

TRANSFORMING TEACHING AND LEARNING FOR STUDENTS WITH COMPLEX COMMUNICATION NEEDS USING INNOVATIVE MOBILE TECHNOLOGY: UPS AND DOWN

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ABSTRACT

Two-way interactions in classroom are remarkably challenging, especially when students with complex communication needs are concerned due to their inability to express their needs and wants verbally. One method that could establish effective two-way teacher-student interactions is through augmentative and alternative communication (AAC) systems. A qualitative study exploring special education teachers' awareness and knowledge regarding high-tech AAC systems was conducted. The barriers and challenges that may hinder teachers from adopting mobile-based AAC systems, and the teachers' expectations of the AAC applications were explored. The qualitative data obtained from semi-structured interviews revealed that (a) teachers are unaware that AAC systems could improve dyadic classroom interactions, (b) teachers face internal and external barriers in implementing high-tech AAC systems in their classrooms, and (c) teachers want AAC systems which are suitable to be used in classrooms. The findings provided insights for transforming classroom teaching and learning using innovative mobile technology for students with complex communication needs.

1. Introduction

Teachers and students are two essential entities of education. Interactions between teacher-student, teacher-teacher, and student-student could provide a positive and meaningful classroom environment (Rasmitadila et al., 2017). During instructional interactions, these two entities come together, participate and cooperate to achieve educational goals. Interaction is fundamental between students and teachers during the teaching and learning process in a classroom. According to Dagarin (2004), classroom interaction is a two-way process between the teachers and students in the learning process, in which reciprocally, the teacher influences the students and the students influence the teachers. This implies that when both parties communicate effectively, learning occurs (Dagarin, 2004). Therefore, a two-way teacher-student interaction is a fundamental component that contributes to effective classroom instruction.

Worldwide, about 97 million individuals have some form of disabilities that impede their functional speech, which restricts these individuals from participating in education, employment,

healthcare, family life, and community activities (Light et al., 2019). Many of these individuals have special medical conditions such as Autism, Down syndrome, cerebral palsy, vision and hearing impairment, and other developmental disabilities, which cause them to have complex communication needs (CCN) (Light et al., 2019; Sigafoos & Gevarter, 2019; Singh et al., 2017). Students with CCN endure various difficulties interacting with their teachers and peers in the classrooms that directly impact their social skills, motivation, academic achievement, and behavioural issues.

Augmentative and alternative communication (AAC) systems are created to assist individuals with CCN to communicate. AAC systems include manual signs, communication boards, speech-generating devices, and mobile technology with AAC applications (apps) (Light et al., 2019). Individuals with CCN may use the AAC systems to supplement or replace speech or writing permanently or temporarily, depending on the severity of their speech impairment (Gaba, 2014). AAC technologies have proven to benefit students with CCN improving their receptive and expressive communication skills and remediate their challenging behaviours (Light et al., 2019; Ronski et al., 2010). Today, many AAC technologies are created as mobile applications, which can be easily accessible via mobile devices.

Individuals with CCN are turning to mobile devices to assist them in communicating more effectively because mobile devices are a much smaller and less expensive alternative to conventional dedicated AAC devices (Mcnaughton & Light, 2013). However, the implementation of AAC systems for students with CCN in special education schools in Malaysia is minimal (Yasin et al., 2020). Teachers' limited use of AAC systems in the classroom was attributed to a lack of AAC knowledge, skills, and training (Joginder Singh et al., 2020). Therefore, this research aims to shed light on this issue, via asking three research questions:

1. What is the current awareness and knowledge among teachers about high-tech AAC systems that could improve classroom interactions?
2. What are the challenges and barriers that teachers face when implementing high-tech AAC systems?
3. What enhancements and changes do teachers want from high-tech AAC systems?

2. Method

2.1 Design

This study adopted qualitative research design using semi-structured face-to-face interview. For data analysis, deductive content analysis approach was applied. The deductive content analysis process included the identification of pre-selected categories (themes) and codes (Gale et al., 2013).

2.2 Participants and Context

Five female special education teachers were recruited from different integrated special education primary schools in Penang and Kedah states, using a purposeful qualitative sampling approach. These teachers have five to twenty-five years of experience educating students with various disabilities, including students with CCN. The teachers voluntarily agreed to participate in this

research. The interviews took place in a pleasant location chosen by the participants. Before the interview session began, the consent of the teachers to document their interviews were sought. Depending on the participant's choice, the interview was conducted in Malay or English. Table 1 shows the demographic information of the participants.

