Testing the outcome of hands-on versus verbal demonstration teaching methods on memory in adults with Down Syndrome and/or mild-moderate developmental disabilities

Anna M. Wearsch

This Scholarly Project is brought to you for free and open access by The University of Toledo Digital Repository. It has been accepted for inclusion in Master’s and Doctoral Projects by an authorized administrator of The University of Toledo Digital Repository. For more information, please see the repository’s About page.
Testing the Outcome of Hands-On Versus Verbal Demonstration Teaching Methods
on Memory in Adults with Down Syndrome and/or Mild-Moderate Developmental Disabilities

Anna M. Wearsch

Research Advisor: Barbara Kopp Miller, Ph.D.

Department of Occupational Therapy

Occupational Therapy Doctorate Program

The University of Toledo Health Science Campus

May 2010
Abstract

This study compared hands-on versus verbal demonstration instructional methods among adults ages 21 and older with Down syndrome and/or mild—moderate developmental disabilities. It was hypothesized that participants receiving hands-on instruction would have greater memory recall when compared with participants receiving verbal demonstration only. The immediate, short-term, and long-term memory of the participants regarding the steps and sequence of making a sun-catcher craft were tested via verbal recall. Scoring was based on functional ideas rather than exact wording. No statistically significant differences were found between the hands-on and demonstration groups in terms of immediate, short-term and long-term memory; thus, the hypothesis was not supported. Future research is needed to determine the most effective teaching method for adults with Down syndrome and/or mild—moderate developmental disabilities.
Testing the Outcome of Hands-On versus Verbal Demonstration Teaching Methods on Memory in Adults with Down Syndrome and/or Mild—Moderate Developmental Disabilities

Occupation itself lies at the heart of the profession of occupational therapy. Nelson and Thomas defined occupation as “a dynamic relationship among an occupational form, a person with a unique developmental structure, subjective meanings and purposes, and a resulting occupational performance” (2003, p. 90). The patient’s occupational performance is what occupational therapists are most concerned with, as successful occupational performance can promote health. Occupational therapists must teach their patients the skills they need to optimally perform their occupations. Thus, occupational therapists are teachers. In this paper, it will be shown that a basic tenant of the occupational therapy profession is that a person holding this degree must be an effective teacher. Next, three types of teaching strategies will be defined. Types of memory and memory retrieval will then be presented. Previous research demonstrating the effectiveness of hands-on teaching will be presented. Finally, the current research study will be reviewed.

Instructional Strategies

The National Society for the Promotion of Occupational Therapy (NSPOT) stressed that the “ability to instruct” is one of the “essential qualifications in the occupational therapist” (Cerca 1920, p. 6). The American Occupational Therapy Association (AOTA) has continued to uphold this belief stating that “an occupational therapist…is accountable for the safety and effectiveness of the occupational therapy service delivery process” (2006, p. 308). Because occupational therapists have the responsibility of teaching patients skills which are vital to their health, they must be sure to employ the most effective instructional strategy.
There are three major types of instructional strategies which occupational therapists may utilize. The first type is verbal instruction. In this type of instruction, the learner must employ auditory means to process information. An example of this type of learning would be a student in a home economics class who listens as a lecture on baking bread is presented.

Verbal demonstration is a second instructional strategy. A learner participating in this type of instruction would be presented with visual aides to supplement auditory information being presented to him. An example of this type of learning taking place would be a student in the same home economics class watching a soundless video of bread dough being mixed and kneaded while also listening to an accompanying lecture by his teacher on how to bake bread.

The third type of instructional strategy is hands-on. This strategy encompasses a multi-sensory approach, in which the student is actively involved in the learning process. This teaching strategy provides auditory, visual, tactile, and proprioceptive input. An example of this type of strategy being employed is the student listening to a lecture on how to bake bread while simultaneously kneading bread dough.

It has long been thought that a hands-on instructional strategy is best in terms of promoting learning. John Dewey, a renowned educator and philosopher stated that when action is taken and a change is made within a person, this change “…is loaded with significance. We learn something” (1916, p. 163). Many of the founders of the profession of occupational therapy also maintained the belief that active participation on the part of the patient promoted learning as well (Cohn, 1908; Dunton, 1931; Fidler, 1948; Slagle, 1922). Regardless of the instructional strategy utilized, in order to make use of what one has learned he or she must be able to effectively remember the information. Thus, it is important to understand the types of memory and memory retrieval that one may employ.
Types of Memory and Memory Retrieval

The three types of memory which will be discussed are immediate, short-term, and long-term memory. Immediate memory allows an individual to instantly (within 60 seconds) recall information that has been presented to him (Toglia, 1996, as cited in Golisz & Toglia, 2003). Short-term memory is defined as “information maintained at a surface level” that it not dependent on “permanent knowledge structures” in order to be utilized (Isaki & Plante, 1997, p. 427). Long-term memory is essentially permanent, as Cavanaugh and Blanchard-Fields have stated that it gives an individual the ability to “remember rather extensive amounts of information from a few seconds to a few hours to decades” (2006, p. 223). Two types of long-term memory are episodic memory and semantic memory.

