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Yewande Dada
ydada@smu.edu

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Can iPads Enhance Opportunities to Respond and On-Task Behavior with Children Who Have Intellectual Disabilities?

by Yewande Dada

Southern Methodist University

Engaged Learning Program

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Abstract

This study serves as a preliminary project that explores different strategies that can be used to teach the population of children with intellectual disability (ID) how to read, by addressing the influence presentation of reading material through technology has on factors that affect reading development. It was predicted that iPads can increase Opportunities to Respond (OTR) and On-Task Behavior (OTB) in children with ID when teaching them how to read. This study had a sample of three students, one male and two females, ranging from ages nine to eleven with IQs that were 80 or below. The results from the study were able to show presentation format effects OTR and OTB, but the effect more so depends on the child than on the presentation format. The overall conclusion from the findings of the study is that presentation type affects factors that influence the experience of children with ID when learning reading skills.

Keywords

Intellectual Disability, Literacy, Opportunities to Respond, On-Task Behavior
Can iPads Enhance Opportunities to Respond and On-Task Behavior with Children Who Have Intellectual Disabilities?

Literacy plays an essential role in creating opportunities for success and access to information in education, work, and throughout life (Allor, Gifford, Al Otaiba, Miller, & Cheatham, 2013; Allor, Mathes, Roberts, Cheatham, & Chaplin, 2010). One of the goals of the nation’s No Child Left Behind Act is to ensure that all children, including children with disabilities, obtain a high quality education (107th Congress, 2002). It is evident within this act that literacy development is essential and should be a primary focus in accomplishing the intended goal.

Though the importance of literacy is well-recognized, the development of the skills necessary to achieve literacy has received minimal attention in the education of children with intellectual disabilities (ID). Children with ID are unlikely to learn how to read without the implementation of explicit, carefully planned instruction (Browder, Ahlgrim-Delzell, Courtade, Gibbs, & Flowers, 2008). This is an issue of grave importance since children who cannot read are left at a disadvantage and will encounter more difficulty in gaining access to opportunities that can help them fulfill their full potential. In spite of the lack of focus on the development of literacy in children with ID, research has shown that when children with ID are taught the necessary skills they have the capacity to learn essential literacy fundamentals (e.g. Allor et al., 2010.) For the benefit of children with ID, the nation’s educational system should conduct research that provides more insight to how reading instruction for children with ID should be implemented. Conducting such research will help ensure students with ID receive the quality education they deserve.
The Misconception and its Effects

The National Reading Panel (2001), which assesses the effectiveness of different approaches used to teach children to read, has identified five areas of reading instruction that have been scientifically proven to successfully teach children how to read: phonemic awareness, phonics, fluency, vocabulary, and text comprehension. In addition, the National Reading Panel has provided evidence-based ways to implement these five areas in the reading instruction of children (2001). Yet past research has shown that many educators of students with ID solely focus on teaching sight word identification to their students, instead of incorporating other skills that would facilitate the development of literacy in addition to sight word identification (e.g., Browder, Wakeman, Spooner, Ahlgrim-Delzell, & Algozzin, 2006). Research has shown this practice is due to the incorrect assumption of many educators that reading is a skill that is beyond the intellectual capabilities of these students (Katims, 2000). This assumption is not scientifically supported. As a result of this misconception, special education teachers focus on teaching children with ID social, vocational, and daily living skills without incorporating literacy development in their curriculum. This practice based on inaccurate information has led to special education programs in the U.S. where four in five children with moderate to mild ID never even achieve minimal levels of literacy (Katims, 2001).

What Research Reveals

Fortunately recent research, though limited, has tried to address the challenging and necessary task of teaching students with ID how to read. This research has been able to show that students with ID can learn how to read. Studies have demonstrated that students with mild to severe ID and autism are capable of developing phonemic awareness and phonics skills, which
are strong predictors of development of reading skills (Allor et al., 2013; Browder, Ahlgrim-Delzell, Flowers, & Baker, 2012; Browder et al., 2008). Browder and colleagues (2008) were able to show that reading skills can be developed in children with ID who are nonverbal. Allor and colleagues also conducted a longitudinal study with a large sample of students with mild to moderate ID. This study showed that when comprehensive and complex instruction is implemented students with ID can develop all of the five skills that are essential for literacy (Allor et al., 2010). In addition, it is one of the only studies to obtain measures of the effect of a reading intervention that shows children with ID can develop oral reading fluency (Allor, Mathes, Roberts, Cheatham, & Champlin, 2010).