Table 1: Demographic information of the participants

Teachers	Age	State	Years of teaching experience	Teaching subjects	Experience using AAC mobile applications
ST1	39	Penang	13	English	Nil
ST2	41	Penang	14	Arts & Mathematics	Nil
ST3	53	Kedah	26	Malay Language	Nil
ST4	39	Penang	15	Malay Language	Nil
ST5	40	Penang	13	Preschool subjects	Nil
<i>n= 5</i>	<i>Mean= 42</i>		<i>Mean= 16</i>		

2.3 Data Collection

The data was collected using 6-item interview questions between December 2019 and January 2020. Before the interview, the study objectives were explained in detailed. The participants were given a sheet containing facts, terminologies, and a brief summary of the research before the interview began. With the consent of the participants, the interviews were digitally recorded using a voice-recording smartphone application called "Simple Voice Recorder." On average, each interview lasted about 45.12 minutes. Table 2 contain the list of interview questions.

Table 2: List of interview questions

Interview questions	
1.	In your opinion, is there a need for two-way interaction between teacher and student with complex communication needs?
2.	In your opinion, what are the ways (methods) to improve two-way interactions between teacher and student during classroom instruction?
3.	What do you think about mobile devices that are being used as an AAC system to increase teacher-student interactions?
4.	How likely would you use such mobile AAC system in your classroom to interact with your students for the teaching and learning process?
5.	What will stop you from using the mobile AAC system in your classroom?
6.	What kind of improvements would you like to add to the mobile AAC system that you will use in your classroom?

3. Results

The findings of the qualitative interview analysis have been outlined in the categorisation matrix shown in Table 3. The results will be presented based on three main categories.

Table 3: The categories, sub-categories, and codes of the study

Category	Sub-categories	Codes
(A) Awareness and knowledge towards high-tech AAC to enhance classroom dyads	Teacher-student interaction is essential	Teachers will know their students' needs and wants
		Teachers can assess students' understanding of a lesson
	Methods of improving teacher-student interaction in the classrooms	Picture cards containing a picture of the discussed topic increase engagement
		Mobile devices and laptops improve participation
	Resources from Internet	
Unaware of the AAC systems that could improve teacher-student interactions	Lack of training and knowledge regarding AAC	
(B) Barriers implementing high-tech AAC	Inadequate resources and supports from the surroundings	Lack of parent-teacher support
		Lack of financial support for purchasing these tools
		Lack of space and facilities to accommodate the implementation of high-tech AAC systems
	Believe in myths about the use of AAC	Full use of high-tech AAC could lead to dependency on the external device and hinder natural speech production
	Uncontrollable student behaviour with the presence of mobile devices	Mobile devices attract peer students' attentions
	Linguistically and culturally inappropriate AAC applications	AAC mobile applications not available in local languages
		AAC mobile applications with irrelevant contents are not suitable for instruction
(C) Enhancements and changes expected from high-tech AAC systems to	Mobile-based AAC systems need modifications	AAC applications should add local languages
		Mobile AAC applications should have contents relevant to teaching subjects
		The vocabulary of the application must be suitable for the students

improve dyadic interactions	The application should have real pictures, videos, own voice, and songs
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(A) Awareness and knowledge towards high-tech AAC to enhance classroom dyads

The results on participants' understanding of the importance of classroom interactions revealed that all participants recognise the importance of classroom dyadic interactions between teachers and their students. According to them, successful teacher-student dyadic interactions will help teachers understand students' needs, desires, and emotions. Additionally, teachers can measure students' comprehension of a lesson whenever they communicate and answer during instruction. When participants were asked about the strategies they use to enhance teacher-student interactions, all of them commonly use of picture cards to help them increase their students' participation. Here is a statement given by a participant when she was asked about the methods used to increase the two-way interactions with her student.

ST5 : "I have prepared an A4 paper with images containing land transportations. When I talk about 'car' the student will bring the A4 paper and show the image of a car and say 'car'".

Three out of five participants said that mobile technology was often used in their classes, mainly to increase student engagement during class. To increase student engagement, they often use mobile devices such as smartphones, tablets, and laptops. Despite this, none of them has ever used these mobile devices as AAC speech-generating devices. One teacher (ST2) claimed that her nonverbal student often follows a YouTube tutorial video in creating arts and crafts, which he can pause, play, and replay at his own pace without having to ask his teacher.

Participants were asked about mobile-based AAC systems that could enhance classroom experiences to gauge their knowledge of AAC systems. The findings revealed that there is a shortfall in AAC knowledge and skills. Four out of five participants have never attended any AAC-related classes, seminars, or formal professional development. Below is the statement was given by participant ST4 when she was asked about her knowledge of the high-tech AAC system.