Episodic long-term memory deals with “the conscious recollection of information from a specific event or point in time” (Cavanaugh & Blanchard-Fields, 2006, p. 224). An example of this type of memory would be an individual remembering how he spent his last Christmas. Semantic long-term memory involves the ability to learn and recall “the meaning of words and concepts that are not tied to specific occurrences of events in time” (Cavanaugh & Blanchard-Fields, 2006, p. 224). An example of semantic long-term memory would be an individual who is able to understand what his friend is telling him in a conversation.

The three types of memory retrieval are free, cued, and recognition. Free memory retrieval involves the capability of recalling information without any cues being provided. Cued memory recall is defined as the capability to recall information when being provided with cues, such as the color and category of an object. Recognition memory recall is simply the ability to recognize information that was introduced in the past (Toglia, 1996, as cited in Golisz & Toglia, 2003). Because memory and memory retrieval are such critical components in regards to
learning effectively, they have been studied extensively as is evidenced by the following presentation of previous research.

*Previous Research*

The hands-on instructional strategy has been proven superior to other instructional strategies in the past. Vessey (1988) tested the memory retention of 159 children on their internal body parts using two separate teaching methods: a multisensory method, which paralleled a hands-on strategy, and a cognitive-perceptual method. Children in the multisensory group were taught about their internal body parts by listening to a speaker present information, while also being able to handle a doll which contained three-dimensional organs in its abdomen. Children in the cognitive-perceptual group listened as a speaker presented information while viewing two-dimensional drawings of internal organs. A third group of children served simply as a control, and were pre and post tested without any presentation of the material. It was hypothesized that children in the multi-sensory group would have greater memory retention of their internal body parts than children in the cognitive-perceptual group. The hypothesis was supported. It is thus implied that healthy children have better memory retention when taught using a hands-on method.

Warner (1989) compared the effectiveness of a hands-on instructional strategy versus verbal demonstration only among 29 elderly females with cognitive deficits. The occupation which was chosen was ice-cream making. It was hypothesized that women receiving hands-on instruction would have higher memory retention regarding ice-cream making as evidenced by a task-related quiz than those receiving verbal demonstration only. Warner found that women who participated in the hands-on instruction had greater memory retention than those who received
Hands-on versus Verbal Demonstration

verbal demonstration only. Hands-on appears to be a superior method of instruction in terms of memory retention when teaching elderly women.

Buddelmeyer (1995) compared hands-on instruction with verbal instruction only in 60 children with learning disabilities. Children who received hands-on instruction were read one instruction at a time on how to make play-doh, and were then able to physically perform each instruction. Children who received verbal instruction were simply read the instructions on how to make play-doh. Each child was then asked to recall as many steps to making play-doh as he or she could. It was hypothesized that children in the hands-on condition would remember more steps to making play-doh than the children in the verbal instruction condition. The hypothesis was supported. It is thus reasonably assumed that children with learning disabilities have greater memory retention when taught using a hands-on strategy.

Hartman, Miller, and Nelson (2000) also compared a hands-on approach with a verbal demonstration approach. The 73 children who participated in the study were divided between the two conditions. Children in the hands-on group were read instructions on how to make a volcano, and were then allowed to make the volcano model themselves. Children in the verbal demonstration group were simply read instructions on how to make a volcano. It was hypothesized that children in the hands-on condition would remember more steps to making a volcano than children in the verbal demonstration group. The hypothesis was supported. This study provides additional support for the premise that healthy children have more memory retention when taught using a hands-on instructional strategy.

Eakman and Nelson (2001) compared the same two conditions of hands-on versus verbal demonstration in 30 men who had sustained traumatic brain injury. The men were divided into two groups between the two conditions. Men in the hands-on group were read instructions on
how to make meatballs. After each individual instruction was read, the men were able to carry out the instruction they had just heard. In contrast, men in the verbal demonstration group were read the instructions individually, and then asked to read each instruction out loud while circling each individual word with a pen. The hypothesis of the study was supported, in that men in the hands-on group were able to remember more steps to making meatballs than men in the verbal demonstration group. The conclusion of this study is that men with traumatic brain injury have greater memory retention when taught using a hands-on teaching method.

Messina (1999) compared the effects of hands-on instruction to verbal demonstration with adults with mental disabilities living in the community. Immediate and final recall were tested with regards to cookie-making. The participants in each group were asked to recall the steps of cookie-making in correct order immediately following the last step of the recipe as well as 15 minutes after the recipe was completed. A card game was played during the 15 minute interval in an attempt to prevent the participants from rehearsing information in their heads. Points were awarded for the number of syntactical units remembered, the number of steps remembered regardless of order, and the number or steps remembered in relation to correct order. These points were added together to determine each participants overall score. The results showed that while there was not a significant difference in terms of immediate recall, there was a significant difference concerning final recall.

Hearns, Miller and Nelson (in press) compared the effects of hands-on instruction to verbal demonstration with 60 college students. Participants in the hands-on group were able to actively engage in the occupation of making no-bake cookies, while participants in the verbal demonstration group were only shown how the cookies could be made. The variables included in the study were immediate, short-term, and long-term memory. Participants in each group were
Hands-on versus Verbal Demonstration

asked immediately following the occupation, fifteen minutes later and twenty-four hours later to repeat the steps of the cookie-making occupation in the correct order. Points were given for remembering the syntactical units within each step, as well as for remembering the steps in correct order in relation to each other. It was hypothesized that participants in the hands-on group would have greater recall for immediate, short-term and long-term memory when compared to participants in the demonstration group. Hearns, Miller and Nelson (in press) reported that one of their hypotheses was supported: participants in the hands-on group did have a greater long-term recall than participants in the demonstration only group.

