STaR

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In 2013 a collaborative study was conducted to investigate whether a book or an iPad app on the same theme of interest would be a better catalyst to engage young children with significant intellectual disabilities. The research team consisted of Macquarie University Special Education Centre academics Associate Professor Jennifer Stephenson and Dr Coral Kemp in collaboration with STaR staff members Dr Kerry Hodge and Megan Cooper. The findings were presented at two national conferences—in learning technologies and in special education—in 2014. A brief summary of the findings was also presented at the conference of the International Society on Early Intervention in Stockholm, Sweden in 2016. The study has now been published in an international academic journal, *Infants and Young Children*. This is a summary of that article.

Why this particular study?

Having children with severe and multiple disabilities engaged in an activity is a high priority in early childhood intervention. Engagement with people and materials is a pre-requisite for learning, and it also makes desirable behaviours (such as vocalising, manipulation of materials and social communication) more likely and challenging behaviours less likely. However, it can be difficult to engage these children, especially in a busy, noisy inclusive setting where adult to child ratios are smaller than in a segregated setting. For children with significant disability, especially those with autism spectrum disorder (ASD), planned one-to-one interventions may be a useful addition to free play so that new behaviours needed for engagement, such as joint attention, can be established.

Picture book reading shared with an adult is a one-to one teaching situation commonly used to develop the language and literacy skills of disadvantaged preschool children. Particular strategies (following and commenting on what interests the child, praising participation, extending the child's utterance, for example) are used. There is some evidence that this intervention is effective in increasing verbal participation of children with significant disabilities; the evidence for increasing their engagement is more limited.

Mobile touch screen devices are becoming more available to young children, and emerging research is indicating that specific apps have promoted engagement of school-age children with ASD. To date there has been little research to indicate the value of touch screen devices for promoting the development of children with significant intellectual and multiple disabilities—and none in the preschool or childcare setting. Yet these devices have the potential to provide more opportunities for learning guided by parents, caregivers and teachers and a better quality of life for the child.

Who took part?

Three young children with severe and multiple disabilities took part, with the permission of their families. Pseudonyms are used here. They had been attending privately owned childcare centres for 19-21 months in middle-class areas of Sydney. None could communicate verbally as the study began and their observed engagement with people and materials in their childcare centres was severely limited.

Zoe (61 months when the study began) was diagnosed with moderate to severe global developmental delay with additional medical conditions and a moderate vision impairment. She played alone alongside other children, using materials in a non-functional way and vocalising (but not verbalising). She needed help to walk from one activity to another. At home she occasionally interacted with a tablet with help and with board books.

Sam was 46 months and was diagnosed with Fragile X syndrome, moderate to severe developmental delay and ASD. He did not engage with peers and frequently mouthed or spun objects, often vocalising. At home he occasionally used a tablet with help and interacted often with a range of types of children's books.

Luke was 63 months. His chromosomal micro deletion resulted in severe developmental delay and he also was diagnosed with ASD. Luke used a walking frame and spent most of his time screaming, scratching his skin or hitting his head. He engaged momentarily with objects given to him and often engaged in self-stimulatory behaviour. At home he interacted with a tablet (with help) and board books daily.

How did we conduct the research?

The research used a 'single subject multiple treatment' design, suitable for comparing the relative effects of two different stimuli (book and iPad app) across the three children. The data collected for each phase (book, iPad, book, iPad) were graphed and analysed by visually inspecting the graphs.

The books and apps

Selection of books and apps was based on each child's cognitive development, preferences and topic interests reported by the individual families. Board books and apps were matched as far as possible by topic, theme and complexity. Zoe's book held a range of colours and textures. Her app allowed her to create brightly coloured dots and lines by touching the iPad screen. Sam's book included trucks with various colours and textures, while his app about trucks included movement and cause and effect. For Luke the book offered a range of farm animals and picture flaps, and the peek-a-boo app allowed him to expose the animal and hide it again.

Child	Book	App
Zoe	*Baby Touch Rhyme Book* (Ladybird, 2005)	*Somantics* (Cariad Interactive, 2012) – Paths (Keah-Bright)
Sam	*Touchy Feely Trucks* (Watt, 2010)	*Trucks HD*, Version 2.0.1 (Duck Duck Moose Inc.)
Luke	*Spot Goes to the Farm* (Hill, 2012)	*Peekaboo HD*, Version 1.6 (Gotclues Inc., 2013)

The book reading and iPad app sessions

The adult facilitators were known to the children and had, or were training for, qualifications in special education. They followed specific guidelines for introducing the media, encouraging participation, redirecting attention if lost and closing the session. The focus was on engagement, not teaching, and books were not read to the children. Children were not forced to come to or stay for the session, which lasted around 6 minutes. The four phases (book, iPad, book, iPad) each had 5 sessions, which were held indoors twice a week while other children were playing outdoors.