Furthermore, Allor and colleagues conducted an additional study that provided persistent, individualized instruction to three children who did not respond well to the instruction provided in the previous study (Allor et al., 2013). In this study Allor and colleagues were able to show that even in more difficult cases in which students with ID may seem unresponsive to effective reading interventions, constant and careful instruction can yield positive gains in the development of reading skills in these children. This can be accomplished when instruction is customized to the progress and needs of the individual students (Allor, et al., 2010; Browder et al., 2012). In spite of the assumptions of many educators, such findings support the view that children with ID are capable of learning reading skills.

Overall, research that focuses on developing reading skills in students with ID has shown that this population requires extensive time and scientifically based instruction that is complex and comprehensive to each of the five areas of reading instruction. This instruction should encompass instructional strategies and techniques that address various areas of skills necessary to completely process individual words and derive meaning from the text (Allor et al., 2010).
Research has shown that effective instruction for these children contains six features: 1) highly motivating; 2) systematic and explicit; 3) fast and carefully paced; 4) repetitive in its use of instructional language and routine; 5) utilizes scaffolding; and 6) provides corrective feedback (Allor, Mathes, et al., 2010; Allor, Champlin, et al., 2010).

**The Promise of Technology**

A new area of study addressing the teaching of literacy in children with ID, that has not been heavily researched, is the use of technology in providing reading instruction. Research that address the effect of technology on literacy development, usually focuses on how additional electronic tools within the electronic presentation of reading materials can enhance reading skill development. Tools such as font size adjustment, animations, words changing colors as they are read electronic games, etc., have shown to be effective scaffolding tools in some cases and ineffective distractions in other cases.

Coyne and colleagues examined the effectiveness of Literacy by Design (LBD), a technology-based universal design for learning (UDL) approach to literacy instruction for children with ID. The LBD instruction provided a wide variety of materials that support the teaching of the five core areas of reading through use of e-books, wiggle works e-books, and letter word recognition software. The tools within these forms of technology would serve as a form of scaffolding. Scaffolding is the provision of guidance during reading task that assist in maintaining a child’s engagement, providing confidence in risk taking, demonstrating possible solutions, and drawing attention to relevant information (Coyne, Pisha, Dalton, Zeph, & Smith, 2012). It is when support is provided or with drawn to assist in maximizing the educational gains of the student. Scaffolding was a core characteristic of UDL utilized in the LBD intervention in
this study. Additional factors that played a significant role in the UDL used in the LBD intervention was the provision of multiple ways to stay engaged, access information and knowledge, and address tactical task (Coyne, Pisha, Dalton, Zeph, & Smith, 2012). This study showed the combination of UDL principles with technology in LBD was beneficial in developing reading comprehension skills in children with ID who received the LBD intervention.