The results of Hearns, Miller and Nelson’s (in press) study were not in line with previously cited research conducted by Vessey (1988), Warner (1989), Eakman and Nelson (2001), Buddelmeyer (1995) or Hartman, Miller and Nelson (2000). However, the results of Hearns, Miller and Nelson’s (in press) study did correspond with research conducted by Messina (1999) in terms of showing a statistically significant difference between hands-on and demonstration with long-term recall only. This is important when considering the fact that clients of occupational therapists must often implement what is taught to them in therapy long after the initial teaching session.

Kluczynski (2002) compared a hands-on teaching method to a verbal demonstration method with 50 older adults. Immediate, short-term and long-term memory were all tested. Three separate groups of scores were added together, each group representing a specific time frame. One group of scores analyzed the overall accuracy of the syntactical units remembered. Another looked at the steps recalled regardless of the order they were placed in, and finally, the last group analyzed the steps recalled with respect to the order they were placed in. When the results were analyzed, a statistically significant difference was not found between the hands-on and
demonstration groups in terms of immediate, short-term and long-term recall. This study was the first of its kind to show no statistically significant differences at all between the two teaching methods.

Due to the unexpected findings of Kluczynski’s (2002) research, Bird (2004) replicated the study with forty older adults. The occupation of choice was making strawberry ice cream. Again, the hypothesis was that there would be a difference between the hands-on and demonstration groups in regards to older adult’s immediate, short-term and long-term recall. In the end, no statistically significant difference was found between the two groups. The results of these studies seem to suggest that the teaching method used for older adults is not an important one.

However, both Kluczynski (2002) and Bird (2004) realized that their studies had limitations and called for further research to be conducted in a modified manner. One possible limitation for each author included the small number of participants in each study; a greater number of participants increases the chance for significant findings. Another severely limiting factor appeared to be the constraining scoring system to which participants were held; the participants were only given credit for correct recall if all syntactical units for each step were remembered. For example, the first step in Bird’s (2004) study was to “prepare the strawberries by washing them.” However, many participants remembered and recalled the first step as, “wash the strawberries.” Thus, participants were doubly penalized: once for not remembering all the syntactical units in the first step, and again, as participants would not receive credit for any subsequent steps recalled due to the first step being recalled incorrectly.

Kluczynski (2002) and Bird (2004) both called for adaptations to be made to following research. The main adaptation that they called for was to revise the scoring system for
Hands-on versus Verbal Demonstration

participants, so that they were not penalized for not recalling all of the syntactical units in a step and for not recalling all of the steps in perfect order. The restrictive scoring system could be a significant reason for why a difference was not found in each study between the two groups. Bird (2004) also notes that many participants in his study questioned why the steps to a recipe needed to be memorized, when recipes are typically referenced from a pre-written format of sorts. Several other participants found it difficult to read the printed steps on the note cards: thus, these participants lost valuable visual input that could have contributed to their overall learning and recall of the steps of the occupation. These reasons may partially explain why significant results were not found in the Kluczynski (2002) and Bird (2004) studies.

Yearly (2008) completed a hands-on versus verbal demonstration study with forty adult men and women between the ages of 18 and 55 in an attempt to implement some of the suggestions for future research made by Kluczynski (2002) and Bird (2004). The occupation of choice for Yearly’s (2008) study was the making of a facial mask recipe. Immediate, short-term and long-term memory were all tested in regards to the number of steps correctly chosen, the order in which the steps were placed in and a combination of the first to scores (to obtain a total memory recognition score). A statistically significant difference was not found between the hands-on and demonstration groups for immediate, short-term, or long-term memory. It was hypothesized that “perhaps focusing on a broad age group is not enough information about a population to understand which teaching method is the most effective,” (Yearly, 2008, p. 20).

In summary, while there appears to be somewhat conflicting evidence regarding the effectiveness of hands-on teaching in comparison to a demonstrative teaching method, the majority of the favor lies with a hands-on method. The hands-on teaching method has proven to be superior to demonstration across time and populations. The populations mentioned above that
have had greater overall memory retention when taught using a hands-on approach are healthy children, children with learning disabilities, elderly women with cognitive deficits, and men with traumatic brain injury. Additionally, it was found that adults with mental disabilities and college students have greater long-term recall when taught via a hands-on approach. The only study to not show a difference between the two groups amongst all three conditions was completed with a wide age-range of healthy adults. This is compelling evidence that suggests that for most of the populations it is used with, hands-on is an effective teaching strategy. Thus, the current study aims to continue the line of research regarding hands-on instruction versus verbal demonstration within a different population.