Analysing the data

The sessions were recorded with a video camera, with 5-second beeps from an iPod added to facilitate data analysis. The first author viewed each session and coded it using a specially designed coding sheet. For each 5-second interval she recorded whether the child was engaged or not, or partially engaged, according to definitions. A second observer coded some of the sessions, one per phase for each child and randomly selected, to ensure the coding was reliable (at least 80% agreement). Checks were also carried out to determine whether the intervention strategies were implemented as planned.

What did the study tell us?

The study showed the potential of the iPad apps to engage the children in one-to-one interaction with an adult.

For Zoe, engagement with both book and iPad was immediate and sustained; she also engaged socially with her facilitator and began to use single words and two-word combinations during the sessions. She showed no notable difference in her engagement between the book (mean 76% across phases 1 and 3) and the app (mean 66.2% across phases 2 and 4).

For the two boys there was a marked increase in engagement when the iPad was introduced (phase 2) and a fall when the book was re-introduced (phase 3). Sam's difference in mean percentage of engagement was the greatest: 8.3% for the book and 63.2% for the app. There was also a substantial difference for Luke: 31.3% for the book and 77.2% for the app.

Sam's engagement with the iPad app began to wane towards the end of the study, which suggests he may have become bored by it. An advantage of apps is the presence of variations within it. Although it was contrary to the research procedures, when Sam was permitted to use a parallel variation of his app (same subject and theme) in the final session his engagement immediately rose.

Luke's results were the most interesting. His limited mobility and communication makes it difficult to know whether he would have left the early book sessions if able to (he was rarely engaged, however, with mean 5% engagement). His 80.7% mean engagement in the first iPad phase was a remarkable change. By the end of the study he was walking independently but willingly stayed for the book and iPad sessions. His engagement with the book increased steadily in phase 3 to a level comparable with the first iPad phase. For him the iPad revealed a higher level of fine motor skill (using his index finger) than the book, for which lifting the flaps was often difficult. An unexpected observation of Luke occurred towards the end of the research period. He was obviously enjoying a peek-a-boo game with an educator not involved in the research, at a level not observed prior to the study. Given the similarity of this game to the format of the book and app, it is possible that the skills Luke developed in the one-to-one sessions had generalised to other settings and people.

How might others use this information?

Practitioners

The study was conducted in a one-to-one, controlled context to be sure that it was the book or the iPad app that was influencing the child's engagement. Although this very personal approach away from distractions is counter to recommendations for inclusive practice, for children with such high support needs it may be necessary in order to teach the basic skills of engaging with materials and people. The children can then gain greater benefit from inclusive activities.

Six minutes twice a week of individualised one-to-one interaction with an adult (over 20 weeks) was sufficient to give these children the opportunity to show that they could engage with a book or an iPad app or both. There were clear advantages in the iPad apps for promoting engagement for Sam and Luke, with the potential for learning new skills in other developmental domains and planned generalisation to activities involving other children. This one-to-one time also gave Zoe's facilitator the chance to tune into and reinforce her communication attempts, in the context of a shared stimulus, in ways that inclusive activities had not.

There is potential benefit in exploring the use of mobile touch screen technology in early childhood settings where children with significant disabilities are enrolled. In this study the research facilitators and other educators on site were able to experience the relevance of the use of iPad apps for the children's individual goals.

Researchers

Replication of this study with a larger number of children with severe and multiple disabilities is needed to support these findings, and if the introduction of the book and iPad conditions were counter-balanced (books first or iPad first) across the participants, this would avoid any possible carry over effects. Adding a generalisation phase, that is, generalisation to inclusive activities, would increase the relevance of the research for practitioners. The full article discusses more fully the limitations of this study.

Where can you read the full report of this study?

Kemp, C., Stephenson, J., Cooper, M., & Hodge, K. (2016). Engaging preschool children with severe and multiple disabilities using books and iPad apps. *Infants and Young Children, 29*, 249-266.