Another study utilized a Computer-Assisted Collaborative Strategic Reading (CACSR) intervention to analyze the effectiveness of a computer assisted comprehension practice on the reading comprehension skills of middle school students with learning disabilities (LD) (Ae-Hwa, Vaughn, Klinger, Woodruff, Reutebuch, & Kouzekani et al., 2010). The CACSR intervention in the study had electronic tools that aided sounding out and defining difficult words, instructional support, a learning log, built in function that records a student’s learning data so as to allow immediate feedback, and other tools in addition to the presentation of the text itself. In this study the students who received the CACSR intervention exhibited significant improvement in reading comprehension. The improved reading comprehension exhibited by students who received the CACSR intervention was attributed to the intervention’s provision of explicit instruction, instructional support, and a tracking of student’s progress, which allowed targeted instruction to meet the needs of each student (Ae-Hwa et al., 2010). In addition, the quality of student generated questions elicited by the intervention was identified as a major factor in the enhancement of reading comprehension skills yielded by the CACSR intervention. Though this study did not have children with ID as its population sample, research supports that strategies used to develop reading skills in children with learning disability (LD) can be applied to children with ID (Allor et al., 2013; Browder et al., 2008).
Although there is not much research available in regards to use of technology in developing literacy in children with ID, more research is available focusing on the use of technology and reading skill development in children without disabilities. A case study was conducted in which second grade students were given the opportunity to read a text using a Kindle and the additional tools innate to Kindle such as changing the font size, using the dictionary, text-to-speech function, and inserting notes. From the data gathered it was suggested that the Kindle tools and features made engagement with and manipulation of text possible which resulted in the promotion of new literacy practices and connections between the student and the text. This study reveals that the control electronic tools provide in reading, assist in the development of reading skills in children (Larson, 2010).

A study was also conducted that used electronic books in developing reading skills in kindergarten students (de Jong, 2002). The electronic books had additional tools such as words changing colors as they were read, icons used to represent nouns in the text, and animations. The results from this study showed that the electronic format is a less efficient way of supporting internalization of story content. The electronic tools that made the electronic book more appealing, served more as distracters. It also showed that in some cases when students had some letter-sound knowledge and used this knowledge to read, the electronic tools especially the icons offered overlapping and complimentary supports that assisted in internalization of vocabulary and characteristics of written word forms. Overall it was concluded from this study that electronic tools would better serve as a supplement that could assist in literacy development but not as a replacement of paper copies (de Jong, 2002).
In addition research in regards to children without disabilities has shown that technology based reading interventions increases the motivation of students (Ciampa, 2012; Cuevas, Russell, & Irving, 2012).

Overall research on technology based interventions that have shown to be effective in developing reading skills in children with LD and ID, attribute success to technology that incorporate factors such as increasing motivation, scaffolding, task variability, and variability in presentation of material (Ae-Hwaet et al., 2010; Coyne et al., 2012; Cuevas et al., 2012).

Though such research shows promise, there is a need for more research that focuses on teaching literacy to children with ID through the use of technology. Project Intensity is a federally funded research grant at Southern Methodist University that is focused on developing a supplemental literacy program for students with ID that provides rigorous, extensive practice with multiple-criteria text (Project Intensity, 2014). This research project under Project Intensity will provide new insight into the possible promise of using technology in the teaching of reading skills to students with ID. Unlike the research reviewed, this study will serve as a preliminary study that focuses on whether simply presenting reading material through electronics, in this case the iPad, would elicit any changes in the learning experience of the children. The purpose of this study is to determine the effectiveness of the Intensity activities on the scaffolding provided by instructors and on the on task behavior of children with ID. It is hypothesized that the students who receive the technology version, iPad presentation, of the Project Intensity stories will receive more 1) opportunities to respond (OTR) to text and 2) exhibit more on task behavior (OTB) than those who receive the paper booklets of the stories.
METHODS

Participants

Schools in and near the Dallas, Texas area were recruited to participate in the Intensity Project, through sending emails and visiting the schools to ask if they would be interested in participating in the study. Schools that were recruited were schools that had students from kindergarten to fourth grade with an IQ of 80 or below. Students with an IQ range between 70 and 80 would be within the classification of borderline cognitive delay, students between 70 and 55 were the mild range of cognitive delay, and those between 55 and 40 were classified as moderate cognitive delay.

Purposeful sampling was used to determine which students from the Intensity Project student pool would participate in the study. Teachers at the schools used, selected good candidates for the study based on age, IQ, and reading ability. One male and two females were selected to participate in the study. Shawn is a ten year old Caucasian male, Jessica is a nine year old Caucasian female, and Sally is an eleven year old Hispanic female. All three students have been diagnosed as having Down syndrome. Each student is taught in a self-contained class for children with developmental delays within a typical public school and receives instruction from a Project Intensity research teacher.

