



CENTRE FOR AUTISM
MIDDLETOWN

Assistive Technology, Apps and Autism



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INTRODUCTION

This is the twenty seventh Research Bulletin produced by Middletown Centre for Autism and it provides summaries of eleven articles spanning from 2013-2018.

The Bulletin commences with an interview with Professor Sarah Parsons.

Professor Sarah Parsons is Professor of Autism and Inclusion, and Deputy Head of School (Research and Enterprise) for Southampton Education School, at the University of Southampton. She has longstanding research experience in the use of innovative technologies for children with autism, evidence-based practices in autism, and research ethics relating to children and young people. Sarah is especially interested in working in collaboration with others in the context of participatory design and

inclusive research. Sarah led the ESRC-funded seminar series: 'Innovative technologies for autism – critical reflections on digital bubbles' (www.digitalbubbles.co.uk), and has established ACoRNS: the Autism Community Research Network @ Southampton (<http://acornsnetwork.org.uk/>). She was also a partner on the Horizon2020 project ProsocialLearn: <http://prosociallearn.eu/>. Sarah is currently the Editor of the *Journal of Enabling Technologies*.

Please note that the views presented in this document do not necessarily reflect the views of Middletown Centre for Autism. Reviewers have, where possible, used the original language of the article, which may differ from UK and Ireland usage and the usage of a range of terminologies for autism.

AN INTERVIEW WITH PROFESSOR SARAH PARSONS

1. How can professionals encourage parents, children and young people to use the technology that is available to them?

First of all, I think it's important not to be scared of the idea of technology! There are so many media headlines, usually about the negative effects or influence that technologies can have. Unfortunately, most of these headlines are not supported by any evidence. What we do not see or hear so often are all of the positive accounts and the reasons why technologies can be really helpful. Technology is an essential part of everyday life for all children and families now and they will be regularly using different technologies anyway. The best thing is to encourage exploration, be aware of what is being explored, and follow the child's lead. They will find things that they like and that's usually a good place to start.

2. What factors facilitate the effective use of technology and what are the barriers to its effective use?

As with most things, balance is the key and it depends on what you expect as well as what you think of as being 'effective'. Remember that playing and having fun are important aspects of using technology, and in supporting learning, and so it is important to think of 'effectiveness' in broad terms. This means encouraging children to explore for themselves and try out new things. If something really captures their attention, and they enjoy it, then it is more likely to support formal and informal learning.

The main thing to remember about technology is that it is just a tool that can be used in many different ways. Technology should never be thought of as something that can do all the work (in enabling learning) by itself. It can be used to inform, explore, play, initiate conversation, share a joint focus and ideas, to read, respond, research subjects...and so on. Always try to think about what you want to do *with* the technology, rather than focusing on what the technology *is*.

My good friend Barnabear (2014) (a self-defined Aspie and Software Engineer) has a really excellent way of helping us to think about the potential roles that technologies can play in our lives, as a:

- Barrier – this can be helpful (e.g. noise cancelling headphones), or less helpful (e.g. when passwords and access codes for technologies can be difficult to remember, and accounts easily blocked as a result);
- Bridge – technology used as a bridge can overcome barriers, for example using assistive technologies to translate text, or using symbol-based communication on an iPad which can also be given spoken 'voice';
- Buffer – this is where technology can enable information to be processed in a time that makes sense to the person on the spectrum rather than in real time e.g. self-paced online learning (see also the answer to question 6 below);
- Filter – Barnabear talks about how much his SatNav is an enabler for him because the technology filters out lots of extraneous information and focuses only on how to get from A to B.

Technologies are not necessarily inherently one of these things, but they may become one depending on who we are, what our needs are, and what we are trying to do with it.

3. What systems have you seen used effectively in schools or other educational settings?

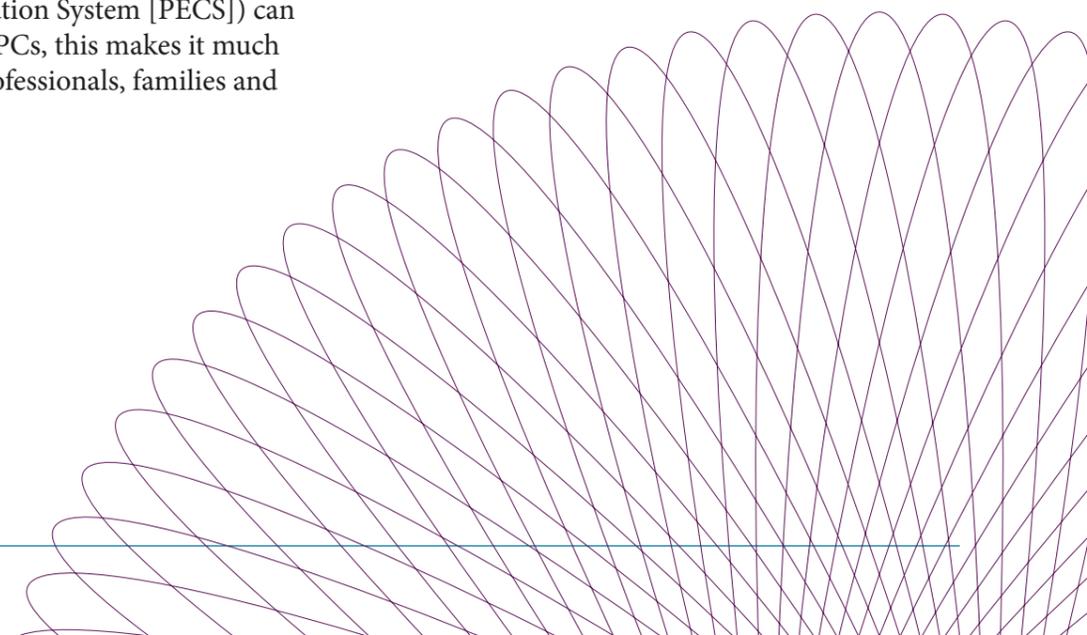
I've seen all the kinds of things you would probably expect used effectively in schools and elsewhere, including straightforward PCs and laptops, interactive whiteboards, and tablet PCs. Sensory rooms can also play an important role in supporting children, for example through helping to manage anxiety and regulate emotions and, therefore, being more ready to learn. Sensory rooms or sensory technology comes in lots of different forms of course and can include simple lights, bubble tubes, and cause and effect equipment as well as more sophisticated projection systems for interactive surfaces.

