

RESEARCH ARTICLE

Choice as a Strategy to Enhance Engagement in a Colouring Task in Children with Autism Spectrum Disorders

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Abstract

This study investigated the effect of choice on a colouring task in children with autism spectrum disorders (ASD). Children with ASD typically have difficulty engaging in purposeful activities, which makes progress toward skill development difficult in therapeutic or educational settings. Participants included 26 male and female children with ASD, aged 8 to 15 years. In this counterbalanced design, participants either chose which picture to colour or were given a picture to colour. When given a choice, participants spent more time colouring ($p = 0.005$) and used more coloured markers ($p = 0.016$), but did not colour more of the page ($p = 0.498$). This study demonstrated that when offering a choice in a colouring activity, children with ASD participated and engaged in the colouring task for a longer period of time and used a larger array of markers while doing so. However, associated small effect sizes require caution with generalization. Future research should focus upon offering choice with other age-appropriate activities to determine its efficacy as a useful strategy for facilitating activity engagement for children with ASD. Copyright © 2012 John Wiley & Sons, Ltd.

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Effect of choice in a colouring occupation in children with autism spectrum disorders

This study explores the concept of choice making upon task engagement in children with autism spectrum disorders (ASD). Promotion of choice is one of the keys to the uniqueness of the occupational therapy process (Yerxa, 1967). Self-initiated occupation is a tenet of occupational therapy “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 engage within and among specific occupations that have personal significance.

A fundamental assumption upon which this study rests is that providing options (i.e. a choice) is intrinsically motivating. The ability to make a choice is believed to be an essential component of self-determination

(Wehmeyer *et al.*, 2007). Furthermore, it is believed that when the opportunity for making a choice is provided, people respond to the choice on the basis of their own personal interests, motivation and capabilities. This concept has been included in occupational therapy literature since the founding of the profession. Specifically, Baldwin argued that patients should be offered a variety of equally desirable options from which to choose (Baldwin, 1919). Moreover, King (1978) surmised that offering a choice resulted in enhanced performance because of an increase in motivation associated with having been given the option to choose. Rice and Nelson (1988) and LaMore and Nelson (1993) considered this self-determination, or as they termed "locus of control", to be of paramount importance to be included in the delivery of occupational therapy services to those with intellectual and mental disabilities. Kielhofner (1992) highlighted the importance that choice making has in the development of personal causation. This concept of personal causation is congruent with self-determination's inherent ideas of being able to determine one's fate without compulsion. The provision of choice-making opportunities is particularly important for populations with chronic disabilities who have historically been denied "choice making" options as a default in their lives; hence, it is apposite to explore the concept of choice making in a population of 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. A number of different strategies have been developed to address some of these issues, not the least of which include the applied behavior analysis (Matson *et al.*, 2011) and the pivotal response treatment for children (Renshaw and Kuriakose, 2011). Dunst *et al.* (2012) completed a meta-analysis of 24 studies incorporating the interests of 78 children aged 2–6 years with ASD into early intervention practices. They found that when the interests of the child were incorporated into early intervention exercises, pro-social behaviour increased, whereas excessive motion behaviour decreased. Furthermore, these researchers found that when the interest-related behaviour focused on communication and "personal core features of ASD", favourable results

occurred more frequently than interventions focusing on suppressed or repetitive motor actions.

Ulke-Kurkcuoglu and Kircaali-Iftar (2010) recognized the importance of investigating the concept of providing choice and its effects on the ability to stay on task. In their study, they recruited four male participants aged 5 to 8 years with ASD. Within the context of a classroom experience, choice and no-choice conditions were provided. Using a repeated measures design, these researchers found that when given a choice, the participants were able to stay "on task" to a greater degree than when not given a choice.