Data Collection

A Single subject design was used for this study. Each of the students had reading sessions in which presentation of the reading material via book and iPad took place. Each reading session was recorded using an iPad. Shawn read two books, Sally read two books, and Jessica read three books with the instruction of an Intensity researcher. The presentation type, paper booklet or
iPad, varied in order for each child, as illustrated by Table 1. The variation in presentation type served as a means to see whether the presentation via iPad or paper booklet made any significant difference in the designated measures related to reading development. It was felt that if the same order of presentation format was used for each child and each story, the same order of presentation format could serve as an explanation for the differences seen in the values obtained. To avoid this effect, variation in the order of presentation format for each child’s sessions was used to show that the presentation format itself was the reason behind the differences seen.

**Table 1. Order of Presentation of iPad and Paper Booklets**

<table>
<thead>
<tr>
<th>Child</th>
<th>Story Title</th>
<th>Presentation order</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sally</td>
<td>Hide and Seek</td>
<td>I, I, B</td>
</tr>
<tr>
<td></td>
<td>Farm Animals</td>
<td>B, B, I</td>
</tr>
<tr>
<td>Jessica</td>
<td>Bake a Cake</td>
<td>B, B, I, I</td>
</tr>
<tr>
<td></td>
<td>I Like the Zoo</td>
<td>I, I, B, B</td>
</tr>
<tr>
<td></td>
<td>The Day I Got Jazz</td>
<td>I, B</td>
</tr>
<tr>
<td>Shawn</td>
<td>Hide and Seek</td>
<td>I, B, B</td>
</tr>
<tr>
<td></td>
<td>Farm Animals</td>
<td>I, B, B</td>
</tr>
</tbody>
</table>

**Variables**

Two variables were coded from the video-recordings: Number of opportunities to respond (OTR), and percent time of on-task behavior (OTB).
**Opportunities to Respond (OTR).**

Opportunities to Respond (OTR) is an instructional strategy in which teachers present a prompt that elicits an academic response from a student (Houten, 2001). It is any opportunity the teacher gives the student to respond to a presented stimulus that is related to the book being read. OTR is used as a questioning strategy at the beginning and end of a learning trial, which is a contingency sequence that consists of three terms, stimulus, response, and consequence (Houten, 2001). Examples of OTR include: a) instance when teachers ask questions about the material that requires a specific or open-ended response, b) when teachers ask students to repeat a word from the material, or c) when teachers allow students to begin or finish a sentence being read from the material. To evaluate OTR for each student, a frequency count was used to determine OTR per session. To count as an OTR the stimulus must be one that is related to the book being read. To simplify coding each sentence students read counted as a single OTR instead of counting each individual word read or prompted to be read, for example teachers pointing to the word, as an OTR. If additional questioning took place in order to help students pronounce a word or encourage the student to try and re-read or pronounce a word, then that prompt would count as an OTR in addition to the OTR counted for reading the sentence. Every time a child is given an opportunity to respond during the session, a tally mark is written on the sheet for that child’s session. An opportunity was counted even if the student did not respond or answer correctly. The total number of tally marks at the end of the session will be the number of OTR for that particular session.
On-Task Behavior (OTB).

Students who exhibit on-task behavior are attentive and responsive towards the material and teacher. On-task behavior is evident when the student’s orientation is directed towards the material used at the time of the session, such as the standard paper booklet or the iPad. It is also when the student follows the directions of the teacher, when the student is performing the assigned task, and when the student elicits a response to the teacher’s questions that are relevant to the question being asked. A duration measure is used to determine how long the child is on task throughout the session. A stopwatch was used to record the duration of OTB. When recording OTB the coder would stop the stopwatch for the duration of time in which the student exhibits off-task behavior. Once the student returns to exhibiting on-task behavior the stopwatch was started again and continued recording from the time the stopwatch was stopped. To create a percentage of the time the student was on-task, the on-task time was divided by the actual time of the session, and the number obtained was multiplied by 100. The final number obtained indicates the percentage of the time the student was on task during the session.

Inter-observer Agreement.

