Integrating iPad as a curriculum-based pedagogical tool to facilitate communication in nonverbal students with autism

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Abstract

The purpose of this study was to explore the various instructional strategies used by the teachers using iPads to facilitate communication skills in students presenting as nonverbal with autism spectrum disorder. Two students in the age group of 6 to 12 years who present with little or no functional speech participated in this study. Observations were conducted for one week over 10 sessions during term 2 and term 3 in a natural classroom setting with the students and the educators interacting during classroom activities. Interviews were also conducted with the students' respective educators and speech-language pathologist to identify various strategies that are implemented using iPads to facilitate communication skills. There were many strategies identified during the study. However, this paper discusses two prime strategies such as Aided Language Stimulation (ALS) also known as modelling and prompting techniques. Students used Proloquo2Go which is an iPad-based communication app. The findings provide support that strategies were effective and the students exhibited positive gains in achieving their learning goals.

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Introduction

Autism Spectrum Disorder (ASD) is a neurodevelopmental condition that affects individuals in (a) social communication and interaction and (b) restricted and repetitive behaviours. Communication both verbal and nonverbal is one of the significant challenges faced by students on the autism spectrum. Nearly 30% of individuals diagnosed with autism are nonverbal or minimally verbal despite engaging in extensive interventions and a range of educational programs (Tager-Flusberg & Kasari, 2013; Wodka et al., 2013). They depend on gestures such as reaching, pointing, showing, eye gazing and other various facial expressions as a way of communicating their needs and requirements. To date, autism research that investigates the impact of digital technologies tends to focus on higher-functioning children rather than on low to moderate functioning children on the autism spectrum (Maljaars, Noens, Scholte, & van Berckelaer-Onnes, 2012; Sitdhisanguan, Chotikakamthorn, Cechaboon, & Out, 2008). Students on the spectrum may experience considerable delay in learning language, and they adopt different patterns in achieving it. Owing to the unique nature of autism they require a high level of support throughout their school years (Carpenter, 2010) and there is a need to adopt individual strategies that suit each individual (Heimann, Nelson, Tjus, & Gillberg,1995).

Students with complex communication needs benefit from using Augmentative and Alternative Communication (AAC) strategies. AAC (unaided and aided) is any form of expressive or receptive communication that acts as a supplement (augment) or replaces (alternative) natural speech (Beukelman & Mirenda, 2005; Schlosser & Sigafoos, 2006). These devices have been explicitly designed and developed for individuals with little or no functional speech to help them communicate their ideas and express their thoughts and needs (Ganz, 2014). Thus many individuals with ASD are candidates for aided augmentative and alternative communication (AAC) interventions (Sigafoos et al., 2014).

Emerging tablet technologies including iPads are used as an Augmentative and Alternative Communication (ACC) devices to facilitate communication and other learning goals in these students. Over the years, a range of communication strategies and language modelling techniques have been designed and developed to teach individuals with complex communication needs to assist in learning the meanings of the symbols that are from their AAC device to communicate. This method is known as Aided Language Stimulation (ALS) where the communication partner, as referenced in this paper, include educators and therapists highlights by pointing out to the symbols on the student's communication display along with verbal instructions (Goossens', 1989). After using ALS, the communication partner motivates the student to repeat the demonstrated actions on their AAC system (Beck, Stoner, & Dennis, 2009). A growing number of communication intervention research has identified that using aided language stimulation in children with little or no functional speech presenting with cognitive difficulties have shown an increase in vocabulary acquisition and was more effective in facilitating symbol comprehension and production using Low-tech AAC (Dada & Alant,

2009) and also shown positive outcomes using iPad device in achieving their communication goals (Dundon, McLaughlin, Neyman, & Clark, 2013; Ward, McLaughlin, Neyman, & Clark,2013).