The current study

The United States Department of Health and Human Services: Centers for Disease Control and Prevention (CDC) reported that Down syndrome “occurs one in 800 births” (2006). Individuals with Down syndrome have a greater life expectancy now than in the past, with the CDC reporting the median age of death of those with Down syndrome rising from 25 years in 1983 to 49 years in 1997 (2008). In fact, individuals with Down syndrome made up part of the 641,161 individuals with Mental Retardation (MR)/Developmental Disabilities (DD) age 60 and older living in the United States in the year 2000 (Factor, 2004). Due to the aging of the baby boom generation, it is expected that the number of adults with MR/DD age 60 and older is expected to nearly double in size to 1.2 million by the year 2030 (Heller & Factor, 2004, as cited in Factor, 2004).

Considering the projected increase in magnitude of adults with Down syndrome and/or mild—moderate developmental disabilities, it can be expected that the number of occupational therapists needed to work with these individuals will increase as well. While hands-on has
proven to be an effective teaching method for children with learning disabilities (Buddelmeyer, 1995), there is currently little research regarding the effectiveness of hands-on instruction used with adults with Down syndrome and/or mild—moderate developmental disabilities. As the life expectancy and number of individuals with Down syndrome and/or developmental disabilities has been outlined above, it is apparent that these individuals are members of an important population. Taking this information into account as well as the fact that hands-on learning is an important theoretical principle in occupational therapy, the rationale for the current study is established.

The purpose of this study was to compare hands-on versus verbal demonstration teaching methods and their effect on immediate, short-term, and long-term memory recall in adults with Down syndrome and/or developmental disabilities. It was hypothesized that participants receiving hands-on instruction would have greater immediate, short-term, and long-term memory recall when compared with participants receiving verbal demonstration only.

Method

Participants

Twenty-seven adult men and women with Down syndrome and/or mild—moderate developmental disabilities ages 21 and older were recruited for the study. The participants were recruited from different locations, including Josina Lott, the Ability Center of Greater Toledo, the Lucas County Board of MRDD, and the Luther Home of Mercy. Information regarding each participant’s age, gender, and race was gathered. In order to be eligible for the study, participants needed to have no prior experience with making a sun-catcher, be able to follow simple verbal instructions, have a level of visual acuity such that they could accurately name all pictures on the top row of a pediatric near-vision chart, and sequence picture cards that contained components of
the occupation of tooth brushing with 100% accuracy. If any participant was not able to meet the requirements, he or she was thanked and then excused from further participation in the study.

Materials

Materials that were used to determine eligibility for the study included a completed sun-catcher craft, an informed consent and/or assent form, a pediatric near-vision chart, four small cards containing numbers one through 4 on them, and small cards of which each contained a necessary component regarding the occupation of tooth-brushing. The materials that were used for the craft portion of the study included 5” x 7” cards containing the steps of the occupation, wax paper, crayons, a crayon sharpener, a pre-made shape for tracing, a marker, scissors, a clothing iron, an ironing board, paper towels, a hole punch, and yarn. A MP3 recorder was used to record participant recall.

Procedure

All participants were asked to sign an informed consent or assent form before the study began. The participants were randomly assigned to either the hands-on or demonstration group. The investigator administered both conditions of the independent variable. Each participant was tested individually. Administration of informed consent for both conditions was varied based upon convenience and guardianship. In the case that a potential participant was not his or her own legal guardian and that it was convenient for the informed consent to be administered to the legal guardian in person, the investigator sat across from each participant and his or her guardian during the completion of the informed consent. However, in such cases where a participant was not his or her own legal guardian and the guardian was not able to be physically present to sign informed consent (e.g., if the guardian lived outside of the Toledo and/or surrounding area), the guardian had the option of receiving an informed consent form via mail. A letter was included
with the informed consent form explaining the basics of the research study with an offer to answer any additional questions. Once informed consent was received by the investigator via mail, the investigator proceeded by obtaining assent from the potential participant. For each condition, this was done as the investigator sat across from the participants. For all potential participants who were their own legal guardians, informed consent was completed as the investigator sat across from them.

The investigator was present while participants sequenced the cards containing the pictures regarding tooth brushing. The investigator sat across from the participants while reading the instructions for completing the craft and while the participants completed the sequencing portion pertaining to completion of the craft.

The investigator first administered the informed consent or assent form. This process allowed the investigator to determine whether or not the participants were able to follow simple verbal instructions such as “Please have a seat,” and “Please read this form,” and “Sign your name here.” Next, each potential participant was shown a completed sun-catcher craft and asked: “Have you ever made a butterfly sun-catcher like this before?” If a participant had made a butterfly sun-catcher before, he or she was thanked and then excused from further participation. Then the investigator asked the participants to identify objects on a near-vision pediatric eye chart. If the participants were not able to correctly identify all objects on the top row of the eye chart, they were thanked for volunteering their time and were excused from further participation in the study.

Next, participants were asked to sequence picture cards containing components of the occupation of tooth-brushing. Participants were told, “These pictures show what you do when you brush your teeth. I would like you to put these pictures in order. Put the picture that shows
what you do first here under the number one. Then keep putting the pictures in order until each picture has a place under a number.” If participants took longer than ten seconds to sequence any one card, they were cued by the investigator by being asked, “Which picture shows what you do next when you are brushing your teeth?” If participants did not place another card for an additional ten seconds, they were asked, “Can you remember anything else?” If the participants indicated that they could not, the sequencing was stopped. All participants who were not able to sequence pictures regarding tooth brushing with 100% accuracy were thanked for their time and then excused from further participation in the study. Completing this task with 100% accuracy thereby proved a participant’s competence in regards to understanding the principle of a sequence itself, thereby giving the investigator the ability to measure memory alone following the completion of the craft later in the study.