There was a main coder who coded all of the 22 videos and two additional co-coders, each of which coded 20% of the videos for one of the 2 variables being coded. One co-coder coded five of the videos in the study for OTB and the other co-coder coded five of the videos in the study for OTR. The percentage of Inter-observer agreement was calculated for OTR and OTB between the co-coder and the main coder (Houten, 2001).

The Percentage of inter-observer agreement for OTR was calculated by dividing the lower frequency count by the higher frequency count, between the main coder’s and co-coder’s
counts, and multiplying this quotient by 100. The average of the values for the five videos were calculated and represent the average inter-observer agreement for OTR, which was 86%. For OTB, the difference between the co-coder and main coder’s recordings was calculated for each of the five videos to show the percentage of disagreement. The average of this value for the five videos was taken. This value was then subtracted from 100% to provide the average inter-observer agreement for OTB, which was 94.25%.

RESULTS AND DATA ANALYSIS

Line graphs were created for each child’s OTR and OTB data. Visual analysis was used to interpret the trends or lack thereof, present in the line graphs of each child’s OTR and OTB data (Engel, 2013).

Sally

Sally read two books, Hide and Seek and Farm Animals. Sally is a student who is usually on task. Throughout the Intensity project Sally usually was focused during reading sessions, and her behavior was no different for this study. During this preliminary study when the stories were presented through iPad and paper booklets there was little variation in the Sally’s trend in OTB, illustrated by graph 1. Throughout the reading of the Hide and Seek story her OTB was consistently high, no less than 98%. During Farm Animals Sally’s OTB was above 90% for the readings except during the first day of reading the story via booklet where Sally’s OTB was 73.8%.
Sally’s OTR data revealed a trend in which OTR was higher when iPad presentation was used in comparison to when a paper booklet was used to present the story, as shown by Graph 2. On average Sally was provided with 42 OTRs when material was presented through use of iPad presentation. When material was presented through paper booklets an average of 26 OTRs were provided. Since Sally’s OTB was consistent throughout the study except for one day, it is felt that the teacher elicited more OTRs due to the use of an iPad to present the material and not due to Sally’s behavior. This finding shows that the use of iPad technology resulted in Sally’s teacher providing more OTRs.

Shawn

Shawn read the same books as Sally, Hide and Seek and Farm Animals. Although he had the same teacher as Sally, interestingly his OTRs during the readings of these two books showed no trend in which variability present can be attributed to the difference in presentation type. One can see in Graph 3, that while his OTR did vary during instructional session, that variation did not correlate with presentation type.

Though neither of the presentation formats used was favored over the other in regards to OTR, a trend was present in regards to OTB. Overall Shawn exhibited OTB that was above 94% for all the reading sessions. During all the reading sessions in which the story was presented via booklet Shawn exhibited 100% OTB, whereas OTB was below 100% when reading sessions were presented through iPad presentation, as shown by Graph 4. This data shows that overall Shawn is usually on task no matter the presentation type but is more on task when the stories are presented via iPad. This finding was counter to the proposed hypothesis, thus showing that some students, like Shawn, exhibit more OTB when paper booklet copies of the stories are used.
Jessica

Jessica was a particularly challenging student. Jessica read three books, Bake a Cake, I like the Zoo, and The Day I Got Jazz. Unlike Sally and Shawn there was no trend present in regards to OTR and OTB that showed one form of presentation type yielding higher OTB and more OTRs than the other format. Jessica’s OTR and OTB data shows no consistent trend in which variability in OTR and OTB could be attributed to variation in presentation format, as demonstrated by Graph 5 and Graph 6. Jessica’s data reveals that some children’s OTB and OTR are not influenced by different forms of presentation type.

Overall, the results revealed no single presentation type was favored by all the children in the study. Each child exhibited unique responses to the variation in presentation type.

DISCUSSION

This study is a preliminary study that focused on exploring the possible promise in the use of iPad technology in teaching children with ID how to read. The conclusion drawn from this study is that the effect of presentation type on OTR and OTB depends more on the individual child’s interest than on the presentation format of the stories used. Also, it is clear that, while many think technology is a “magic bullet” to increase student engagement not all students prefer it, especially as an “e-reader” rather than a typical book.

