**Using digital assistant to increase vocabulary retention rates amongst children with cerebral palsy**

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**Introduction**

Most children with cerebral palsy (CP) develop cognitive impairment as an associative condition. Severe learning disabilities characterized by low reading comprehension, speech deficiency, and poor memory have resulted from this condition. Affected children have difficulties processing emotions, feelings, or information. They often rely on assistive and augmentative communication (ACC) devices for learning. Moreover, studies have found that cognitively challenged children are more engaged when learning with the aid of an ACC device (Murchland, 2010). As the world experiences unprecedented advances in telecommunication technology, the range of ACC devices has expanded to include: tablet, smartphone, IPod, and other wireless and digital communications innovations. A previous study has shown that the successful use of an IPod to play music helped cognitively challenged children access age appropriate entertainment content thus facilitating their social integration (Kagohara, 2011). The rise of digital assistants is ushering in a new era of learning in special education. Experts are already promoting the benefits of online digital communication devices to improve the cognitive and social development of children with CP. While early studies in the field were promising, McNaughton argued that further studies were needed to fully understand the future of ACC devices in the age of technology and mobile revolution. He identified 5 areas: face-to-face communication; distance communication and interconnectivity; training and support for system use; adapted applications and cognitive tools; and supports for independent operation, development, and maintenance. (McNaughton, 2007).

**Significance**

Each year in the United States, nearly 10, 000 children develop CP. The condition is caused by trauma or damage to the brain that can occur before, during, or after birth. While different treatments exist to alleviate its effects, CP is a permanent condition. People affected often require assistance with the most trivial of tasks. The impact and severity of CP vary significantly from one person to the next. However, those afflicted exhibit some level of dysfunction with their neurological and cognitive system. In addition to learning difficulties, spinal deformities, speech and language disorders, can also accompany the condition. For example, the effects on the neurological system lead to uncontrolled muscle movement, coordination, and tone. ACC devices have been used as part of the treatment and have allowed individuals to function autonomously. Introducing innovation in communication technology to the treatment could provide even greater reliefs to affected individuals.

Multiple chronic conditions are commonly found in the diagnosis of CP. Diminished cognitive development leads children to exhibit difficulties learning, remembering, and they are easily distracted. Focusing on the smallest of tasks requires intensive efforts. Accordingly, children with CP often fail the most basic academic tasks. In order to combat these issues, many children are placed on medication that produce adverse side effects which including lack of appetite and delayed physical growth.

This study involves participants under the age of 11. The age limit is purposely defined. At approximately 11 years of age children experience puberty, a period characterized by hormonal changes that lead to uncooperative or challenging behaviors. Children with CP are not exempt from this biochemical phenomena and experience behavioral challenges that are severe due to under-developed emotional capabilities. Stability and routine support their development, whereas small changes could impact them negatively. Our study provides insight into the adoption of digital assistant to promote vocabulary learning and retention among ACC participants. It is believed that this device can improve the quality of their communication as well the quality of life of ACC device users. In the context of this study, quality of life refers to physical, emotional, and social well-being. In a previous study, Lindstrom reported that most of the 44% of disabled students using assistive technology (computers) were dissatisfied mostly because it required the development of certain motor skills (Lindstrom, 2012). We found limited research in using digital assistant in helping cognitively disadvantaged children.

**Research question**

This study focuses on vocabulary retention by asking if learning new vocabulary from a digital assistant increases word retention among children with CP?

**Research Method**

The purpose of this study is to measure word retention amongst children with CP. The age of the participants range from 8 to 10. All participants are medically diagnosed with CP and displayed some degree of learning disabilities. For validity purposes, the sampling process ignores all data related to the participants’ previous academic achievements. The population target is the Tampa Bay Diagnosis Center for children with CP (Center).

The medical conditions and the age of the participants do not allow for random sampling. Parents or legal guardians consent must be obtained to participate in the study. The age of the participants must fall within defined range. This is mainly because older kids have established learning routine that can impact the validity of the study. Younger children require more assistance.

This study uses 2 groups: control and test. The sample includes 20 children boys and girls selected from the Center where the study also takes place. Participants are randomly assigned to groups. The control group receives instruction from a teacher. The test group receives instruction from the digital assistant. Operationally, we define the following terms:

Sample size (n): number of participants.  
Dependent variable (dv): word retention rate.  
Independent variable (iv):word learning method (digital assistant, traditional learning method).

Treatment (x):consists of words being presented to the participants on a tablet. A digital assistant reads the word out loud and asks the participant to repeat the word several times until full mastery of the word is observed. We define full mastery of a word as the ability of the participant recognize the word and read it successfully 3 times.

The digital assistant is programmatically able to call the participant by his first name and uses positive reinforcement to support the learning process.