Prompting hierarchies provide an efficient way of scaffolding students learning and to respond to a new skill or a behaviour and enhances their level of independence. Depending on the students learning styles and requirements there is a range of prompts to assists them. McClannahan and Krantz (1999) defined prompts as "instructions, gestures, demonstrations, touches or other things that we arrange or do to increase the likelihood that children will make correct responses" (p. 37). Studies have shown that systematic instructional strategies with iPad such as time delay, least-to-most prompting and reinforcement were successful in teaching new skills and also supports in the learning and development of functional communication skills facilitates in the development of functional communication skills in nonverbal students with autism (Kagohara et al., 2012; Xin & Leonard, 2015).

Emerging tablet technologies like Apple iPads are widely incorporated in special education schools as AAC devices to facilitate communication, academic and other learning goals. Some of the advantages of iPads for them to be included in the classroom are they are less stigmatising when used as an assistive technological aid (Kagohara et al., 2013). Further benefits are their portability (Achmadi et al., 2012), accessibility (Shane et al., 2012), affordability, motivation and social acceptance (McNaughton & Light, 2013).

To date, there is a myriad of apps available on the market that targets various skills like social skills, communication skills, behaviour skills, academic skills and others. There are few communication apps like Proloquo2Go, Sonoflex, My Choice Board, GoTalk Now for Free and LAMP (Language Acquisition Through Motor Planning) that were used as single subject case study. Apps are easily customised to the needs of the students (Shane et al., 2012). With the possibility of customisation based on the student's learning profile and their individual goals, the apps within the iPads are used as a differentiated instruction (DI) tool to meet the needs of the diverse learners. The iPads are used as a comprehensive tool to support and integrate through the various area of the curriculum. Thus, this paper focuses on the teaching strategies adopted by the educators using iPads to facilitate communication skills in students with autism. The current study employed a case study approach for an in-depth examination of students who have varying needs and requirements. Further, it provides a detailed understanding of the various strategies implemented by the educators.

There has not been much research that focuses on the various teaching strategies adopted by the educators and the Speech Language Pathologists with the use of iPad applications to scaffold communication skills in students presenting as nonverbal and low to moderate autism spectrum disorder. This exploratory study aimed to observe the various effective teaching strategies used by the teachers using iPad-based communication apps to facilitate communication skills in students presenting as nonverbal with autism.

Method

Design

Data in this study was collected using various sources of information. A qualitative research design was employed comprising of semi-structured interviews and observations. Ethics approval was obtained from the University Human Research Ethics Committee and the Department of Education and Child Development after careful consideration of the proposal.

The Setting

The study was conducted in a special education school located in the Adelaide metropolitan area where iPads are integrated as a curriculum-based pedagogical tool. In general, the classroom has eight students, one teacher and two school services officers. The students have their Individualised Education Plans (IEPs) or the learning goals with a modified curriculum that enable the students to participate in the programs to achieve their learning goals. The goals were reviewed twice a year and when the goal was achieved a different goal is designed for the student. The students accessed their iPads through the National Disability Insurance Scheme (NDIS) which is a government funding. The students in this study used Proloquo2Go application (Sennott & Bowker, 2009) as recommended by their speech-language pathologist. To support different stages of language and communication development, the app is designed with three levels of support namely basic, intermediate and advanced level. One of the students is in basic level and another student access the intermediate level. However, their apps are customised depending on their level of competencies and their IEP goals to facilitate communication skills.

Participants

Students. A total of 10 students were recruited by the principals of three schools in consultation with the teachers and other professional staff who worked closely with the students. To be included in the study participants were required to meet the inclusion criteria: (a) age group between 6 – 12 years, (b) diagnosed with low to moderate on the spectrum (c) with limited or no speech and language abilities, and (d) have sufficient motor skills to operate an iPad. All the two students had significant language, and communication delays and their communication skills ranged between using limited words to no speech. The students preferred mode of communication at school environment was using nonverbal behaviours and iPad-based communication apps.

Other participants. The range of participants included classroom teachers, school services officers (SSOs), para-professionals, parents/carers, siblings and early intervention support staff who worked closely with the ten students. From the broader study, this paper is limited to looking at two students in one school with one classroom teacher and one speech-language pathologist.