Assistive technology is also really helpful for many children (e.g. alternative keyboards, visualisation tools, audio books etc) and so technology choice does not have to be digital or focused only on which apps or software to use. Now that symbol communication (e.g. the Picture Exchange Communication System [PECS]) can also be used on tablet PCs, this makes it much more accessible for professionals, families and children as well.

4. What evidence is there to support the use of technology for everyday adaptive skills for young people with autism?

There is reasonably good evidence that technologies can help children with learning and developing everyday skills, especially through supporting their motivation and engagement, and through reducing anxiety. Video modelling is an approach to learning that has some of the strongest evidence from the research literature. This is where children can use specially designed software that shows short videos of other children or adults (or indeed, themselves) completing a task (e.g. washing hands) and are then encouraged to respond to questions about that action and/or repeat the action themselves.

It is important to bear in mind, though, that due to the very swift changes and developments in technology, practice regularly outpaces the research evidence base. This means that there will definitely be great things happening in practice that have not yet been systematically explored or reported in the research literature. It is, therefore, important for professionals, families and children to continue to try things out to see what works best for them.



5. Are functional outcomes dependent on early intervention and across setting support?

Technology is really no different in these respects from any other resource or approach that could be used for supporting children and families. Best practice guidelines nationally and internationally repeatedly emphasise three main messages: (1) there is no single type of approach to learning or intervention that will be appropriate or effective for all children on the autism spectrum; (2) early intervention is important for supporting positive outcomes over the longer-term; and (3) communication, respect, co-operation and understanding between multi-agency professionals and parents/carers are crucial for providing the best environments in which children can flourish.

It is also worth emphasising of course that it is never too late for learning. Children and adults on the autism spectrum are always capable of learning new things, perhaps using different approaches and tools at different times and for a wide range of purposes. The real value of technology within all of this is that it is constantly evolving and so if one thing does not seem to work then it is very likely that something else might.

Technologies of course can also facilitate communication *around* and *with* the person on the spectrum (e.g. between professionals and parents; between the person on the spectrum and care workers) and this can be really helpful too.

6. Thinking of learning, how important is the use of innovative technology and apps at school and at home amongst children and young people with autism?

Technology is at least as important for children and young people on the autism spectrum as for any other child or young person, if not more so. Expectations about the use of, and access to, technologies are different for this generation of children and young people such that technologies permeate all aspects of life. Indeed, it is socially inclusive (and expected) to be using technology to communicate with friends, access online content, play games etc, and so to deny children and young people on the autism spectrum participation in such mainstream activities would be socially exclusionary.

We also know from self-reports of many autistic young people and adults that technology can really make the difference in making and sustaining friendships, and in pursuing interests and hobbies in ways that move beyond 'typical' or 'expected' everyday use. This is often because many of the difficult aspects of face-to-face communication and interaction can be removed or managed in online forums and social media. This is a great example of Barnabear's 'buffer' and 'filter' mentioned earlier. For example, as early as 1997 Blume used a blog to talk about the enabling features of online communication for autistic adults saying that: '...for many autistics the Internet is Braille'. A quote from an autistic participant in research by Benford and Standen (2009) gives an illustration of why this might be the case:

In cyberspace, you are protected against the misleading messages given out (without your knowledge) by your body, your face, your voice and your lifestyle. You can convey what you want to convey. You can be seen as yourself. (Pat)

As with any tool, technology or resource there will inevitably be different views and experiences. This point of view will not be shared by everyone. Nevertheless, I think these kinds of accounts are helpful for reminding us that online communication, friendships, and interactions can be just as meaningful and important as those that take place face-to-face.

7. Can you outline any recommendations/tips for the use of innovative technology and apps which can help promote learning with children and young people with autism?

Between 2014 and 2016 I led an Economic and Social Research Council (ESRC)-funded seminar series called (for short) 'Digital Bubbles' where we held seven seminars focusing on the uses and development of technologies for and with people on the autism spectrum. All of the information relating to the seminars can be found on our website (<http://digitalbubbles.org.uk/>). Crucially, the seminars involved a wide range of stakeholders including adults on the autism spectrum; parents and families; multi-agency professionals and practitioners; industry; and academics and students from different disciplines. Therefore, our discussions really helped to inform the kinds of things we need to be thinking about when considering autism and technology.

In the final summary of the seminars (Parsons et al, 2017) we drew out some main messages about what we had learned along the way, including:

- Really think about the child or adult, who they are and what they like and enjoy when considering technology choices.

- Special interests can be really helpful and motivating for engaging children and young people in using technology. These can be carefully incorporated into lessons, projects, and homework to support children's motivation, engagement and hopefully, learning!
- Learn, therefore, from the lead of the child or young person. A strong interest in something can enable the technology to become a source of shared enjoyment and/or initiation of communication, in sometimes surprising ways. For example, a Mum at one of the seminars told us that her son's love of Minecraft (which she was initially concerned about) had now become an activity that the family could join in, and a source of discussion (initiated by the child) at home.
- Uses of technology that may appear highly repetitive or redundant often do have real value and meaning for many children and young people. We need to try to understand the value of the repetition from their point of view and use that in a positive way. Perhaps the repetition is important for managing anxiety and so allowing some time in those repetitive activities could be important for establishing the right environment for learning. If children like something they'll stick with it, if they don't they won't! Don't be afraid to try something else.
- Sometimes 'innovative' is not always the right choice. The old-fashioned, ageing hardware or software can be really familiar and therefore important for individuals in providing a safe, predictable and meaningful space.

- Finally, and by extending Barnabear's idea of technologies as bridges, we learned that technologies can be helpful bridges between many things including:
 - o interactions between people, and between contexts;
 - o across gaps in understanding, for enabling people to understand and experience different perspectives;
 - o between real and virtual, in terms of making online connections and friendships as well as moving more smoothly between real and virtual contexts;
 - o between cultures, in relation to the positive representation and expression of autistic culture online and how this is raising awareness;
 - o between research and practice, through applying tools that support and document practitioner involvement; and
 - o between communities, by establishing networks of interest and expertise that can be local, national, and international in nature.