Based on this preliminary research, while hardly conclusive, further study involving technology to increase attention and opportunities to respond are necessary.

Though the conclusion drawn from the study is that OTR and OTB depend more on the individual child’s interest than on the presentation format of the stories used, there were
limitations present that prevent the generalization of the conclusion drawn to the population of children with ID. Since a single subject design was used for a small sample of three children, the results obtained are representative of the children used in the study and not necessarily the general population of children with ID. To address this factor and to explore whether the findings from this study are representative of the population of children with ID, this study should be repeated with a larger sample size.

Aside from sample size and single subject design, it is felt that more books should have been read, at least four books for each child, with a minimum of three readings for each book read. With such changes, more data would be available to ensure that the trends present in the data can indeed be attributed to the presentation format of the stories read.

In spite of these limitations, the goal of this preliminary study was to address whether variation in presentation type, iPad or paper booklets of the stories, effect factors that influence the learning experience of children with IDs when learning reading skills. This study has been able to show that presentation format can affect the learning experiences of children with IDs during reading instruction. With the results obtained from this study it is felt that more research should be done to understand the effects different presentation formats, such as technology like the iPad have on variables that influence how children with ID respond to reading material and instruction. In addition research should not only focus on how the child responds to differences in presentation format, but also how presentation format influences teacher’s administration of reading instruction. By addressing such questions through structured research the knowledge gained has the potential to reveal unexplored possibilities that can yield benefits in reading development in children with ID.
The knowledge gained from this research study, Project Intensity, and research of similar nature provides a new perspective in the teaching of reading instruction that will assist in the development of reading skills in children with ID. Research thus far has shown that children with ID are able to learn the fundamentals necessary for the development of literacy. Therefore, the question at hand is not a matter of whether or not students with ID are able to learn how to read. It is a matter of what are the most effective strategies that can be used to teach these students how to read in a manner that is conducive to these students’ way of learning.

Literacy provides opportunities for people with IDs that not only assist in their progression in society but also in the development of these individual’s full potential. People with IDs are capable of and have more to offer this world than what is accredited to them. It is the duty of the nation’s educational system to look past the setbacks associated with educating students with IDs and teach the skills needed to surmount the possible hindrances these children may encounter. It is a necessary task that will not only yield benefits for those who have IDs, but society as a whole.

All people are entitled to the right of self-fulfillment and to obtain as much independence as possible. Literacy is a skill that can assist all people in achieving these goals. Children with ID are too often, not given the opportunity to use this tool; therefore more efforts should be made to ensure this is no longer the case. When children with ID are taught how to read, they gain a skill that will help them fulfill their full potential, a potential that has been untapped for far too long, a potential that in turn can change our society for the better.
RESULTS & FIGURES

Note: The solid blue line in the graphs represents when a new story was used. The white lines indicate a change in presentation format.

Sally

Graph 1

*Sally's OTB was not influenced by presentation type. Aside from one day of 73.8% OTB, Sally's OTB for both stories was always above 90%.

Graph 2

*Sally's OTR was influenced by presentation type. On average Sally was provided with 42 OTR with iPad presentation and 28 OTR with book presentation.
Shawn

Graph 3

\begin{figure}
\centering
\includegraphics[width=\textwidth]{shawn-otr}
\caption{Shawn: OTR}
\end{figure}

*Shawn's OTR was not influenced by presentation type.* The trend present did not correlate with changes in presentation type.

Graph 4

\begin{figure}
\centering
\includegraphics[width=\textwidth]{shawn-otb}
\caption{Shawn: OTB}
\end{figure}

*Shawn’s OTB was influenced by presentation type.* Shawn's OTB was consistently above 94%, but OTB was 100% for every reading session when iPad presentation was used.
Jessica

Graph 5

Jessica: OTR

Jessica's OTR was not influenced by presentation format

Graph 6

Jessica: OTB

Jessica's OTB was not influenced by presentation format
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