Profile of student participants. The two students had their diagnosis for ASD before the age of 4 and had undergone early intervention services as part of their pre-school support program. They were receiving ongoing therapy sessions with a speech-language pathologist who meets them fortnightly for 45 – 60 minutes across home, school and clinical setting. All the students had co-morbid

symptoms/conditions alongside with ASD. They also had sensory sensitivities. A brief description of the student's profile collected during the time of data collection is mentioned below.

Student 1, Ian was an eight-year-old male who also had Attention Deficit Hyperactivity Disorder (ADHD). He used around 5-10 verbal keywords at the time of data collection. Some of the nonverbal cues used by Ian were pointing, giving, head nod and showing. He used the communication app for the past two years and he used an intermediate level.

Student 2, Nathan was a seven-year-old male who used the only word "bye". His nonverbal cues included waving hands and facial expressions. His teacher mentioned that he had Cortical Visual Impairment (CVI). He responded well to high contrast, bright colours and hence his teacher had personalised the symbols on his Proloquo2Go app to suit needs. He had been using the app for the past six months and used basic communication level. He had trouble isolating his pointing finger to point to the symbols and was using two or three fingers to invoke the buttons.

Instruments

The checklist used for observations was adapted from Communicative Functions and Means, developed by Prizant, Wetherby, and Roberts (1993). Also, a few modifications with indicators were made to the adapted checklist after conducting the pilot study before the original data collection procedure.

Data collection

Data was collected using classroom observations, field notes and individual semi-structured interviews. As an exploratory study, the following methods were implemented to obtain the data.

Observations. Observations were conducted with the teachers and students during different classroom activities for one hour each week over a 10-week period during term 1 and 2. The classroom activity includes group-time, one-to-one, break/lunch and reading time. The purpose of this observations was twofold: firstly to identify whether students were able to achieve their communication goals designed through the Individualised Education Plan (IEP) and secondly, to understand the communicative intents the students used iPads to communicate in everyday classroom routine. Since students have limited speech and use a range of nonverbal behaviours as a way of interaction, observations were collected on the number of times the student responded to the teacher's strategies to achieve the goals. Also, the teachers will be observed for their teaching strategies.

Interviews. Interviews were conducted after observations. A standardised semi-structured, open-ended interview was used to ensure that all the participants were asked the same set of questions and at the same time enabling them to provide detailed information (Turner III, 2010). The interview questions were aligned with the aim of the study and focussed on the use of iPads and teaching strategies. During term 3 the participants were provided with the questions before the interview and were interviewed individually within the school premises at their convenient time. A follow-up interview was conducted with the classroom teachers at the end of term 4 to know if the students were able to achieve their learning goals at the end of the year.

Data Analysis

The audio interviews and the field notes were transcribed into word documents and imported into NVivo11, a software for qualitative data analysis, provided by QSR International (QSR International Pty Ltd, 2013). Apart from using NVivo, the researcher also analysed the data comprehensively to have an in-depth understanding of the information emerging.

Findings

Students with autism are diverse learners, and they learn diverse learning needs. Hence, the role of educators in a special education classroom is very critical as they need to identify suitable and effective strategies to help them to motivate and engage them in everyday classroom activities. There were many teaching strategies identified by the use of educators throughout the day to meet the requirements of each student. Students who have limited or no speech and language abilities may need additional support while they are learning a new skill or a behaviour. Due to the students diverse learning needs, there is no "One size fits all" strategy. One strategy may work for a student one time, and the same strategy may not work the next time. Hence, the teachers need to try and adopt various teaching strategies that help the student engage in learning to communicate and to achieve their learning goals. Hence, the focus of the study was to explore the instructional strategies that facilitate students to achieve their learning goals.Two evident-based strategies such as AAC modelling and prompting strategies were incorporated with iPad-based communication apps across the curriculum to assist students' in achieving their goals. The observational data obtained is illustrated as examples of how the teaching strategies were implemented across group time and during lunchtime in school 1.