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USE OF COMPUTER-ASSISTED TECHNOLOGIES (CAT) TO ENHANCE SOCIAL COMMUNICATIVE AND LANGUAGE DEVELOPMENT IN CHILDREN WITH AUTISM SPECTRUM DISORDERS

BACKGROUND

Major advances in multimedia computer technology over recent years have made sophisticated computer games readily available to the public and opened up the possibility that computer-assisted technology (CAT) like games may be beneficial for skill development in individuals with autism.

This study reviews the literature from 1970 to 2011 on the use of computer-assisted technology (CAT) such as games, to enhance social, communicative, and language development in individuals with autism.

RESEARCH AIMS

The purpose of this study was to collate, summarise and evaluate the existing literature on CAT and individuals with autism and consider CAT's effectiveness for improving social, communicative and language development in individuals with autism.

REVIEW METHODS

The authors of this study conducted a formal search, using PsycINFO with keywords 'autism' and 'computer' to identify the number of publications in peer-reviewed journals for the time span of 1970–2011. They then considered the effectiveness of CAT to impact on the four main areas of: remediation of deficits in language skills (including reading); enhancement of face processing and emotion recognition and comprehension; teaching Theory of Mind (ToM); and teaching social skills including non-verbal communication, play skills, and daily life skills.

ARTICLES REVIEWED

The search procedure identified a total of 46 studies which met criteria for inclusion in this review.

RESEARCH FINDINGS

This study considered the effectiveness of CAT in relation to:

Remediation of deficits in language skills (including reading).

- The reviewed articles suggest that CAT can play a strong role in helping children with autism to recognise more words, which may encourage children to spend more time reading.
- These studies also suggested that CAT induces less anxiety than other methods of instruction and increases the enjoyment that the children experience while engaging in lingual activities.

Enhancement of face processing and emotion recognition and comprehension.

- Individuals with autism commonly exhibit difficulty with nonverbal behaviours such as recognising emotions in others, which is essential for social interactions. Some of the studies reviewed by the authors indicate that employing CAT and targeting facial emotion recognition showed significant improvements.
- However, the improvements do not seem to generalise well, which might suggest that individuals with autism are simply learning to score high in a particular computer activity.

Teaching Theory of Mind (ToM)

- It was unclear whether CAT facilitated an improvement over traditional methods when attempting to teach components of ToM to children with autism.

Teaching social skills including non-verbal communication, play skills, and daily life skills.

- CAT in the form of video modelling, proved to be effective in teaching age-appropriate social skills to academically high functioning children with autism.
- CAT in the form of video modelling was also found to increase the number of verbal and motor responses during play and was effective in teaching complex play sequences in a relatively short amount of time, without the use of time-consuming chaining procedures.

Overall, the CAT approach was shown to be effective in increasing social competence in children with autism and was generally found to be a favourable mode of learning new skills. However, the authors pointed out that nearly all of the studies neglected to provide a comparison with an alternative approach to allow for an evaluation of CAT's efficacy.

IMPLICATIONS FOR PRACTICE (by authors)

In summary, much technological progress has been made to develop engaging CAT programmes. However, at this date, most studies still lack scientific-methodological rigor to allow for a comparison between CAT and traditional, non-CAT, methods, to convincingly demonstrate the efficacy of CAT. Thus, it is too early to rely fully on CAT alone as a skill teaching methodology.

However, findings are promising for CAT; there is accumulating evidence that the use of computers in the treatment and education of individuals with autism has advantages in terms of enhancing motivation and treatment fidelity.

With continued rigorous scientific research, CAT will likely play a very prominent role in the treatment of individuals with autism in the near future. Until then, professionals should continue to implement traditional non-CAT methods, but could try supplementing these with CAT to reinforce learning.

Full Reference

Ploog, B., Scharf, A., Nelson, D., and Brooks, P. (2013). Use of Computer-Assisted Technologies (CAT) to Enhance Social Communicative and Language Development in Children with Autism Spectrum Disorders. *Journal of Autism and Developmental Disorders*, 43, p. 301 – 322.

ACCESSING QUALITY APPS TO PROMOTE BASIC RELATIONAL CONCEPTS ACQUISITION AMONG YOUNG CHILDREN WITH AUTISM

BACKGROUND

Due to a rise in the number of children with a diagnosis of autism spectrum disorder (ASD), schools are finding it difficult to cope with the increased demands upon their already stretched resources. Effective and efficient interventions are vital in managing spiralling costs. Currently mobile touch screen devices and their applications (apps) are one of the most used interventions in schools due to the high level of engagement students have with them as well as the affordability, portability and usability of the technology. Most of the research in this area has focused on looking at how the devices are being used (such as providing instructional videos or giving the person access to preferred stimuli) but there has been little research into the content of the apps being used for intervention. Furthermore, research into apps aimed at young children (ages 3-7) is lacking. Because of the increasing number of children being diagnosed with ASD at a young age, there is a greater demand for therapy which cannot always be met. To fill this gap, parents and professionals are using special educational apps in their own interventions.

During this critical developmental period of early childhood, where the skills learned will lay the foundations of future learning, it is important to investigate the content of the apps being used with young children with ASD and how relevant it is to their education.

RESEARCH AIMS

With typically developing children, educational research suggests that basic relational concepts referring to size, distance, position in space, time and quantity are critical in the development of cognitive and early literacy skills as well as following directions. It is these skills that children with ASD have difficulty in acquiring. It is not known whether the popular apps used in interventions are addressing these concepts. The main aim of the research was to investigate the content and organisation of the apps used with young children (ages 3-7) with ASD, and addressed the following two questions:

1. Which basic relational concepts were contained in the apps?
2. How are these concepts presented in the apps? Specific sub-questions included: (a) Are the concepts systematically taught? (b) Are the concepts presented in the directions of the tasks? (c) Are the concepts embedded in the stories/videos/games? (d) What concepts are frequently used in teaching children with ASD social, academic, language and functional skills?

RESEARCH METHOD

The study was carried out in two stages. The first stage identified the most popular apps used with children aged 3-7 with ASD. The second stage analysed the content of the apps for (a) the presence of basic relational concepts, using Boehm's Test of Basic Concepts, and (b) how the concepts were presented in the context.

To identify the most frequently used apps, a digital survey was distributed using social media to professionals who work with children with ASD and use apps and parents of children with ASD aged 3-7 who use apps with their children. The survey was also distributed through the Autism Speaks web page.

