished coloring your picture?” If the child indicated verbally, physically, or by pointing to the red light, that he or she was finished, the stop time was recorded. If the child indicated more time was needed, more time was given. The child was asked this each time he or she stopped coloring until the child indicated he or she was finished. After the child completed the coloring, the amount colored was calculated for each condition. Each picture was scanned into the computer in order to calculate the amount of pixels colored by each child. The process for calculating the amount colored is explained in the Dependent Variables and Statistical
Analyses section. Once the scanning process was completed, the child was given the colored picture as well as the package of markers to keep as a "thank you."

**Dependent Variables and Statistical Analyses**

Dependent variables included coloring quality and time on task. Coloring quality was defined as the amount of pixels filled with color within the object that was colored. Each choice of object had the same amount of available surface area to color as each picture offered was developed using a circle with a diameter of 6.5625 inches. Coloring quality was reported as an error score; therefore, a picture colored and given a lower score would be colored with higher quality. Time on task was derived using a digital stop watch that was operated as long as the child was coloring as per the above stated protocol. A one-tailed paired Wilcoxon signed rank test was performed to compare the performance during the choice condition with the performance of the no-choice condition for time on task as well as error score.

The amount of pixels for each figure was calculated using the following process. After the child colored the picture, the amount of color was calculated in pixels. The amount of template pixels was subtracted from the amount of pixels colored by each child. The amount of pixels was calculated using the select and histogram features within the Photoshop program. This process allows one to calculate the amount of pixels colored by each child. The scans of the figures were saved into a Tiff file in Photoshop. One file was made to represent the exact circle size used for the original prints. This file was used throughout to standardize the circle size for all children’s drawings. This will be referred to as the circle layer in the following. The original scan was cropped to 8.5” x 11” at 300 dots per inch. The white point for the background was set to 255. The circle layer was added and original scan is scaled to the exact same size. The background layer was duplicated and the original was deleted. This layer was then duplicated.
and titled background copy. A new layer was made and named circle. At this point there were four layers: reference circle, circle, background, and background copy. A selection was made just outside the circle from the background layer. The selection was adjusted to just touch the outside of the original and saved. This selection was cut and pasted to the circle layer. The magic wand tool was used to select a clear white area from the background layer. The number of white pixels in the histogram tab was read and recorded. This was the total number of white pixels remaining in the figure. The same procedure was completed in the circle. This number was the number of white pixels remaining inside the circle. There were a total of 131,747 pixels in the original file. There were a total of 44,272 pixels inside the circle of the original file. The total number of pixels each participant added to the figure was calculated by subtracting the number of white pixels remaining in each figure and the number of black pixels from the original figure from the total number of white pixels in the original figure.

Results

Hypothesis 1) stated that there would be an increase in the quality of coloring in the choice condition versus the no choice condition. The mean percentage of amount colored in pixels in the choice condition was 22.26% with a standard deviation of 19.02%. The mean percentage of amount colored in pixels in the no choice condition was 21.16% with a standard deviation of 16.52%. A one-tailed, paired Wilcoxon signed rank test revealed no significant difference of the amounts of pixels colored in the choice condition versus the amount of pixels colored in the no choice condition \( (p = 0.498) \) with no effect size. See Table 1 and Figure 6.

Hypothesis 2) stated that there would be an increase in the duration of the coloring in the choice condition versus the no choice condition. The mean amount of time children colored in the choice condition was 202.7 seconds with a standard deviation of 183.4 seconds. The mean
amount of time children colored in the no choice condition was 154.6 seconds with a standard deviation of 137.2 seconds. A one-tailed paired Wilcoxon signed rank paired t-test showed a significant difference ($p = .005$) in the amount of time children colored in the choice versus the no choice condition. There was a small effect size. This demonstrates that these children with autism were engaged longer when given a choice of what figure to color. See Table 1 and Figure 7.

Discussion

The purpose of this study was to investigate the effects of choice on the quality and duration of a coloring occupation in children with ASD. While the results of this study did not support the hypothesis that children with ASD would color with a higher degree of quality in the choice condition versus the no choice condition, they did support the hypothesis that children with ASD would color for a longer amount of time in the choice condition versus the no choice condition.