Observation data

Strategy 1: Modelling or ALS. Modelling is one of the prime strategies that is implemented across various activities by the educators. The example below illustrates the impact of modelling strategy used by the educators in the classroom. To reduce distractions and increase focus there was a calm area inside the classroom with individual workstations provided for each student where they work during their one-to-one sessions with educators and therapists. Ian was sitting on his workstation, and his teacher was sitting next to him. One of Ian's goal using Proloquo2Go app was to use sentences of at least three words to give information.

For example, when the teacher asked Ian "What day is today?" He could respond by saying "Today is Tuesday". To say this using his communication app he had to navigate across the pages of the app to access the words. The possible way to create a sentence was to tap on the buttons across the folders on the app. The selected words appear on the message window (top section of the app), and it had an auditory output option to speak the message.

Step 1: Click the 'More' button on Home screen

Step 2: Click 'Time' folder on Home 2 Screen

Step 3: Click 'today' button on the 'Time Words' screen

Step 4: The 'today' icon was clicked, the word 'Today' appears in the message window (top section) of the app.

Step 5: Choose the button with "equal" symbol and the word "is" appears next to 'Today' in the Message Window.

Step 6: The final step is to select the 'Days of the week' folder on the 'Time Words' screen

Step 7: Choose 'Tuesday' button on the 'Days of the week' screen. When 'Tuesday' is selected, the word 'Tuesday' is appended to the existing text in the message window, this reading 'Today is Tuesday.'

Initially, Ian's teacher modelled the pathway in his iPad step by step by pointing to the symbols to perform the actions and simultaneously giving out verbal instructions to navigate across the folders to reach the days of the week. The teacher asked Ian "What day is today?". Initially, Ian was not able to identify the symbols as he was completely lost in his thoughts and the teacher then showed him the visual card saying "Time to listen". The teacher verbally said, "It is your turn, Ian". The teacher provided verbal prompts and gesture prompts for three to four times and Ian was able to navigate through the folders and said, "Today is Tuesday". After doing the steps for 2 to 3 times, he was able to perform it independently. Also, the message window when clicked produced an auditory output of the corresponding words seen on the Message Window. Ian pressed the message window to repeat the sentence continuously and listened to the audio. By doing this, he was trying to imitate and repeat the words verbally. The teacher appreciated Ian with verbal praise saying, "You are pretty clever Ian!" Here Ian had not only learnt to communicate through symbols but had also developed his verbal imitation skills by listening to the auditory feedback from the iPad and was slowly developing to use functional keywords. He required frequent adult modelling to identify the symbols on the communication app.

Strategy 2: Prompting hierarchy. Another evidence-based strategy that facilitates communication with individuals with autism is the prompting hierarchy which uses the least-to-most prompting hierarchy (model, gesture, verbal, full physical) after a time delay of 5- 10 seconds pause. The example below illustrates the impact of prompting strategy used by the educators in the classroom. During the observation in school 1 that happened during lunch-time to explore how and what teaching strategies were implemented by the teacher with Nathan. One of Nathan's communication goal was to use Proloquo2Go app to request without prompts. Nathan can eat independently, however, he requires assistance to give him small portions of food at one time. Food is a motivator for him, and during lunchtime, he was offered a small amount of food, and when his plate was empty, he was motivated to say, "more please" using his iPad before being offered more. Initially, Nathan just waved his hands to the teacher as a nonverbal cue of telling her that he needed food.

During lunch time the school services officer asked, "Show me what you want for lunch?" His iPad had the symbols of chips, sandwich, fruit and drink. He showed sandwich by tapping on the iPad display screen. So, he was offered little sandwich on his plate. Now the teacher used Model

prompt to show him the pathway to request for more food using his iPad. She was verbally saying the symbols names and simultaneously choosing the home button followed by "more" and "please" symbol which was present on the home page. Again, the question was asked, and the teacher waited for his response. Though he was looking at what the teacher was doing on his iPad, there was no response from Nathan. Now the teacher provided gestural prompt by pointing to the specific button that needs to be pressed to make the communicative attempt and followed the procedure. Since there was no response from Nathan, the verbal prompt was provided to say, "use your device" which indicated that Nathan should use the app to request for food. Nathan failed to respond to the question, and hence full physical prompt was provided using hand-over-hand assistance to show him the correct symbols to request "more please", followed by tapping on the message window for auditory feedback.