ST4: "The courses are not widely available. Hence not all teachers are getting information regarding this; therefore, many teachers won't use this method."

(B) Barriers implementing high-tech AAC

This finding explains the barriers to implementing high-tech AAC systems in the classrooms. Three out of five teachers indicated that implementing mobile devices as a communication tool in the classroom is challenging due to insufficient funding and cooperation, negative perceptions about the use of these AAC systems, and inappropriate language and cultural content of the AAC applications. The lack of parent-teacher involvement was mentioned as a major obstacle when participants debated about insufficient resources and support. Meanwhile, participants want parents and family members to continue use high-tech AAC systems at home after school hours. When participant ST3 was asked about the barriers, she responded as below.

ST3: "There are no such devices supplied by the education ministry. These devices are expensive and need financial support."

Three participants see a lack of financial resources for buying these mobile devices as another obstacle to introducing a high-tech AAC system (ST1, ST2, and ST4). One participant (ST3) recommended that these tablets be bought with the students' monthly allowances. Three participants described inadequate space and facilities as barriers to using AAC mobile devices in their classrooms. They clarified that their classrooms are very noisy, cramped, and lack electric power outlets to accommodate the use of high-tech AAC systems.

When asked how likely participants were to use an AAC mobile app in their classroom, all of them were interested in using the high-tech AAC mobile devices. According to one participant (ST1), students born in the technology era will quickly embrace this technology. Few participants, however, feel that using high-tech AAC would lead to a reliance on these external technologies, and therefore do not want to use them for the whole lesson. One particular teacher (ST4) firmly believes that the prolonged use of high-tech AAC could hinder natural speech production. Nonetheless, one participant (ST2) believes that these AAC apps and mobile devices can give her nonverbal student a "voice" to talk.

ST4: "When students are comfortable using this device, surely they no longer want to talk."

The uncontrollable classroom is seen as a barrier to implement mobile technology AAC systems in the classrooms. Participants are also concerned that the presence of mobile devices would cause them to lose control of their classrooms. The participants are concerned about their inability to direct other students' attention away from mobile devices, as other students tend to keep their hands on them (ST1, ST2, ST4, and ST5). As one participant (ST1) intriguingly stated

ST1: "It's too attractive. Once you enter a class, you put a tab on the table; all of them, like ants looking at the sugar, will come together. Even though they don't know what we are going to use it for in the class."

Adding to factors hindering the AAC implementation is the language and culturally appropriate content of these AAC applications. All five participants showed concern about the language of the AAC applications since most of the AAC applications are available in the English language. They all want the AAC applications to be available in Malay as well. One participant (ST3) stated that in order for AAC applications to be implemented into schools, they must be relevant to teaching and learning materials.

ST3: "If this device has content not related to teaching and learning content for that day, then this device is not suitable."

(C) Enhancements and changes expected from high-tech AAC systems to improve dyadic interactions

The final product reflects the participants' requests for improvements to the current high-tech AAC systems for implementing this technology in their classrooms. All the participants are expecting some modifications to the AAC applications. Every one of them wants the Malay language to be added to AAC applications. Four participants want the contents of the teaching subjects, such as arts, music, mathematics, and so on, to be included in their AAC applications.

ST5: "The content for 'Pengurusan Diri' /Self Management subject and other teaching and learning subjects must be added."

Participant ST3 hopes that these mobile apps will have vocabularies that are appropriate for students' cognitive levels. Some participants indicated that AAC applications should provide the ability to add real-world images, play videos and songs, and record their voices.

4. Discussion

4.1. Awareness and Knowledge of High-tech AAC Systems

The results of this study have answered all three research questions. First, the findings regarding participants' awareness and knowledge of high-tech AAC systems are consistent with previous research by Joginder Singh et al. (2020). Participants recognise the importance of dyadic interactions between them and their students with complex communication needs. Still, most of them communicate with their students using conventional approaches. The majority of the participants are still unaware of the existence of AAC mobile applications. They are unaware that these AAC mobile applications have the ability to turn mobile devices such as tablets and tabs into speech-generating devices, a finding that is close to that of Ghani et al. (2019), who found that 68% of teachers are unaware that AAC apps (GoTalk) can be used as a communication aid. Their lack of AAC knowledge and skills are the source of their ignorance. Participants have never been exposed to high-tech AAC systems training or courses before. Many literature support this finding, where many studies have found that teachers lack awareness and skills in AAC, likely because pre-service teacher training provides little exposure to this topic (Kent-Walsh & Light, 2003; Tönsing & Dada, 2016). Surprisingly, in this study, we found that participants do use mobile devices during teaching and learning sessions to engage students with complex communication needs. However, the use of these mobile devices is limited to accessing the Internet, YouTube tutorials, and Pinterest to be used as teaching aids.