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 *et al.*, 2007). Many children with ASD display stereotypic behaviours such as hand flapping, body rocking, head rolling, oral/vocal repetitions, repetitive object manipulations or self-injurious behaviours (Lee *et al.*, 2007). Stereotypic behaviours 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 while engaged in occupations (Rice and Nelson, 1988). 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 provide an array of different objects and encourage the client to actively choose one of the items. In doing so, occupational therapists can structure the environment while continuing to provide choice for the child. Several researchers have investigated the effect of choice during a variety of occupations (e.g. Taber *et al.*, 1953; Rice and Nelson, 1988; LaMore and Nelson, 1993; Schroeder Oxer and Kopp Miller, 2001).

Taber *et al.* (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 (i.e. being capable of receiving and acting appropriately to receiving "direction"), interestedness and cooperativeness. The results of this study suggest that patients who participated in the free-choice

craft group demonstrated work tolerance and psychosocial behaviours closest to the norm. This was one of the first studies to address the concept of “choice” and its effects upon behaviour.

LaMore and Nelson (1993) 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 within a population of adults with mental disabilities. In a similar study, Schroeder Oser and Kopp Miller (2001) also investigated the effect of choice in an art project involving painting a plastic figure. This study involved 32 adolescents diagnosed with psychiatric conditions. 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.

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 developmental delay. 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 developmental delay.

While there have been only a handful of studies regarding the effect of choice in occupational therapy, there has also been a dearth of research regarding the effect of choice in school aged children with ASD (with the exception of Ulke-Kurkcuoglu and Kircaali-Iftar (2010). The research that has been carried out, collectively, suggests that offering choice can enhance motivation and engagement in activity. The purpose of this study is to investigate the effects of choice on the

quality and duration of a colouring activity in children with ASD. A colouring activity was chosen for this population as it is age appropriate and commonly engaged in, both in school-related tasks as well as therapeutic interventions. The hypotheses for this study are as follows: 1) there will be an increase in the amount of colouring in the choice versus no-choice condition; 2) there will be more colours used in the choice versus no-choice condition; and 3) there will be an increase in the duration of the colouring in the choice versus no-choice condition.

Method

Participants

The participants in this study were 22 male and 4 female children with ASD from local area schools aged 8 to 15 years ($M = 12.2$ years, $SD = 2.3$ years). By verbal report, one participant was left hand dominant, 22 were right hand dominant and one participant's dominance was reportedly “undecided”. All participants had a 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 colour with markers.

Apparatus

Each participant completed a colouring occupation in a no-choice and choice condition. Depending on the condition, participants either chose from three pictures or were assigned which picture to colour. The picture templates were available on an 8.5 in. $\times$ 11 in. sized piece of paper. The pictures were coloured using Crayola Broadline Markers-Classic-8 count (55-7708). The colours 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 1–4. To calculate the amount coloured, each picture was scanned into Photoshop with a resolution of 300 pixels per in. The scanner was an Epson Perfection, model number 4180 (Nagano-Ken, Japan).

Procedure

This study was approved by the second author's Biomedical Institutional Review Board. Data were collected from

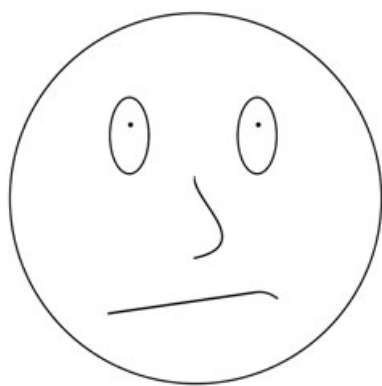


Figure 1 Face number one

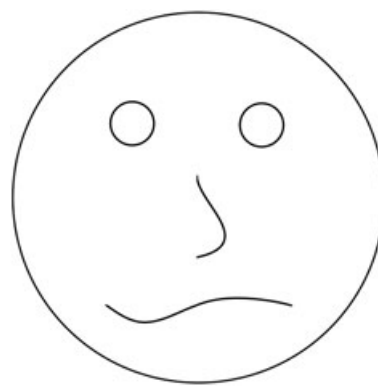


Figure 4 Face number four



Figure 2 Face number two

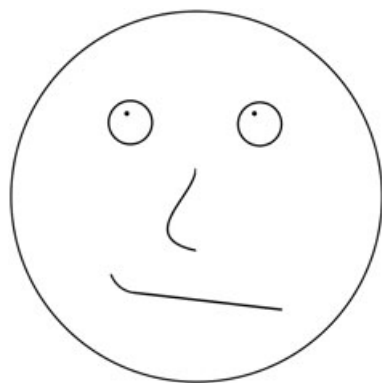


Figure 3 Face number three

October through June of 2010. 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 colour and subsequently assigning the choice of the first member of the dyad to the second member. The