Contrary to Hypothesis 1, the amount of pixels colored in the choice condition versus the no choice condition yielded no significant results. One reason this could have occurred is that children with autism spectrum disorders often have difficulty with fine motor tasks. While the children may have been engaged for a longer period of time during the coloring occupation, the results of the colored pictures may have continued to demonstrate impairment with fine motor tasks. It may be that the amount of coloring was similar for the for both the choice condition and the no choice condition because the participants were not so much concerned with the quantity of color they placed on the page, but rather were perhaps more concerned with the location of their marks; in other words, the participants may not have equated quality with quantity in this coloring occupation.
In support of Hypothesis 2, the amount of time children were engaged in the coloring occupation was significantly different in the choice and no choice conditions. On average, participants colored for 48.1 seconds longer in the choice condition. Many children with autism struggle to maintain engagement in purposeful occupation secondary to decreased interaction and communication skills (Wimpory et al., 2006). In order to develop and learn new skills, it is imperative that children with ASD be engaged with teachers, therapists, and parents. Children with ASD commonly show impairment with social interaction, social play, and communication (Morrison, 2006). The children with ASD in this study were engaged significantly longer when given a choice of what picture to color. Giving choice in a task can increase occupational engagement in order to teach children with ASD new skills.

It is possible that the children with ASD may have colored longer when given a choice because they enjoyed the occupation of coloring. The goal of the participants’ may have been different in the choice condition versus the no choice condition. As mentioned above, it is possible that participants did not see covering the page as important, and they just enjoyed being “in” the occupation. The amount of color covering the page may not have been part of their strategy. In some instances, participants drew on to the pictures of faces versus coloring in the faces. Participants may have been more thoughtful about “how” they colored, instead of mass color coverage. This idea offers another explanation of why the amount of pixels may not have changed; however, the duration of time after having been given a choice, showed a marked increase.

The only difference between the choice condition and the no choice condition was the presence of choice in what facial expression was to be colored. The occupational form was the same in each condition for each participant. Giving choice can increase an individual’s
perception of locus of control. This perception of locus of control may be something that participants do not often experience. Having this perception may increase the amount of meaning that an individual ascribes to an occupation and its associated occupational forms. When this occurs, an individual may be more motivated to participate in an occupation. Motivation and engagement in occupation are major issues facing children with ASD (Wimpory, Hobson, & Nash, 2006). This study shows that providing a choice may be a strategy to increase motivation and engagement in purposeful occupation. Providing children with ASD choices may be a way to increase the “potency” of an occupational therapy session.

Occupational therapists can utilize choices within treatment sessions by using creativity when planning sessions. For example, an occupational therapist may give a child a choice of two occupations that require the use of the same skill, such as fine motor coordination. The child could be working toward the same goal; however, would be more motivated engage for a longer period of time when given a choice of which occupation to complete. This strategy could be utilized in many ways when completing occupational therapy with individuals with ASD and other developmental disabilities.

The increase in duration of engagement in a coloring occupation is strengthened by the similarity to results from previous studies involving individuals with cognitive impairments (Taber et al., 1953; Rice & Nelson, 1988; LaMore & Nelson, 1992; Schroder Oxer & Kopp Miller, 2001). In each of these studies, individuals with cognitive impairments were more successful in a task when given a choice of task. The results of this study strengthen the evidence that individuals with disabilities benefit from having some control over the occupations they complete.
In Rice and Nelson (1988), used the amount of water evaporation as the dependent variable to measure the effect of choice on a T-shirt ironing occupation completed by adolescent and adults with mental retardation. The results of Rice and Nelson (1988) demonstrated that there was less water remaining in the shirts after the ironing in the choice condition compared to the no-choice condition. While Rice and Nelson (1988) didn’t directly measure time as a dependent variable, it is safe to assume that there would be a linear relationship between the amount of water evaporation and the duration of time attributed to the ironing task. In the present study, the results indicated that as the amount of time coloring increased; however, the amount of color on the page did not significantly increase.

Schroeder Oxer and Kopp Miller (2001), also used an art project to investigate the effect choice had on occupational performance in individuals with psychiatric disorders. In this study, the dependent variables were the amount of time spent painting and the number of paintbrush dips into the paint. These dependent variables are similar to the present study in that they were being utilized to quantify the degree of completion, and therefore, the occupational performance on a project. Schroeder Oxer and Kopp Miller (2001) found that there was a significant increase in both the amount of time spent painting and the number of paintbrush dips.

