Picture Exchange Communication System (PECS) Mediums: Comparative Analysis

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Abstract

This study is a detailed review of the commonly cited software/hardware mediums currently able to host the Picture Exchange Communication System (PECS). PECS is an augmentative and alternative communication (AAC) system that relies on visual cues for communication and instruction. This research examines each supporting technology systems uses, techniques, and current applications. This paper provides a review of the mediums based on instructional, interactive, and behavioral aspects that all users of these systems need to take into account when choosing which will best allow them to communicate. By providing an in depth review, users and families suffering from Autism Spectrum Disorder (ASD) and developmental delay can better understand the uses and options available in order to help them make a decision in which system to use.

Introduction

The Picture Exchange Communication System (PECS) allows people with little or no communication abilities to communicate using pictures/visual cues such as through flashcards that are shown to the intended recipient. A child or adult with autism can use PECS to communicate a request, a thought, or anything that can reasonably be displayed or symbolized on a picture card (Aresti-Bartolome & Garcia-Zapirain, 2014).By doing this the person is able to initiate communication.

Due to the increase in diagnosed cases of ASD, software and hardware dedicated to helping persons with autism have been developed, increasing their vocabulary and communication skills to overcome their weaknesses (DeLeo & Leroy, 2008).

Professors Aresti and Garcia (2014) of the University of Deusto stated that Information and Communication Technologies (ICTs) can compensate and support education of students with special needs, and particularly people with ASD.

The aim of this analysis is to provide a detailed comparative review of existing software and hardware mediums currently able to host the Picture Exchange Communication System – PECS. In addition, this research examines various supporting technologies programs designed to be used on computers, tablets or mobile telephones, using PECs in a cost effective manner.

This paper will review the following systems -- including individual uses, techniques and current applications:

1. PECS Cards
2. IPad and Mobile Devices
3. Video Instructions
4. Virtual Reality

Literature Review

With the integration and the inclusion of computer and assistive technologies, students with autism, non-verbal learning disorder or disability (NLD or NVLD), or other forms of communication disabilities can now communicate their needs and wants using computer generated PECS, which are more effective and accessible (DeLeo & Leroy, 2008).

Interventions have been developed to focus on alternative communication strategies for children who do not develop speech. These programs involve non-vocal methods of communication (Mustonen, Locke, Reichle, Solbrack, & Lindgren, 1991), and include sign language, picture-point systems, electronic devices, and other picture-communication systems (Carr & Kologinsky, 1983; Mirenda & Schuler, 1988; Reichle & Sigafoos, 1991). Augmented input illustrates the real-world meaning of symbols (e.g., PECS), the many functions they can serve, and demonstrates that the AAC system is both accepted and encouraged as a modality for communication (Romski & Sevcik, 2003; Sevcik & Romski, 2002).

PECS is an example of an augmented input system used to offer children suffering from ASD. ASD causes mental delays, such as language deficits and delays in speech, cognition, and social/personal skills. PECS uses visual cues to let the recipient know the intended meaning by choosing the image located on the card and displaying it to others. It was originally created to offer an alternative form of communication to children suffering from ASD, substituting oral and written forms of communication by having a visual based system using images to convey messages (Bondy & Frost, 1994; Bracken & Rohrer, 2014). Notable studies (Bondy, 2001, Schwartz, Garfinkle, & Bauer, 1998) corroborate the effectiveness of PECS when used by young children with autism. More recent studies have provided evidence that PECS can also be used not only for communication, but can assist in the development of independent vocalizations; this is speaking words independently from the system (Cagliani, Ayres, Whiteside, & Ringdahl, 2017).

Methodology

The purpose of this study is to provide a review of all the commonly cited mediums based on criteria that all users of these systems need to take into account when choosing which will best allow them to communicate. These criteria were chosen based on motivations new and trained users and their families would consider when choosing a system or switching to a new one. These are:

1. Ease of use
2. Accessibility
3. Cost
4. Maintenance
5. Future opportunities for scalability

Ease of use refers to difficulty of setting up and performing the necessary functions the medium requires to operate it. Accessibility is the difficulty of obtaining the medium and obtaining additional materials that the medium may require. Cost is the overall price of not just the system but any accessories that may also need to be purchased. Maintenance is the difficulty of maintaining the medium in working order and repair if the need arises. Lastly, future opportunities for growth refers to advances technology/society can contribute to the medium to improve it over time. The four mediums that were chosen for the study are shown in the figure below.