The investigator then began the craft. In both conditions, the investigator read aloud the steps of the occupation one at a time. After each step was read, the investigator asked the participants to verbally repeat the step by reading the step aloud from print contained on a 5” x 7” card. This was meant to ensure understanding on the part of the participants. Participants in the demonstration group watched as the investigator performed each step of the sun-catcher craft. Participants in the hands-on group performed each step of the craft along with the investigator.

At the beginning, participants in the hands-on group were read the following instructions:

“Today, we are both going to make a butterfly sun-catcher. I will tell you each step one at a time as we go along. After I tell you each step, I want you to say the step back to me by reading the step from a card that I will give to you. Then I would like you to do the step with me. Do you understand?” Upon confirmation that each participant understood the instructions, the experiment continued.
Participants in the demonstration group were read the following instructions:

“Today, I am going to make a butterfly sun-catcher for you to keep. I will tell you each step one at a time as we go along. After I tell you each step, I want you to say the step back to me by reading the step from a card that I will give to you. Then I will do the step for you while you watch. Do you understand?” Upon confirmation that each participant understood the instructions, the experiment continued.

The ten steps were printed on 5” x 7” white note cards. The investigator read each card to each participant. A corresponding card with the same step was shown to each participant. If a participant did not read each step within five seconds, they were asked to, “Please read this step aloud to me.”

The steps for each group were as follows:

1. Trace a butterfly on wax paper using a shape.
2. Shave several crayons of different colors.
3. Put some crayon shavings on the wax paper inside the butterfly.
4. Cover the butterfly with a piece of waxed paper.
5. Cover the butterfly with a paper towel.
6. Iron the butterfly for 5 seconds.
7. Cut out the butterfly.
8. Punch a hole near the top of the butterfly.
9. String yarn through the hole.
10. Tie a knot in the end of the yarn.

In both conditions, materials were kept out of the participant’s sight behind a screen until they were needed in order to complete a step. Once the materials were used and were no longer
needed, they were removed from the participant’s view and put back behind the screen. The investigator in the demonstration condition and participants in the hands-on condition were both given three minutes to complete each step.

After each of the above steps was read, the investigator asked the participants to read the step aloud. Participants in the hands-on group were reminded after each step was read to complete the step with the investigator. Participants in the demonstration group were reminded after each step to watch as the investigator completed the step.

Upon completion of the sun-catcher in both conditions, the investigator asked each participant the following questions: “What is your favorite color?” “What is your favorite animal?” and, “What is your favorite game?” One minute was allotted to allow participants to respond to these questions. These questions were asked to minimize the possibility of rehearsal, and to ensure time consistency across both conditions.

After the participants responded to the investigator’s questions, they were told as follows: “I would like you to tell me how to making a butterfly sun-catcher. Tell me all of the steps. Say the steps in the same order that I told you. Also, try to use the words that I told you. Tell me when you cannot remember anything else. I am going to use this tape recorder to save your answers for later so that I can hear them again. Is that OK with you?”

If a participant refused his or her responses to be tape-recorded, he or she was excused from further participation in the study. For all participants who agreed to be tape recorded, the investigator continued by saying:

“Please tell me how to make a butterfly sun-catcher. Do your best to remember the same words I told you in the right order. I will give you five minutes to tell me all of the steps. Go ahead.”
While the participants recalled the steps, the investigator looked directly down at the stopwatch lying on the table. An exception was made whenever the investigator had a participant with particularly “thick”/non-articulated speech. In these circumstances, the investigator watched the participant’s mouth as he or she recalled the steps. Then the investigator repeated each step into the recorder to ensure a clear recording to be listened to later. Otherwise, the investigator did not indicate, either verbally or non-verbally, the responses which were given by the participants. If a participant specified that he or she could not remember any more steps, the recording was stopped. If a participant was silent for ten seconds, they were prompted to “Try your best to remember.” If a participant was silent for an additional ten seconds, they were asked, “Can you remember any more of the steps?” If a participant responded no, the recording was ended. If the participant responded with yes, they were told, “Please tell them to me.” If the participant did respond to this verbal prompt within ten seconds, the recording was ended. Participant’s responses were recorded immediately following the completion of the sun-catcher, within 20 minutes of completing the sun-catcher, and within 24 hours of completing the sun catcher. During the 20 minute interval between immediate and short-term recall, participants were invited to engage in a game or picture puzzle of their choice with the investigator. These time intervals were meant to ensure that accurate measurement of immediate, short-term and long term memory was occurring.

Scoring

Each of the steps presented to the participants have been divided into syntactical units. Each syntactical unit has a value of one point (see Table 1). A full point could be earned per syntactical unit even if the participant did not remember the exact wording of each step (see Table 2). The reason for this is that scoring will allow for substitution of functional synonyms. A
functional synonym is defined as “a recalled word which is equivalent in idea or use to the exact imperative wording” (Eakman, 1992, p. 21).