To find the most popular apps being used, respondents were asked to give the top five apps that they use the most. For each app listed, they were asked to choose their top three reasons (from a drop-down list of 11) as to why they use the app. Respondents were also asked to choose, from a list of specified choices, how they had got to know about the app. There was an 'other' option for responses that didn't fit the choices.

There were 28 apps that were mentioned by at least three respondents. These apps were then further investigated to check their popularity of use in the field. This was done by cross-referencing the apps using eight different internet sources for mentions, review or ranking. From this, 15 apps were selected for content analysis. There was variety in the apps in terms of developer-defined intended function, whether the content was produced by the developers, the user or both and the way the content is presented.

RESEARCH FINDINGS

(Part 1) App identification and survey

There were 246 respondents to the survey and from that, 122 (49.6%) surveys were used for the final analyses. Of the 122 respondents, 48.4% were speech and language therapists/speech and language therapy assistants, 27% were parents of children with ASD, 13.9% were teachers, 3.3% were psychologists and educational psychologists, 2.5% were behaviour specialists, 1.6% were occupational therapists and a teacher assistant (0.8%), physical therapist (0.8%), autism mentor (0.8%), and a paraprofessional (0.8%).

Altogether 251 apps were named but only 77 (30.7%) were mentioned more than once. There has been research to suggest that there has been a recent surge in the market for apps aimed at children with special needs and this was confirmed with a majority of the apps (69.3%) only being mentioned once. Due to the wide variety of apps available, in terms of intended function, content origin and presentation, it can be overwhelming to select apps for particular children/needs.

Respondents to the survey were asked how they had learned about certain apps and whilst there was a wide range of responses, most people rely on 'word of mouth' to learn about apps, whether they are recommendations from colleagues, other parents, professionals or online research.

Respondents were given a choice of reasons why they used an app and for the five most used apps, expressive language (20.9%) was the primary reason selected. The use of the app for fun or as an incentive (16.8%) was the second highest response, followed by receptive language (16.3%), cognitive skills (11%), as an alternative communication device (7.3%), social skills (6.9%), none of the above (6%), motor skills (6%), self-regulation skills (4%), articulation (3%) and adaptive behaviour (1.9%). The findings possibly highlight the lack of awareness of the deficit in receptive language compared to expressive language in young children with ASD. Delays in speech are usually the first concern parents have, and intervention efforts may be focused on getting their children to produce speech as opposed to understanding language.

Each app was analysed to determine the presence of the 50 basic relational concepts identified in the Boehm-3. Each concept was documented and coded according to how it was presented to address the secondary questions. This content analysis identified how much the different categories of app used basic relational concepts and also how they were presented.

(Part 2) Analyses of app content

The focus of the analyses of the 15 apps was on documenting whether the 50 basic relational concepts were present and how these were presented. The presentation methods were categorised as embedded, taught and tested, and apps could use more than one form of presentation. Of the apps analysed, 11 out of the 15 apps contained at least one of the basic relational concepts, and as before the concept could be in multiple categories of presentation within the app.

When a concept is embedded in the content of the app alongside strong context and stimuli, that clearly conveys the meaning of the concept, then children with ASD will benefit from exposure to the concept even in lessons targeting other skills. Without strong context clues and clear visuals, children may find it difficult to work out the meaning of concepts embedded in content.

Only two of the apps analysed, Proloquo2Go and BitsBoard Pro, were coded as teaching the basic concepts. Due to teaching the concepts in isolation, the quality of the 'lessons' was variable. Both apps use simple visual images accompanied by the concept's written label, similar to a flashcard. Proloquo2Go demonstrates concepts with simple visuals using consistent stimuli which reduces ambiguity in the meaning of the image. Most of the content on Bitsboard is created by users and therefore it doesn't have the continuity and consistency of presentation, and some of the images used on its 'flashcards' do not adequately convey the meaning of the concept.

Only four apps: Bitsboard Pro, See.Touch.Learn, Preschool and Kindergarten Splash Math, and Fun with Directions HD, tested for understanding of the basic relational concepts. The apps that design and protect their own content (Preschool and Kindergarten Splash Maths and Fun with Directions HD) had more 'quality control' over content and testing methods and therefore could clearly assess what they intending to assess. Bitsboard Pro and See.Touch.Learn use community-designed content and even though they test for many more relational concepts than the other two, the quality of the assessment was less reliable for testing the understanding of a concept.

IMPLICATIONS FOR PRACTICE (by the authors)

Recommendations for app developers

1. Stimuli should be clear and concrete.
2. Keep stimuli consistent across concepts as it reduces the likelihood of a child developing a false understanding and makes it easier for the child to comprehend that the difference between images is key to understanding the concept.
3. Use short animations to demonstrate the meaning of the word as the meaning may be clearer than using a static picture.
4. Teach the use of basic relational concepts using the context of phrases and eventually longer directions by varying the context and stimuli, which will help children generalise their knowledge to a variety of situations. Furthermore, use stimuli and contexts that are concrete and familiar.

Recommendations for parents and professionals

There is no formal guidance for app selection, but users should carefully review apps before using them with children. If using an app with community-designed content, then users should be aware that using others' material may not be reliable. Instead users should create their own lessons within these apps making sure to use clear visual depictions of concepts, ensuring the lessons and tests teach and assess for the intended concepts. Parents and professionals can help children with ASD broaden their knowledge of basic relational concepts by incorporating them into directions children follow when using these apps. My PlayHome and Toca Kitchen are particularly useful when offering opportunities to generalise receptive language skills and practice following directions within a digital world that bears a close resemblance to real-world home settings.

Full Reference

Mykata, A.D., and Zhou, Z. (2017). Accessing Quality Apps to Promote Basic Relational Concepts Acquisition among Young Children with Autism. *Psychology in the Schools*, 54(10), p. 1302-1311.

EMOTIONAL SELF-REGULATION OF INDIVIDUALS WITH AUTISM SPECTRUM DISORDERS: SMARTWATCHES FOR MONITORING AND INTERACTION

BACKGROUND

Many individuals with a diagnosis of autism spectrum disorder have an innate difficulty with the self-regulation of their emotions. This is due to alexithymia or the inability to identify and describe feelings, including body sensations of emotional arousal. To date many interventions to support emotional regulation have necessitated the input of another person or persons, and materials that may not be readily accessible when needed. Equally whilst a variety of assistive technology products also exist they are often neither customised nor utilised across the individual's environments. Research has also found that the social stigma attached to the use of non-mainstream supports can result in a high abandonment rate.