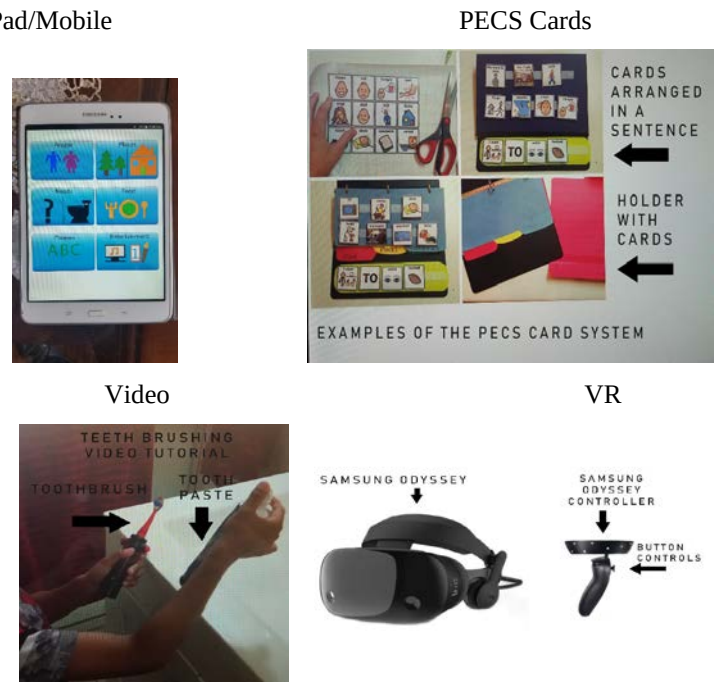

Figure 1. Mediums used in this study

PECS Cards

This is the original PECS card medium. The system uses basic behavioral principles and techniques such as shaping, differential reinforcement, and transfer of stimulus control via delay to teach children functional communication using pictures (black-and-white or color drawings) as the communicative referent (Yoder & Lieberman, 2010). The child is taught to create a ‘‘sentence’’ by selecting picture cards (e.g., ‘‘I want’’ card plus ‘‘juice’’ card) and delivering the cards to a communicative partner as a request for a desired item (Yoder & Lieberman, 2010).

IPad and Mobile Devices

The introduction of the Apple iPad in 2010 has seen a shift toward technology-mediated learning for typically and atypically developing children. Tablets and similar handheld devices offer the promise of flexible, mobile, and individualized learning to support language and literacy development, math, social sciences, etc. (Banister, 2010). However, to date, there is little empirical support that the technology, rather than the content, results in improved educational outcomes, despite media reports to the contrary (Biancarosa and Griffiths, 2012).

Video Instructions

Video modeling typically involves showing a video-recorded display of a target response to teach a child to emit specific behaviors (Bellini & Akullian, 2007). Video modeling has been used to teach a variety of play, communication, social, vocational, and other skills to children with autism (Rayner, Denholm, & Sigafoos, 2009).

Virtual reality

While several programs/uses for helping children with autism and/or developmental delay exist using virtual reality (VR), there are no exact uses for PECS with VR, as PECS is meant to be used as an augmentative way for users to communicate using pictures and symbols, and develop communication between two users face to face. While VR is generally used in various instructional settings (Chandramouli, Zahraee, & Winer, 2014; Chandramouli, Takahashi, & Bertoline, 2014) , from the perspective of this research, current use of VR is intent on teaching emotive understanding and appropriate situational behavior.

Judgement of each medium was based on information from academic journals and peer reviewed sources of the experiences along with findings of the testers and researchers that had performed similar comparisons between mediums or with applications in the same medium. Industry professional Luz Cruz was also interviewed to help with feedback and planning for this analysis.