There are 34 syntactical units arranged in 10 consecutive steps (2 to 4 units per step). Therefore the possible range for scoring is 0 to 34. In order to get one point, the subject must have stated the syntactical unit (or its equivalent) within the proper sequence as defined by the consecutive steps. For example, in step two there were three syntactical units: "shave," "crayons," and "colors." In order to get the full three points for this step, the subject must have used these words or designated synonyms in the proper sequence in relationship to other steps. For example, the idea of shaving different-colored crayons must have preceded the idea of heating the components by ironing.

The subject did not need to use the exact words listed in Table 1 as long as designated synonyms were used. For example, instead of saying "shave" in step two, the subject may correctly say "grate," "cut," "chop," "slice," or “scrape.” Scoring guidelines for functional synonyms are specified in Table 2.

The rules for correct sequence protect against loss of all points if a sequence error was made at the beginning of the sequence. For example, omission of the first step should not result in all the other steps being judged as wrong. The units within a step were judged correctly sequenced when they were part of a correct sequence that maximized the subject's score. For example, even if a subject omitted all of step one (with four syntactical units), credit was given for steps two through ten if they were stated in the proper relative order. For a more complex example, let us assume that the subject recalled the steps in the following order: 1, 3, 8, 4, 5, 6, 10, 9 (while omitting steps 2 and 7). To maximize the subject's score, syntactical units recalled in
steps 1, 3, 4, and 5 were credited along with the correct units in steps 9 or 10, depending on number of correct units recalled.

Results

Data analysis was conducted based upon the responses of 27 adults for immediate, short-term, and long-term memory. Ten subjects (or 37%) of the participants in the study were male while 17 (or 63%) of the participants in the study were female. Regarding race, 85% of the participants identified themselves as Caucasian, 11% as African-American, and 3.7% as Native American. Regarding age, the youngest participant was 26 years old while the oldest was 75 years old. The mean age of the sample was 44.70 ($SD = 11.62$).

Thirteen participants (4 males and 9 females) were in the hands-on group and fourteen participants (6 males and 8 females) were in the verbal-demonstration only group. The mean age for participants in the hands-on group was 41.46 ($SD = 9.31$), while the mean age for participants in the demonstration only group was 47.71 ($SD = 13.02$). The final data was skewed, so non-parametrics were used for analysis.

Interrater Reliability

Interrater reliability was tested and an Interclass Correlation Coefficient (ICC) was calculated for the immediate, short-term, and long term testing scores. Student research scores were used for this data analysis. The ICC score was 0.99 for immediate memory, 0.99 for short-term memory, and 0.99 for long-term memory. These scores indicate a high level of agreement between the two raters.

Hypothesis Testing

It was initially hypothesized that participants receiving hands-on instruction would have greater memory recall in terms of immediate, short-term and long term memory when compared
Hands-on versus Verbal Demonstration

with participants receiving verbal demonstration only. The maximum score possible for each of the three tests was a 34 while the minimum score possible for each of the three tests was zero. A score of 34 indicated that a participant correctly remembered all 34 syntactical units within the 10 steps within the proper sequence as defined by consecutive steps. A score of zero indicated that a participant remembered none of the syntactical units at all. An alpha level of 0.05 was used for all statistical tests.

Participants in the hands-on group had a mean immediate memory score of 9.08 ($SD = 8.24$) while the participants in the verbal demonstration group had a mean immediate memory score of 4.57 ($SD = 4.33$). A Mann-Whitney test, performed to compare the hands-on and demonstration groups to each test condition, showed that immediate memory received a score of $\mu = 61.00; z = -1.46; p > .05$. Participants in the hands-on group had a mean short-term memory score of 9.00 ($SD = 8.39$) while participants in the verbal demonstration group had a mean short-term memory score of 3.79 ($SD = 3.68$). The Mann-Whitney test offered a short-term memory score of $\mu = 58.00; z = -1.62; p > .05$. Lastly, participants in the hands-on group had a mean long-term memory score of 7.92 ($SD = 8.97$) while participants in the verbal demonstration group had a mean long-term memory score of 4.50 ($SD = 4.29$). Long-term memory received a Mann-Whitney score of $\mu = 72.50; z = .60; p > .05$. Thus the results are not significant for all 3 dependent variables.

Discussion

The purpose of the study was to compare a hands-on teaching method with a verbal demonstration teaching method in terms of the effect each had on immediate, short-term and long-term memory. Results of this study show that there was not a statistically significant difference between immediate, short-term and long-term memory recall between participants in
the hands-on and demonstration groups. These results imply that a hands-on teaching method (while affording participants an opportunity to be actively involved in the making of a craft) did not make a difference when compared to a verbal demonstration teaching method (allowing for passive engagement) in terms of recall of essential components of craft-making.

The implication of these results is opposite of that of previously completed research. For example, Vessey (1988) found that children who learned about internal body parts via a multi-sensory method had greater memory retention than children who learned the same material in cognitive-perceptual format. Warner (1989) found that elderly women with cognitive deficits who learned the steps of making ice cream via a hands-on approach remembered more of the steps than elderly women who received verbal demonstration only. Buddelmeyer (1995) found that children with learning disabilities who received hands-on instruction on how to make play-doh remembered more of the steps than children who received verbal instruction only.