This study extends over a period of 21 days and is divided into 3 phases:

In phase 1, a group of 10 new words are selected and presented to the participants. Each participant is asked to read the word out loud. Participants have no prior knowledge of the words. A score of 1 is recorded for successful reading and 0 is recorded for misread words. A score of 0 is recorded after 15 seconds of unsuccessful attempt at reading a word, and a new word is presented to the participant. A total score is computed for each participant. This phase establishes the baseline and set pre-treatment scores. A mean score of each group is also computed.

In phase 2, the control group learns the new words with the aid of a teacher using traditional learning methods. This study defines traditional learning method as the teacher reading the words to participants and assessing that they can recognize and read it successfully. The test group is submitted to the treatment.

In phase 3, participants are tested on the same group of words. Post treatment scores are recorded. The mean score pre and post-test are compared to verify whether the findings support the research hypothesis that children learning new vocabulary from the digital assistant retains more word than children learning with the traditional method. Additionally, the following set of descriptive statistics are also computer to further support the hypothesis: standard deviation and variance.

It can be argued that the convenience sampling use in this study affects the external validity of the findings. Also, participants can learn the words selected for this study from other source e.g. their parents.

**Literature Review**

DM Kagohara and Al: **Teaching students with developmental disabilities to operate an iPod Touch® to listen to music**

This study assessed the use of a video modeling program on IPod Touch® to teach new skill to students with various types of learning disabilities. The researchers argued that children with developmental disabilities often live in isolation as they lacked the ability to connect with their surroundings and could not easily identify with others. It was their beliefs that learning the new skill could facilitate students’ social integration by giving them access to age appropriate leisure.

In contrast with prior studies, the learning methods in this study were developed using video modeling only. The skill to be achieved was the use of the IPod to listen to music. As the dependent variable, learning to listen to music on the IPod included 8 tasks to be completed by participants. Those tasks were measured on a ratio scale where 0 counted as the inability of the participants to complete the task or step.

A mix of sampling method were used in this study. The sample included 3 participants from a special education school for students with developmental disabilities. The study lacked information about the school population therefore no valid inferences could be made about the representativeness of the sample. This indicated a purposive sampling. At best, the credibility of the sample could be questionable. The sampling method used were characterized as convenient since participants came from the same classroom and had prior involvement in similar study. Statistics about the sample showed that the participants have previously recorded a score between 3 to 4 standard deviation below the mean on the vineland-II Adaptive Behavior test. This implied that the participants lacked functional intelligence. Their conditions were further worsened by the presence of syndromes such as: epilepsy, cerebral palsy, and Klinefelter syndrome. Because of participants’ involvement in prior studies using IPod, researchers have tested participants in the initial phase of the study to ensure that they could not use the IPod to listen to music.

A survey conducted by the researchers ensured that all participants provided consent for their involvement in the study. Researchers were also able to obtain participants’ learning and musical preferences. The study took place in the participants’ classroom with a trainer and two teaching assistants. Two observers were also present during all sessions. An inter-observer agreement yielded a rate ranging from 75 to 100% with a mean of 98%. A procedural integrity check for 32% of the sessions was conducted. It reported 100% compliance agreement for the sessions. The research was conducted in accordance to the defined methods and procedures.

The researchers measured the participants’ ability to successfully complete the eight tasks included in the treatment. All training materials were uploaded in the IPod. The research design included four phases: baseline, video modeling, fading, and follow up. In the baseline phase, given the device and asked to turn it on and listen to music independently. Data about completion was recorded and the session were stopped after 30 seconds of non-successful attempts. In the modeling phase, the actual treatment was administered. Participants viewed a video on the ask completion prior to attempting the task. For non-successful steps, researchers intervened and completed the task for the participants allowing them to move to the next steps. The last 2 phases of the research were identical to the baseline phase, no training videos presented to students.

At each phase of the study, a mean score of successfully completed tasks were recorded per participants. They represented the central tendency of the distribution. We found the data collection method to be appropriate for the method used. Because of the smaller sample size, no valid inference could be made about the spread of the data. Larger variance were recorded during the baseline phase in which 2 of the participants recorded a mean of 25% while the third scored a mean of 60% s. The mean recorded were much closer during the intervention and follow up phases.

This study used a naturalistic approached as participants were kept in their learning environments. Furthermore, it yielded positive results since the mean successful task completion rate of each participants improved as a result of the treatment. In the context of this study, the results showed that video modeling was effective in teaching new skills to intellectually challenged students. Minor flaws in the design of this study could slightly undermine its credibility: participants had prior exposure to the technology, participants chose the music to be included in the study as stimuli, and each participants was exposed to the treatment (video modeling phase) for a different length of time. As noted by the researcher the technology used in the study helped participants achieve some social independence. Additional studies must be conducted to confirm the external validity of these findings.

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