All the criteria of each medium were categorized and listed. After compiling the data, each medium would then be compared and discussed with Luz Cruz to reach a joint conclusion.

Results

The table below lists the results of all medium criteria discussed in this study.

Table 1: Comparative Analysis of Various Media & the Major Attributes

	Ease of Use	Accessibility	Cost	Maintenance	Scalability
IPad	Requires training to use all available tools	Incredibly common and widespread	High initial cost, ca be as high as $500 for a new device plus the application	Most devices come with all required tools. Extra can be puchased easily.	Large scalability and rapid evolution
PECS	Most understood and widespread	Starts simple but becomes difficult over time as more cards are needed	Relatively low cost. If complete set and all other items are needed it will be at most $340.	With proper lamination, cards can last long, and can be replaced easily.	Not much scalability, only a few possible new developments
Video	Set up can be difficult for groups; easier for single users-caretaker needed to record videos for individual cases.	Large selection of online resources. Can be shown to a group with a video projector.	Case by case. Personal devices work for single users, and monitors/projectors for groups. Groups will cost more than individual.	Case by case. Easier to maintain for individual than group. If creating own videos, a storage device will be required.	Able to grow through online collaboration and communities..
VR	Still uncertain. New systems allow more freedom of movement but require large indoor space, may cause nausea.	Easy to obtain. Smaller systems like Google cardboard are portable, but, systems like Oculus/Vive are limited to indoor use	Most expensive. Vive can cost $500 for the system alone. Google Cardboard will be around $15.	Requires caretaker support to set up full set systems. Users can be trained to use Google cardboard by themselves.	Most potential for user interaction and development through unique experiences.

The IPad/Mobile medium has the most options available for aiding communication, but because of the large amount of tools and applications, it will take longer for people to master. Is widely accessible, but has a high startup cost for buying a device. Devices can last long when proper

care and protection (Ex. screen protector) are used, along with having a high growth potential for scalability as new technology and applications are being developed around the world.

The physical medium is the most widespread medium with easy and simple use of the system that gets harder over time as more cards are added. It is also the most widely accessible due to being the medium that hosted the original system. The cards can last long when they are protected by laminating and organizing them. However, this does not have much room for growth as all the major developments have been achieved. And it is easy to lose cards, especially later on when more have been added to the collection the user needs.

The Video medium has a large number of options available, both physical and online, but requires training both user and caretaker to use effectively. It is widely accessible but can have a high startup cost, especially for use of groups where more equipment and a larger setting to house the equipment is needed. Maintenance may require a technician to take proper care and repair of equipment. The video medium has a high growth potential in collaborations and communities, internationally thanks to online collaboration.

The VR medium has the least available options due to being the newest medium. However, this is the best medium to maintain user attention for instruction due to user interaction and immersion. It is widely accessible, but has the highest startup cost for buying a full set device such as the Vive. VR will require caretaker/guardian help to maintain and set up the system as the setup is complicated for people not familiar with the technology. The VR medium has a high growth potential for scalability and best potential to maintain the attention of people with ASD.

Discussion

After reviewing each of the mediums and their specific aspects, it was found that each medium has different strengths which set them apart from each other. Because of each mediums unique purposes and traits there is no medium that has all the best attributes people would need.

This study does have limitations. Only the most commonly cited systems were used as these were the systems that were the best documented and most widely used. Less used mediums that have less data/development were not considered. VR (Particularly with Oculus and Vive) with the PECS system has no current applications to provide data, because it is still a new system and more research into this medium is needed.

Conclusion

Each medium has different inherent characteristics that allow them to serve a unique purpose. There is no one medium that is able to handle all possible needs, therefore each user needs to select on a case by case basis which medium has the best attributes to help them communicate.

This should be discussed with a licensed professional who will be able to give the best recommendation after careful analysis of the person.

However, further research is needed to examine the potential of new emerging technologies, particularly of virtual reality's instruction potential. Further research must also be done to determine the effectiveness of these mediums and how they compare to the commonly used mediums using the criteria listed or similar criteria.

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