assignment to the sequence of conditions (e.g. Choice, No-Choice or No-Choice, Choice) depended upon the order in which participants volunteered for the study. There was 1 week between each condition for any given participant, and data collection occurred at approximately the same time (i.e. mornings) for all participants. In each condition, data collection occurred in the same quiet room for all participants. The participants did not know the research investigator. Participants were seen individually and were seated in a chair with large markers in front of them. The child was then given a choice 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 colour 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 colouring or all finished throughout the occupation. They were instructed to get up from the table when they were finished colouring the picture. The participants were timed with the use of a stopwatch throughout the colouring occupation. The start time began as soon as the marker touched the paper. If the participant stopped colouring, 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 colouring until the child indicated he or she was finished. After the child completed the colouring, the amount coloured was calculated for each condition. Each picture was scanned into the computer in order to calculate the amount of pixels coloured by each child. The process for calculating the amount coloured is

explained in the following sections. Once the scanning process was completed, the child was given the coloured picture as well as the package of markers to keep as a “thank you”.

Dependent variables and statistical analyses

Dependent variables included the amount the page was coloured, the number of colours used and time on task. The amount the page was coloured was defined as the number of different coloured markers used and the amount of pixels filled with colour within the object that was coloured. Each choice of object had the same amount of available surface area to colour as each picture offered was developed using a circle with a diameter of 16.67 cm. The amount of pixels filled was reported as an error score; therefore, a picture coloured and given a lower score would be coloured with higher quality. Time on task was derived using a digital stop watch that was operated as long as the child was colouring as per the aforementioned protocol.

The amount of pixels for each figure was calculated using the following process. After the child coloured the picture, the amount of colour was calculated in pixels. The amount of template pixels was subtracted from the amount of pixels coloured 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 coloured 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 in. $\times$ 11 in. at 300 dots per in. 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.

Data for each of the three dependent variables were skewed; therefore, a nonparametric one-tailed, paired Wilcoxon signed rank test was used for each of the statistical analyses. Alpha was set at 0.05.

Results

There was no significant difference of the amounts of pixels coloured in the choice condition versus the amount of pixels coloured in the no-choice condition ($p = 0.498$). However, children used significantly more colours ($p = 0.016$), and they spent significantly more time ($p = 0.005$) during the choice colouring condition than in the no-choice colouring condition. The effect sizes for both the number of markers used and the duration of time while colouring were small. Table I exhibits the Wilcoxon statistics, and Table II is a tabulation of the means and standard deviations for each of the dependent variables. Figures 5 and 6 are colouring examples by the same participant while in the choice and no-choice conditions, respectively.

Table I. Wilcoxon signed rank tests comparing the choice versus no-choice conditions for percent coloured and time colouring

Dependent variable	Sum of positive ranks	Sum of negative ranks	Sum of signed ranks	<i>p</i> -value	Effect size <i>d</i>
Percent coloured	176.0	−175.0	1.0	0.4975	0.06
Markers used	57.0	−9.0	48.0	0.0161	0.20
Time coloured	277.0	−74.0	203.0	0.0051	0.30

Table II. Means and standard deviations and ranges for percentage of the page coloured, number of markers used and duration for colouring

Dependent variable	Choice			No choice		
	Mean	SD	Range	Mean	SD	Range
Percent coloured	0.22	0.19	0.82	0.21	0.17	0.51
Markers used	2.58	1.81	6.0	2.23	1.73	6.0
Time coloured (seconds)	202.65	183.43	670.89	154.62	137.24	467.66

**Figure 5** Choice condition colouring example. Note that the face is yellow, the right eye is brown, the left eye is purple, and the mouth and nose are red**Figure 6** No-choice condition colouring example. Note that only green was used to colour this picture

Discussion

The purpose of this study was to investigate the effects of choice on the quality and duration of a

colouring occupation in children with ASD. Whereas there was no support for Hypothesis 1, in that there was no difference in the amount of pixels coloured between the two conditions, there was support for Hypotheses 2 and 3. Specifically, there were significantly more different colours used, and a greater duration colouring occurred in the choice condition versus the no-choice condition.