Other research that has reported similar findings includes that of Hartman, Miller and Nelson (2000) who found that healthy children who were taught the steps of making a volcano via a hands-on approach remembered more of the steps than children taught via a demonstration only approach. Additionally, Eakman and Nelson (2001) found that men who had sustained a traumatic brain injury who were taught the steps of making meatballs via a hands-on approach remembered more of the steps of making meatballs than did the men taught via a demonstration approach. In terms of participants, all of these studies focused on a very specific age range (third-graders) or special needs population.

The present study, however, is not the first line of hands-on versus verbal demonstration research with results that show no statistically significant difference between the two. For example, Messina (1999) conducted a study with adults with mental disabilities and did not find
a statistically significant difference for immediate recall between the two groups; however, there
was a statistically significant difference for final recall. Similarly, Hearns, Miller and Nelson (in
press) conducted a study with sixty college students and found that while there was not a
statistically significant difference for immediate and short-term recall between the hands-on and
demonstration groups, there was a statistically significant difference between the two in terms of
long-term recall. Both Kluczynski (2002) and Bird (2004) conducted research with older adults
and found no statistically significant differences between a hands-on teaching method and
demonstration in terms of immediate, short-term, and long-term memory scores. A similarity
between these studies that did not find statistically significant results is that they all focused on a
population based upon an age-range rather than one specific population.

While focusing on a slightly different population of individuals, the current study follows
previously cited research (Hearns, Miller and Nelson, in press; Kluczynski, 2002; Bird, 2004;
and Yearly, 2008) that did not find statistically significant results when working with adults. In
regards to the current study, it should be noted that the mean scores for total number of steps
remembered was higher for participants in the hands-on group than those in the demonstration
group for immediate, short-term, and long term memory. Scores of participants in the hands-on
group stayed relatively the same between immediate and short-term memory (9.08 compared
with 9.00) and then dropped from short-term to long term memory (9.00 compared with 7.92).

A craft occupation was chosen to complete with the current population with the belief
that it would have meaning and purpose to participants. It was hypothesized that making a craft
would be important to adults with developmental disabilities because crafts are generally fun and
engaging; additionally, the adults would have a completed decoration at the end to either keep or
give to a friend. Considering this, it appears that the craft was motivating for all individuals
involved in the study, especially those in the hands-on group as they had higher scores on each variable. Unfortunately, the results were not statistically significant, perhaps due to the lack of total number of participants.

An occupational therapist often uses a combination of teaching methods when working with clients on various skills. Occupational therapists often use a hands-on approach to teach clients necessary, new skills. For example, a pediatric occupational therapist might first demonstrate an acceptable tripod grasp on a writing utensil for a child, and then allow the child to practice a proper grasp on the utensil him or herself. Since occupational therapists so often combine demonstration and hands-on methods of teaching instruction, perhaps the effectiveness of a combination of these teachings methods could improve this line of research. Considering this, this line of research should be continued by occupational therapists as no one universally accepted effective teaching method has been absolutely established for use with adults age 21 and older with Down syndrome and/or mild—moderate developmental disabilities.

Implications for occupational therapy

Even through the original hypothesis for the current study was not supported, there are several important implications regarding the field of occupational therapy. Considering that a statistically significant difference was not found between the two teaching methods, the main implication is that perhaps one teaching method is not more effective than another when working with adults with Down syndrome and/or mild—moderate developmental disabilities. Additionally, since participants in both the hands-on and verbal demonstration groups did not remember many total steps of the occupation, it could be that an entirely different teaching method is most effective for use with members of the developmentally disabled population.

Another implication is that adults with Down syndrome and/or mild—moderate
developmental disabilities may need to perform the novel occupation after it is initially learned rather than simply reporting how it was completed to show that learning has taken place. For example, an adult with developmental disabilities may not remember the exact name for something used in an occupation, and may subsequently neglect to verbally attempt stating the step (e.g., may not remember that they used wax paper versus another kind of paper). If the adult was able to perform the occupation as a method to test learning, he or she would not need to remember the exact terminology to show that learning had occurred. It is important for occupational therapists to have their clients perform novel tasks after they have initially been presented. Performance of the occupation ensures that correct learning has in fact taken place.

For the current study, the mean age of participants was 44.70 with a wide range of ages included (e.g., ages 26—75). Considering the participants’ ages, it is reasonable to assume that most of them have been out of school for quite some time, and are thus not as accustomed to having their memory tested in such a manner. Thus, anxiety may have played a factor for participants with less overall number of steps being remembered as a result. Occupational therapists treating adults with developmental disabilities should remain keenly aware of the anxiety that may occur in when the adults are not accustomed to the type of task that they are being asked to perform.