Given the correlation between successful emotional regulation and improved mental health and quality of life, it is imperative to be able to provide individuals with autism with a system that can be effectively utilised across their environments. Using assistive technology that can be implemented through a mainstream device such as a smartwatch can reduce social stigma and thus increase user acceptance. Additionally, the use of mainstream devices can allow for ease of use for the individual's family or caregivers as the technology is already familiar. The provision of an authoring tool accessed through a smartwatch can enable families and caregivers to adaptively create and edit the self-regulation strategies for their user.

RESEARCH AIMS

The aim of this research study is to evaluate if a smartwatch can be employed as a system of self-regulation for individuals with autism. The authors argue the potential of the smartwatch as a non-stigmatising, viable and widespread form of assistance and posit its efficacy in alerting users to their inward emotional state and, providing immediate user-centred strategies for self-regulation. To determine this the study looked at the following main points:

1. Does the user regain a calm state through the use of the self-regulation strategies on the smartwatch?
2. Can the user engage with the smartwatch to gain assistance and complete the strategies?
3. Is the user able to use the smartwatch independently?

RESEARCH METHODS

The research study participants were two ten-year-old male children (User A and User B) with a diagnosis of autism and a mild cognitive impairment. Both children employed picture-based methods to communicate and required visual supports and structure across their environments. Neither child had the capacity to self-regulate without the assistance of an adult to provide access to self-regulation strategies via pictograms.

The research was carried out at the children's autism-specific school from 10am to 2pm over a period on nine days. Both children wore smartwatches with specific individual self-regulation strategies loaded. All images used were those currently used in the children's day to day visual supports. A heart rate of 90bpm was chosen as the threshold based on the monitoring heart rate data taken on the children in the previous three days. Two evaluators were present across the session to take field notes, check the devices and gather the data generated each day.

RESEARCH FINDINGS

The authors found that for User A the smartwatch intervention was activated during classroom activities; this was anticipated as classroom activities were noted as User A's main source of stress. User A was able to attend to the smartwatch and carry out the strategy on two of the three days. However, it was noted that attending to the smartwatch allowed User A to avoid engaging in the classroom activity and also to stop fighting with a peer. It was also noted that it took longer for User A to regain a state of calm when he almost exceeded the threshold value than when he did, and that when User A ignored the watch that he remained in a state of stress for longer.

User A required some help to pair the music pictogram on the smartwatch with the intervention of listening to music. He did so independently by day four but needed prompting again on day eight. It was thought that an intervention strategy which required only the smartwatch i.e. did not necessitate going to the computer to access his music, might have provided more accurate data as to its effectiveness. It was also found that excitement could trigger the self-regulation strategy on the smartwatch to open. From day seven User A was able to independently interact fully with the system and in ten out of the 30 activations was successful in terms of his emotional self-regulation. Furthermore, User A was able to self-regulate within the five-minute window given where previously recovery could require 60 minutes.

The authors found that for User B it was more difficult to ascertain when he was emotionally dysregulated. User B's anxiety was typically triggered by loud noises which would cause User B's heart rate to rise quickly. During these periods he would remain quiet; his skin would pale, his body stiffen, and he would typically withdraw from his environment. By day five User B could independently follow the self-regulation strategy and in 23 out of the 54 activations was successful in terms of his emotional self-regulation. User B's strategy was not time based however it typically took between 30-60 seconds for him to become calm again.

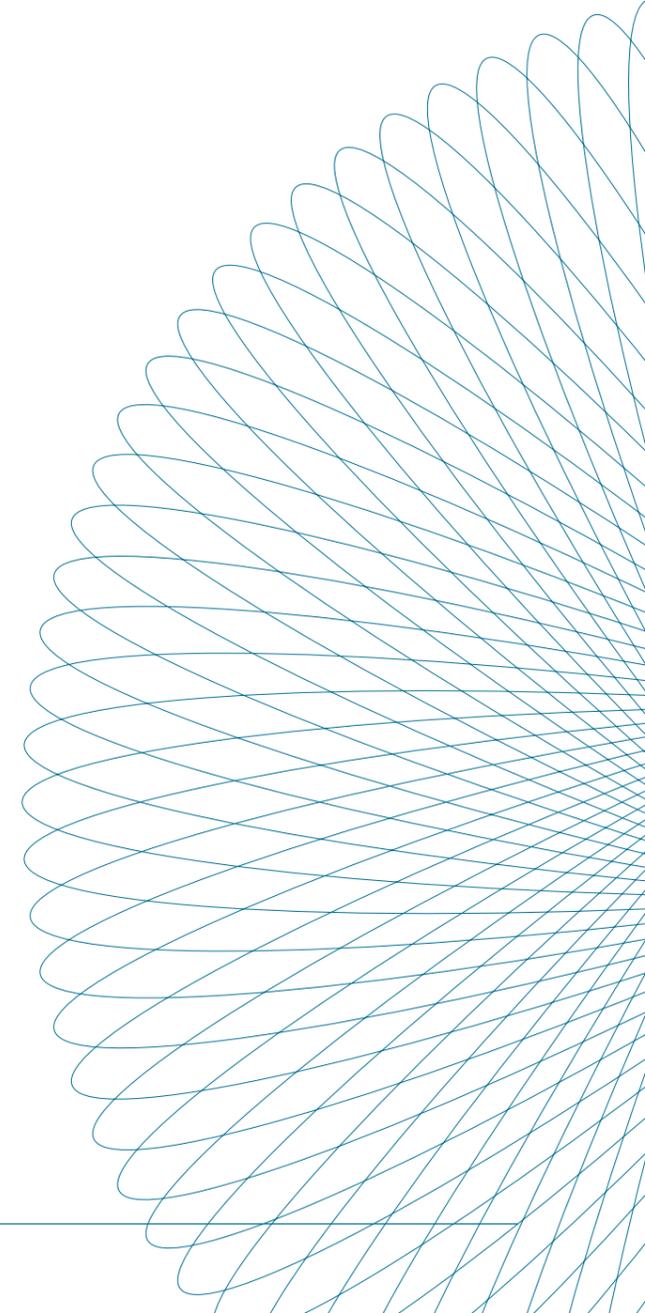
Whilst both User A and User B were dissimilar in how their emotional dysregulation was manifested, both were able to independently self-regulate using their smartwatch intervention strategy within a period of nine days.