Contrary to Hypothesis 1, the amount of pixels coloured in the choice condition versus the no-choice condition yielded no significant results. One reason this could have occurred is that children with ASD often have difficulty with fine motor tasks. It may be that the amount of colouring was similar for both the choice condition and the no-choice condition because the participants were not so much concerned with the quantity of colour 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 colouring occupation. It is also possible that the participants did not perceive the occupation of colouring (these pictures) to be meaningful. If the pictures were perceived as such, it is possible that any motivating effect from being offered a choice was diminished, thereby resulting in no significant difference in the quantity of colouring.

The use of more colours may be a reflection of being more engaged in the colouring activity than if fewer colours were used. This may be true on several levels. It has been shown that normally developing children associate emotions with specific colours (Boyatzis and Varghese, 1994). It is possible that children with ASD can also, at some level, associate emotions with colours. Additionally, the use of colour can enhance the cognitive response time of children when searching for a target on a page (Thistle and Wilkinson, 2009). Given these two premises, the use of colour can have an impact upon the cognitive processes in children. Although it is unknown what was in the minds of the children during

this colouring activity, it is possible that during the choice condition, the children thought about the picture in a more dynamic way than when not given a choice. When colouring, the child must first think about which colour to use where to place that colour. When using multiple colours, these two tasks may occur in sequence with each other as subsequent coloured markers are chosen and used; however, it is also possible that the child may be planning where to apply additional colour(s) before actually colouring or while using a given coloured marker. The first strategy requires fewer cognitive demands but is still arguably cognitively more complex than if using only one colour for the whole picture. The second strategy involves simultaneously thinking about multiple colours and where to place those colours using motor and spatial planning to a greater degree than when using fewer colours.

Many children with autism struggle to maintain engagement in purposeful occupation secondary to decreased interaction and communication skills (Wimpory *et al.*, 2007). 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 colour. 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 coloured longer when given a choice because they enjoyed the occupation of colouring. The goal of the participants may have been different in the choice condition versus the no-choice condition. As mentioned earlier, it is possible that participants did not see covering the page as important, and they just enjoyed being “in” the activity. The amount of colour covering the page may not have been part of their strategy. In some instances, participants drew on to the pictures of faces versus colouring in the faces. Participants may have been more thoughtful about “how” they coloured instead of mass colour 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 coloured. 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 these 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 *et al.*, 2007). 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, he or she would be more motivated to engage for a longer period of time when given a choice within an occupation. This strategy could be utilized in many ways when completing occupational therapy with individuals with ASD and other developmental disabilities.

The increase in the number of colours used and the duration of engagement in a colouring occupation is supported by similar results from previous studies involving individuals with cognitive impairments (e.g. Rice and Nelson, 1988; LaMore and Nelson, 1993; Schroeder Oxer and 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 build upon the evidence that individuals with disabilities benefit from having some control over the occupations they complete.

Sources of potential bias include the primary investigator who completed data collection and the data analyzer. Although the primary investigator strictly followed the research protocol, she was aware of the hypotheses and could have inadvertently influenced the participants in a biased way. Additionally, timing the children's engagement in a colouring occupation was completed using a computerized stop watch. Although 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 stop watch. This study 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. Lastly, it is possible that the colouring task was not age appropriate for all of the participants.

In conclusion, this study has demonstrated that by offering a choice in a colouring occupation, children with ASD used a greater number of coloured markers and engaged in the colouring task for a longer period of time. Although statistical significance was found, the effect sizes were small, meaning that these conclusions must be conservatively accepted. 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 may 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.

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