Limitations

There are several possible limitations that could have affected the overall outcome of this study. The first limitation that may have occurred is that of a Type II error. A Type II error happens when significant results do occur, but go unobserved. The reason can be either a small sample size and/or a large variance within the group. As the sample size for this study was small with only 27 participants, the likelihood of a Type II error occurring is high. Another possible
limitation to the study was the small geographical region from which participants were recruited. All participants were recruited from Toledo, Ohio, and close-by surrounding areas. Another possible limiting factor is that the co-investigator administered both conditions of the independent variable. While there were safeguards in place in an attempt to ensure that bias did not occur, it is possible that the co-investigator unintentionally offered more help to some participants than others. A final limitation may have been that participant’s memory was tested via a recording of their answers rather than a physical repeating of the steps remembered. Bird (2004) suggests that “in addition to testing recall verbally and with a tape recorder, an alternative is to test recall through motor recall,” (p. 32). Having participants repeat the physical act of the occupation may have ensured that actual memory of necessary components was being tested, rather than exact wording of certain materials and/or actions; while this was generally achieved through allowing synonyms to count for credit, some participants may have verbally excluded some steps secondary to not remembering an exact name/term (e.g., one subject pointed in the direction of the iron and ironing board behind the screen and said, “That thing….I don’t remember [the] name.”). If this particular subject would have been allowed to replicate the craft and use the iron, she would have received overall credit for remembering the iron as a necessary component of the occupation.

Future Studies

Several different approaches could be taken when considering future research in the area of hands-on versus verbal demonstration research. The first is to consider working with a more focused group of adults with Down syndrome and/or mild—moderate developmental disabilities. For example, it may be beneficial to concentrate on the adults who live and work independently in the community, or to focus solely on those adults who are residents of long-term care
Hands-on versus Verbal Demonstration

facilities. It may also be beneficial to narrow the age-range for adults who may participate in future studies. Other previously completed research with more focused populations has been able to show the effectiveness of a hands-on teaching method, such as Buddelmeyer’s (1995) and Hartman, Miller and Nelson’s (in press) research with children, or Eakman and Nelson’s (2001) and Messina’s (1999) research with specialized populations. Once the population has been narrowed, another recommendation that could be implemented would be to utilize an occupation very specific to that population that might possibly be more meaningful its members. For example, if working with adults with developmental disabilities who live independently in the community, perhaps teaching a new recipe or organization techniques would be more meaningful and motivating.

A final recommendation is to implement Bird’s (2004) suggestion to examine a participant’s motor recall along with their verbal recall. Observing participants perform the steps that they remember from the previously completed or observed occupation would be the best way to determine whether or not actual learning has occurred. In this particular study, participants could have been asked to make a butterfly sun-catcher craft upon completion by the co-investigator and/or themselves of the first craft.

Conclusion

The present study did not show statistically significant differences between hands-on and verbal demonstration teaching methods in adults with Down syndrome and/or mild—moderate developmental disabilities in terms of immediate, short-term, and long-term memory. Because the crux of the occupational therapy profession is based upon effective teaching, we must strive to have a better understanding of the most effective teaching method for adults with Down
syndrome and/or mild—moderate developmental disabilities. Further research implementing the suggested changes should be implemented in order to obtain this understanding.
References


Table 1

Task Step Imperative Scoring Format—Breakdown into Syntactical Units

Syntactical units are underlined. Each underline designates one syntactical unit. Each syntactical unit carries a value of one point.

1 1 1 1

Trace a / butterfly on / wax paper using / a shape (4)
Shave several / crayons / of different colors (3)
Put some crayon shavings / on the wax paper inside / the butterfly (3)
Cover / the butterfly (OR wax paper, OR crayon shavings) with a piece of / waxed paper (3)
Cover / the butterfly (OR wax paper) with / a paper towel (3)
Iron / the butterfly (OR paper towel, OR wax paper) / for 5 / seconds (4)
Cut out / the butterfly (2)
Punch / a hole / near the top / of the butterfly (4)
String / yarn / through / the hole (4)
Tie / a knot / in the end / of the yarn (4)
Table 2

Scoring Guidelines for Functional Synonyms

Each participant has the potential to earn a full point score per each syntactical unit if the functional synonyms listed below are substituted for the exact task step imperative wording. Points will not be deducted if the participant uses articles (a, an, the), or if a word is used in a different tense (i.e., “covered” rather than “cover”). This list is an explanatory document which not only includes synonyms, but any alternative correct ways of wording indicating correct memory.

Trace a butterfly on wax paper using a shape

*trace*=draw=color=write=mark=copy=outline

*shape*=figure

Shave several crayons of different colors

*shave*=grate=cut=chop=slice=scrape

*different colors*=separate colors=various colors=assorted colors=unlike colors=variant colors=unrelated colors

Put some crayon shavings on the wax paper inside the butterfly

*shavings*=bits=pieces=parts=flakes

*inside*=within=in=into
Cover the butterfly with a piece of waxed paper

   cover=hide, on, on top, over, on the top

Cover the butterfly with a paper towel

   cover=hide

Iron the butterfly for 4 seconds

   iron=press

Cut out the butterfly

Punch a hole near the top of the butterfly

   punch=any words indicating use of a hole puncher (e.g., poke)
   hole=opening=crack=slit=slot
   top=tip=head=upper part

String yarn through the hole

   string=put=thread=pull=push=tug
   yarn=string=thread
   through=in
   hole=opening=crack=slit=slot

Tie a knot in the end of the yarn

   tie=make=form=create=bind
   yarn=string=thread