IMPLICATIONS FOR PRACTICE (by the authors)

- Assistive technology devices need to be non-stigmatising, easy to manage and to customise if they are to be successful support tools for individuals with autism and their families.
- The development of long-term behavioural issues can be prevented through pervasive interventions on a smaller scale that help teach the individual how to manage their emotional regulation.
- The smartwatch system is time and cost friendly, customisable, and pervasive, thus making it a feasible intervention to self-manage emotional dysregulation in individuals with autism.
- Improvements to future smartwatches could include algorithms that can infer stress from physiological signals.
- Data visualisation software could be integrated into the smartphone in the future so as to allow caregivers to see the effects of their implemented strategies.
- Further research on a larger scale would be of benefit to gather more data and to raise any potential issues not highlighted by this study.
- Caregiver questionnaires which test the smartphone authoring tool would provide additional usability information.

Full Reference

Torrado, J.C., Gomez, J., and Montoro, G. (2017). Emotional Self-Regulation of Individuals with Autism Spectrum Disorders: Smartwatches for Monitoring and Interaction. *Sensors*, 17, p. 1359.



TECHNOLOGIES AS SUPPORT TOOLS FOR PERSONS WITH AUTISTIC SPECTRUM DISORDER: A SYSTEMATIC REVIEW

BACKGROUND

Due to the increase in diagnosed cases of ASD, software and hardware dedicated to people with autism have been developed for years. The use of such technologies has prompted a body of research involving ICT.

This study analyses the technologies most widely used to work on areas affected by an Autistic Spectrum Disorder (ASD).

RESEARCH AIMS

This study is a review of the most recent studies of technology and applications as support and helping tools for people with ASD.

RESEARCH METHODS

The study is organised into the following four sections; 'Mixed Reality Applications', 'Dedicated Applications', 'Telehealth Systems' and 'Robots'.

The study further divided according to the area affected by ASD which is targeted in each study.

- Communication and interaction.
- Social learning and imitation skills.
- Other associated conditions.

This review uses the following criteria for inclusion:

- Articles published between 2004- 2014.
- Articles indexed in Web of Knowledge.
- Studies which work on affected area of ASD.
- Studies which incorporate technologies such as virtual reality, robots, telehealth systems or dedicated applications to detect, diagnose or improve ASD.

The articles and research included in this review involved participants whom had a diagnosis of autism and who ranged in age from 29 months old to 19 years.

Research included was conducted in Spain, USA, Israel, Italy, Japan, France, Netherlands, New Zealand and the UK.

RESEARCH FINDINGS

The conclusion reached in this research is that technology serves as a key support instrument for people with ASD, their families or professionals treating them.

- The research highlights communication and interaction and social learning and imitation as the areas in which researchers saw the most significant results for participants.
- The authors observed that social robots and virtual reality are the most suitable technologies for work on communication and interaction because they focus on involving the users or participants in social situations they may be required to cope with.

The authors also note however that it is essential to ensure that the content matches the children's ages and that the use of technology is limited as it can cause addition and further isolation.

The authors also note a number of limitations of the studies reviewed, as highlighted below:

- It is recognised that the use of mixed reality, robots and dedicated applications provide users with predictable behaviours which allow users to feel secure and comfortable, but which do not reflect the variables which exist in real life. It is suggested that more research is needed to establish if skills can be transferred and thus improve quality of life for users. For this reason, more research is required to demonstrate how training with these technologies improves skills that are transferred to the real world, thus improving users' quality of life.

- A further limitation noted by the authors in these studies is the fact that the tools are developed for the entire autism spectrum. In other words, the tools work on all the users' affected skills in a similar manner, regardless of the severity of their diagnosis. For this reason, the results reported in these studies could be altered if the cognitive functions or language evolution are analysed. Therefore, it is important to highlight that they may not fit each individual's needs. This could lead to a lack of interest in the system. The capacities these technologies offer may mean that it would be interesting to develop configurable systems that could be adapted to each person, thus achieving more efficient tools.
- Although the studies analysed do not include robots as tools to work on motor skills, they may be a good option because of the success shown when working on imitation. In this manner, robots could reproduce sequences of movements that users could imitate. This would make it possible to work on both imitation and motor skills.
- A remarkable aspect is that this research consists of pilot studies with a small number of participants, being mostly children, and further analyses have not been conducted following the research to check if the participants have maintained the improvement achieved during the tests. In other words, whether participants have been able to transfer the results achieved to their daily lives.

IMPLICATIONS FOR PRACTICE (by the authors)

Following this analysis, the authors highlighted that it is important to conduct studies which combine various technologies in the same system to take advantage of each of them and where the main focus area is technology-ASD person-family/clinician interaction rather than technologies-person interaction. This may make it easier to transfer the skills they have worked on with the tools to daily life because persons with ASD would constantly be exposed to real social stimuli in controlled environments.

Technology can therefore give important support in therapy and diagnosis of persons with ASD and may even help to obtain objective values which enable us to understand autism a bit more and what people with autism feel in their day to day. This helps professionals to adapt interventions to each person, and families to work from their homes and gain a better understanding of their children's behaviour and needs.

- The study highlights the limitation and potential negatives of the use of technology when working with those with autism, i.e. that the use of technology in some circumstances can create an addiction to it for some individuals with a diagnosis of autism.

Full Reference

Aresti- Bartolome, N., and Garcia-Zapirain, B. (2014). Technologies as Support Tools for Persons with Autistic Spectrum Disorder. A Systematic Review. *International Journal of Environmental Research and Public Health*, 11(8), p. 7767-7802.

USING TABLE APPLICATIONS FOR CHILDREN WITH AUTISM TO INCREASE THEIR COGNITIVE AND SOCIAL SKILLS

BACKGROUND

Several researchers and technicians have been developing software and hardware to support and/or replace the standard method of teaching children with autism. Traditional technology such as laptops, computers, smartphones and tablets have shown benefits such as increasing independence, academic and cognitive skills, and improving social communication and leisure time.