There are several explanations for the differing results of Schroeder Oxer and Kopp Miller’s (2001) study and the present study. The results of Schroeder Oxer and Kopp Miller (2001) and the present study, indicated that there was a difference in perception of quality between adults and children. With adults, perception of quality may be linked to the amount of completion of a project; whereas, in children, the perception of quality may be linked with the time engaged in the occupation. The other difference in these two studies is the population utilized for participants. In Schroeder Oxer and Kopp Miller (2001), the participants were
individuals with psychiatric disorders, unlike the present studies population of children with ASD. While in both populations, a degree of cognitive impairment is likely present, each diagnosis presents somewhat differently. It is also possible that the surface area for the figures painted in Schroeder Oxer and Kopp Miller’s (2001) study were smaller than the surface area of the faces colored by children with ASD. This could make the results show a larger percentage of surface area painted than may have been if the figurines were larger. The occupation of painting a figurine may have also required a greater degree of fine motor coordination.

The coloring occupation completed by children with ASD may have also been affected by the presence of the primary investigator in the room. Participants’ may have adjusted their occupational performance to please or displease the primary investigator. Parents of participants may have also had an effect on occupational performance. Participants may have had visual sight of parents, indicating departure as soon as the occupation was completed.

Sources of potential bias include the primary investigator who completed data collection and the data analyzer. The individual involved in data collection could have been biased towards the study by being aware of what condition each child was in, which could have affected the results. The individual who completed data analysis may have been biased in being aware of the choice versus the no choice conditions, which also could affect the results of the study.

The measures utilized with this study include a timing program, as well as, calculation of pixels. Timing the children’s engagement in a coloring occupation was completed using a computerized stop watch. While the stop watch was very precise and measured the time to the 10th decimal, it is possible that statistical error could have been introduced by the subjective nature of the human interaction to initiate and stop the stopwatch. Calculation of pixels is also a very precise measurement of the amount colored. While there is a margin of error in any
measurement tool, pictures were scanned in at 300 dpi; which allowed the analyzer to be precise in measurement. Also, it is important to note that with the scanning process, the margin of error is the same for all of the pictures analyzed. Another limitation of this study is that it had a relatively small number of participants from a relatively small community in the Midwest portion of the United States, which could limit the generalization of the results. Results may have been different if participants were for another community or had been integrated in school with children without disabilities.

The results of this study support the hypothesis that children with ASD color for a longer duration when given a choice of what to color. The results do not indicate a difference in quality of coloring in a choice condition versus a no choice condition. Further research needs to be completed to determine how choice affects occupational performance in individuals with ASD.

In conclusion, this study has demonstrated that by offering a choice in a coloring occupation, children with ASD will participate and engage in the coloring task for a longer period of time. When working with individuals with ASD, it is important to understand and to be aware of effective strategies for increasing participation and engagement in occupations. This study suggests that incorporating ‘choice’ as a part of the therapeutic occupation can be an effective strategy for increasing participation and engagement. There is also a need for continued research investigating choice in children with ASD. Research investigating the relationship of choice and occupational performance may be an integral part of understanding the most successful interventions for teaching children and young adults who have ASD. There is also a need to investigate the effect choice has on occupational performance in adults with ASD.
References


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Table 1.

*Wilcoxon signed rank tests comparing the choice versus no-choice conditions for percent colored and time coloring.*

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Sum of Positive Ranks</th>
<th>Sum of Negative Ranks</th>
<th>Sum of Signed Ranks</th>
<th>p-value</th>
<th>Effect Size d</th>
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<td>Percent Colored</td>
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<td>.06</td>
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<tr>
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<td>-74.0</td>
<td>203.0</td>
<td>0.0051</td>
<td>.30</td>
</tr>
</tbody>
</table>
Figure 1. Relationship between perception, meaning, affinity, preference, purpose, and movement performance. Model from Rice & Renock (2006) p. 578.
Figure 2. 198,553 pixels within circle (168,987 white, 29,566 black)
Figure 3. 196,310 pixels within circle (169,346 white, 26,964 black)
Figure 4. 196,308 pixels within circle (169,127 white, 27,181 black)
Figure 5. 195,771 pixels within circle (169,191 white, 26,580 black)
Figure 6. Percent of page colored for the Choice and No-Choice Conditions.
Figure 7. Amount of time spent coloring in the Choice and No-Choice Conditions.