4.2. Barriers to Implement High-tech AAC Systems

Second findings lead to barriers to implementing high-tech AAC systems in their classrooms. Teachers want to incorporate high-tech AAC systems into their classrooms, but they are hesitant to do so due to several reasons. The lack of financial support from the ministry of education for the purchase of mobile devices and AAC apps limits the introduction of new technology into classrooms. Agreeing with this finding, Joginder Singh et al. (2020) stated that government funding for assistive devices such as wheelchairs and hearing aids is available in Malaysia, but no funds are available for AAC systems. Parents' ongoing support in training students at home with this mobile technology would ensure that communication skills are mastered in a consistent manner. Students who have more opportunities to communicate using AAC systems at school and at home will learn communication skills much more effectively.

The next finding is very similar to what has been documented previously in past studies: believing that the use of high-tech AAC systems could obstruct students' natural speech. One of the participants raised her concern regarding this matter. However, it has been proven that AAC systems do not hinder natural speech (Romski & Sevcik, 2005). Participants also raised concern about the prolonged use of mobile AAC technologies that could lead to dependency. These are

baseless perceptions; more studies are providing shreds of evidence to support otherwise. The following findings will have a considerable effect on existing knowledge. The presence of mobile devices in the classrooms is said to be obstructing the teaching and learning process due to distractions these devices could bring in. In today's society, mobile devices are no longer a privilege but a requirement. As a result, children are introduced to these technologies at a young age, making them expert users early. Hence, during classroom instruction, students have a propensity to handle mobile devices that are not intended for them. The language and culturally acceptable vocabularies of the AAC apps available in the app stores are also listed as barriers by the participants. Participants see a lack of AAC applications suitable for special education classrooms as a disadvantage, especially those that do not include Malay language or vocabularies that are inappropriate for the teaching and learning process.

4.3. Enhancements for High-tech AAC Systems

The final findings of this study could significantly impact the future of AAC applications. In order to be implemented in their classrooms, the participants demanded several improvements to the existing AAC applications. Participants want the AAC application to include Malay language and content that include syllabus from special education curriculum because language and content have been highlighted as barriers previously. Participants preferred AAC apps that would assist them in the teaching and learning process, so they requested some additional features that could transform AAC apps into a flexible all-in-one teaching aid. This may be due to their lack of understanding of the AAC systems' true purpose. None of the participants had previously used augmentative and alternative communication applications, which may explain their ignorance.

5. Limitation

This research does have some limitations. The gender of the participants may have influenced the study's outcome. An equal number of participants should have been used to avoid bias in the findings. In special education programmes, the number of male teachers is extremely low. Hence, it was much easier to find female teachers as participants. Furthermore, due to cultural norms in Malaysia, it is uncommon for a female researcher to conduct a face-to-face interview with a male participant in public places. The following limitation is the inability to compare results with previous studies due to a lack of prior studies related to this topic. This may be explained by the fact that other researches concentrate on AAC systems in general and not specific to AAC applications.

6. Conclusion

Dyadic classroom interactions could provide a supportive and productive classroom atmosphere. The interaction between teachers and students with complex communication needs, on the other hand, is not a topic that is frequently discussed in the literature. Nonetheless, this area needs a lot of focus since the Persons with Disabilities Act of 2008 states that no student with a disability should be denied their right to education. They must be supported with provisions and accommodations, such as facilities, instructional materials, infrastructure, and other types of assistance that meet the diverse needs of individuals or children with disabilities to pursue education (Persons with Disabilities Act 2008, 2018). There are strategies for increasing classroom interactions for students who have complex communication needs. The high-tech AAC system is one approach that could help students with CCN reach their full potential.

Nonetheless, this technology is still foreign to special education teachers. They still lack the necessary knowledge and skills to incorporate this technology in their classrooms. Aside from that, several factors prohibit them from using mobile devices with their students during the teaching and learning period. Teachers' primary concerns are financial support, parent-teacher cooperation, inadequate facilities, uncontrollable classrooms, and finding a suitable AAC app. Eliminating these obstacles will make it easier for teachers to integrate high-tech AAC systems into their classrooms. Teachers want to use the AAC apps, but they want some changes made to these apps to suit their classrooms. Teachers are dynamic individuals who are always willing to help their students with the available technologies. What they need is assistance from their surroundings. Providing them with the necessary resources and technologies would enhance their teaching and learning, resulting in a positive development for students with complex communication needs.

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