RESEARCH AIMS

The aim of the current study is to evaluate the effectiveness of three tablet applications to enhance the attention, vocabulary and imitation skills of children with autism who followed an Applied Behaviour Analysis (ABA) programme versus the control group (CG) who only followed ABA intervention. The research aims to respond to three relevant questions: (1) whether the experimental group (EG) following training with three tablet applications obtain greater progress within their ABA programmes than those in the CG; (2) whether the real skills of children examined at baseline in their ABA programme, for example, to imitate the therapist and respond to instructions, have an impact on application scores; and (3) whether the graphic features and structure of the three electronic applications influence the motivation and relative scores of the children during the game.

RESEARCH METHOD

Thirty children with a diagnosis of Autism Spectrum Disorder (ASD) were selected for this study. All children were Italian, and under the age of six. They all followed an ABA programme for at least one year prior to the study that included at least six hours of one to one therapy with a behaviour therapist. The Assessment of Basic Language and Learning Skills (ABLLS) was used to identify skill strengths and deficits, and to identify learning goals for the ABA programme. Parents were trained on implementing the ABA programme targets with their children, and they collected data on these targets in conjunction with the behaviour therapist. Subsequently, the sample was randomly divided into parts, with 15 children assigned to the EG and 15 to the CG.

For four weeks, 30 minutes of daily practice with three tablet applications (attention, vocabulary, and imitation) was added to the programme of the EG, while the CG continued with their standard therapy described above. The children in the EG engaged with simple to complex time-based tasks. The attention app required the learner to tap various stimuli on the screen while avoiding distractors. The vocabulary app required the student to discriminate words heard in discrete trials by choosing the correct picture from a variety of at least three. Finally, the imitation app was characterised by imitation of actions with objects such as rocking a doll, moving a car and so forth. After three correct responses the learners received reinforcement in the form of an animation on screen for 30 seconds. To increase motivation during the process, verbal and written praise was also provided after each correct response.

In the CG, the three areas of attention, vocabulary and imitation were taught by a behaviour therapist during the standard therapy sessions. The attention targets comprised of responding to name, maintaining eye contact, joint attention and selective attention through tasks. The vocabulary programme included receptively identifying common objects, while the imitation with actions programme asked the children to replicate the action of the therapist. One session a week was assessed for the therapist's adherence to the teaching procedures. To clarify pre and post experiment, the means of the mastered targets for the three skill areas were chosen as the criteria to compare both groups.

RESEARCH FINDINGS

At post-intervention, the EG showed greater progress in their therapy programmes than those in the CG. Although these results did not exceed the significance level. However, the probability of making progress in mastered goals at post-intervention was higher for the EG than the CG, affirming the belief that the tablet applications were effective in reproducing similar learning strategies to those offered in behavioural therapy.

The children's ability levels at baseline were noted as impacting on game scores, but only for the imitation application. The other applications, vocabulary and attention, did not demonstrate a correlation between real and virtual ability of skills, however, this may be as a result of these applications being over-simplified. It was also noted that the CG attention programme comprised of more complex behaviours than the application required, such as eye contact, and joint attention.

Motivation for the game was demonstrated as scores increased gradually, however, the best scores for the learners were acquired before the end of the intervention. The applications may have been too easy, resulting in the absence of correlation between time spent playing the games and the outcomes noted.

IMPLICATIONS FOR PRACTICE (by the authors)

- Tablet applications may offer a new learning environment in the classroom, where the presence of the teacher is typically required for behaviour interventions.
- Pairing the tablet with similar game-based instructional tasks may encourage generalisation of skills beyond the tablet.
- Tablet applications can be altered to suit a variety of learning abilities, ensuring the inclusion of all learners.
- Learner progress can be easily monitored through the data collected in tablet applications, which has a low error margin.

Full Reference

Esposito, M., Sloan, J., Tancredi, A., Giovanna, G., Postiglione, P., Fotia, F., Napoli, E., Mazzone, L., Valeri, G. and Vicari, S. (2017). Using Tablet Applications for Children with Autism to Increase their Cognitive and Social Skills. *Journal of Special Education Technology*, 32(4), p. 199-209.

IPADS AND THE USE OF “APPS” BY CHILDREN WITH AUTISM SPECTRUM DISORDER: DO THEY PROMOTE LEARNING?

BACKGROUND

As the use of technology continues to advance in home and education, and becomes part of our everyday life, this research looks at how best we can use technology, particularly iPads and apps, to offer children with autism access to effective communication and language strategies. iPads and similar tablets are seen to be helpful due to their easy to use touch screens, portability, contextual appropriateness and their capacity to transmit multimodal output for children who may have a language and communication difficulty associated with their diagnosis of autism. They offer a means of learning and instruction that is not dependent on joint interaction and engagement, essential components of the reasons for using picture books and the art of reading with typically developing children.

RESEARCH AIMS

This study aims to discover if using an iPad or tablet, where the vocabulary is taught using a series of pictures in a variety of colours and contexts, reduces the anxiety children with autism experience when included in the socially interactive learning process of reading in small groups from a picture book and thus promotes language and communication acquisition and understanding.

This study also points out that the development of communication, an inherent difficulty for those with autism, is not synonymous with the acquisition of vocabulary nor is the acquisition of words a true reflection or indicator of socially communicative skills.

RESEARCH METHODS

Sixteen children were selected for the study, all of whom were described as ‘minimally verbal’, previously have used PECS, Picture Exchange Communication Systems, and were experienced with the use of iPads and tablets. Researchers offered four distinct learning opportunities, using:

1. An iPad, repeatedly presenting a single picture of the word to be learned.
2. A picture book, repeatedly presenting a single example.
3. An iPad, presenting multiple differently coloured picture of the target object.
4. A picture book, presenting multiple differently coloured pictures.

The children were then asked to transfer and generalise this learning into the identification of a three-dimensional objects within the classroom environment.

RESEARCH FINDINGS

To be effective, researchers claim that practitioners must, initially, determine whether children with autism understand and learn from pictures and use them effectively, understanding their symbolic role. Research has shown that children with autism find greater meaning in colour pictures than previously used black and white images, yet as practitioners, we must be cautious of whether the child or young person is making generalisations based on the picture content or the colour used. In this study, children with autism learned the names of objects from the multiple differently coloured pictures irrespective of the medium used in delivery. Moreover, this acquisition of additional words did not directly impact on desire for communication.