The teacher asked the question, and this time he tried to choose a wrong symbol and the teacher used gesture prompt by pointing to the correct symbol. He was able to request using the correct symbol, and the teacher used verbal praise as a reinforcement by saying "Good asking, Nathan" and offered him some more food. When food acted as a motivator and a reinforcer, the student attempted to communicate verbally by listening to the teacher's instructions or through the auditory feedback from the iPad. Once the student is confident in performing the target behaviour fading the prompts is gradually used which enables the student is not being fully prompt dependent.

Nathan used his iPad for six months, it took longer time for him to understand the symbols and remember the pathways to access the desired button. Also, Nathan was in his initial stages of learning to use his pointing finger to click on the symbols on the display screen. Hence, his skills steadily improved with constant prompting and by providing continuous opportunities to use the communication app in a meaningful, interactive way.

Interview data

The interview data showed that modelling and prompting are the most commonly used teaching strategies across various activities with students presenting as nonverbal with autism. All the adult participants emphasised the importance of AAC modelling and using prompting strategies as it is implemented across various activities were identified to be effective with students who have limited or no functional communication with autism.

The classroom teacher highlighted the importance of constant modelling of the AAC device to help the students to identify the importance and value of the device and enables them to see it as a viable communication tool which is evident from her quote: "students needed to see how best they can use the iPad device as a communication tool and this can be achieved through continuous modelling." In addition to the above statement, the speech therapist mentioned that to expect students to access iPad to frame meaningful sentences they need to be provided with many demonstrations to show them the usage of the iPad and the navigations across the folders to access required symbols or images. "Students learning to use an app need lots of modelling (input) before they can be expected to produce similar messages (output)."

Modelling supports making both teaching and learning easier. A student needs language before he/she learns to talk. Similarly, before starting to use an iPad effectively, the student should receive modelling many times to show him/her how the iPad device works and how to navigate across the folders to access the symbols or the functions. It was found to be effective for students presenting as nonverbal on the spectrum. The speech therapist mentioned that prompting strategy encourages the student to communicate. She mentioned that the educators use prompting techniques with the student for teaching communication responses which happen throughout the day. She also added that with Nathan and Ian, they get easily distracted and with prompting techniques their focus on to the activities are brought back, and it assists them in learning the skill in a much easier way.

During the follow-up interview, the teacher mentioned that Ian was provided with verbal and physical prompts and gradually he learnt to use sentences using at least three words to provide information. He has achieved the target goat and he had moved on to a different goal. With Nathan, the classroom teacher verified his skills were emerging and he was able to request for more food during lunch-time. He is now able to independently select and press the buttons that he requires to communicate. Also, his pointing finger skills have developed compared to how he was accessing the symbols at the beginning of the study. Nathan is developing his skills and beginning to understand that using the iPad to communicate will get a response from others. Prompting encourages students to learn new skills and also promotes in communication. It provides an efficient way of scaffolding student abilities to communicate effectively and in a much quicker and easier way. It also promotes opportunities to respond to new skills or behaviour and enhances his level of independence.

Discussion

The findings reassure with the literature indicating that the evidence-based strategies such as AAC modelling and prompting have a greater impact on the language development of individuals who use AAC (Kagohara et al., 2013; Sennott et al., 2016). Both the students showed positive outcomes in achieving their curriculum-based communication goals. Students were able to apply their learning skills to communicate using apps across various settings including home, therapy (clinical) and in the wider community. The teaching strategies using iPads can be integrated as pedagogical support tools. They can be used consistently to develop the communication skills in students presenting as nonverbal with ASD. By implementing iPads in special education classrooms especially for students with complex communication needs and on the spectrum it provides them with an opportunity to express their "Voice" to the wider community. Thus, the iPad forms an integral part of the classroom activities to support and enhance the learning and engagement of students with complex communication needs and to support them to meet their communication and their academic goals.

Acknowledgements

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