To satisfy the second aim of the study, the researchers highlighted the variety of research into the use of iPads and tablets to support communication, finding that iPads and tablets are effective for children with autism when requesting items but did not improve the children’s need for spontaneous social communication and interaction. However, they do see the benefits of having a variety of media, of which iPads and tablets are one, to support the education and development of children with autism.

As iPads and tablets are visually appealing to children with autism, interventions and lessons delivered in this mode through apps, appear to be more motivating and engaging, leading to greater time on task and a reduction of challenging behaviours. However, research shows that they do not demonstrate deeper learning. Nevertheless, if you have a group of children who are motivated to engage, it may be a platform that teachers and parents must exploit as a means to supporting better learning outcomes.

The advanced functionality of apps and technology may also allow greater opportunities for individualisation of programmes, allowing for cultural and contextual appropriateness to instruction for children with autism. Such children are primarily visual, concrete learners and the ability to adapt a programme and the use of in-built cameras that utilise real examples within the child’s realm of experience and environment, may increase the learning potential in a given activity.

IMPLICATIONS FOR PRACTICE (by the authors)

- Parents and teachers may need guidance when purchasing apps, iPads or tablets to ensure that they can be adapted to meet the individual needs of the child at that time. Apps that can be modified and developed as the child develops and as he or she acquires knowledge may be more beneficial than those that are immediately appealing.
- As there are so many apps readily available, it is important to have a range of apps that have been thoroughly researched and follow some scientific reasoning, if they are to be used for successful educational purposes.
- It is preferable to use apps that enable the creation and incorporation of customised visual supports using the tablet’s camera. This personalised approach may lead to greater accessibility and understanding for the child with autism.
- Ease of use is also a consideration if the child experiences difficulties with manual dexterity.
- An app, to be functionally employed, must be one that the teacher or parent can easily teach; complexity in use may render the app ineffectual.
- Apps must be evaluated in terms of their affordability; being too expensive can make them prohibitive to many parents and schools. Being tempted to buy a cheaper version may mean one which cannot be adapted to meet the specific needs of individual children thereby being less cost effective.

- Apps and the use of iPads and tablets allow children to easily transport their learning device between the two important teaching environments, home and school. It allows for the educational partnership of parents and education professionals as they are using the same apps and devices to increase the learning of the children.

Full Reference

Allen, M. L., Hartley, C. and Cain, K. (2016). iPads and the Use of “Apps” by Children with Autism Spectrum Disorder: Do They Promote Learning? *Frontiers in Psychology*, 7, Article 1305, p. 1-7.

INNOVATIVE TECHNOLOGY-BASED INTERVENTIONS FOR AUTISM SPECTRUM DISORDERS: A META-ANALYSIS

BACKGROUND

The use of technology to assist individuals with autism spectrum disorder is an area which has received increased attention during recent years. It is thought that individuals with ASD may benefit from receiving interventions through a medium which has few immediate social demands, a visually-based format, and which delivers tasks in a clear and consistent manner.

Technologies such as computers, interactive videos, mobile phones, iPads and robotics have been used to develop tools for those with ASD, targeting skills including face and emotion recognition, everyday living and safety skills and the ability to initiate or terminate certain behaviours. However, strong evidence that such interventions can be effective has yet to be established.

RESEARCH AIMS

The authors aimed to conduct a meta-analysis of studies which investigated the use of technology-based interventions for individuals with ASD. They wanted to establish the size of the differences in ability before and after the delivery of the interventions. They also wanted to assess the efficacy of the research designs used to examine technology-based interventions.

RESEARCH METHODS

The authors conducted a systematic literature search for terms relevant to their investigation such as ‘autism’, ‘computer’ and ‘training’. They limited their search to articles published between 1990 and 2011.

Articles were deemed suitable for inclusion if they (a) involved participants interacting with technology; (b) involved a group of participants with an ASD diagnosis; and (c) used assessments for participants before and after training.

Twenty-one suitable studies were identified, involving a total of 419 participants with ASD.

Analyses were then conducted to establish the size of the difference across studies between intervention and control groups after the interventions were delivered (in studies which included a control group), as well as the pre- and post- training differences across all included studies.

RESEARCH FINDINGS

Results of the analysis of studies which included a control group showed a significant difference between intervention and control groups in terms of their post-training scores. Those who had received an intervention showed greater improvements than those who did not.

There was a negative correlation between the length of the interventions and the effectiveness, however participants’ age or IQ did not influence the effectiveness of the interventions.

When all 21 studies were analysed to establish the size of differences in participants’ scores before and after training, a significant difference was found. Overall, participants displayed improvements post-training compared to pre-training.

IMPLICATIONS FOR PRACTICE (by the authors)

- The current available evidence suggests that technology-based interventions have the potential to assist with the training and education of individuals with ASD.
- Technology may be used to successfully aid the development of essential living skills, social skills and academic skills.
- Such interventions may be most effective when a parent or teacher provides instruction in the use of the intervention.
- Those who develop such interventions should make them easily available for use by educators and parents, rather than merely research tools.
- The authors suggest that future research in this area should employ more stringent study designs and that researchers should attempt to replicate previous studies to investigate the influence of factors such as the individual's verbal ability or level of adaptive behaviour on the effectiveness of such interventions.

Full Reference

Grynszpan, O., Weiss, P. L., Perez-Diaz, F. and Gal, E. (2014). Innovative Technology-Based Interventions for Autism Spectrum Disorders: A Meta-Analysis. *Autism*, 18, p.346-361.

BRIEF REPORT: USING IPADS FOR SELF-MONITORING OF STUDENTS WITH AUTISM

BACKGROUND

Self-monitoring is a strategy which can be used by students to monitor their own behaviour. Research has shown that self-monitoring improves students' motivation and increases on-task behaviours; it is also relatively easy for both teachers and students with disabilities to implement. Self-monitoring involves two steps, firstly teaching the student to recognise if the target behaviour has occurred or not and secondly teaching the student to self-record their behaviour.

RESEARCH AIM

This study used iPads to show students visual representations of self-modelled, on-task behaviours. Students used self-recording screens to record and manage their own behaviours. The study evaluated students' academic performance on a weekly basis to explore the relationship between their on-task behaviour and academic achievement.

RESEARCH METHOD

A single subject research design with ABAB phases was used. Four students with autism were taught on-task behaviours by watching self-modelled videos using the 'Choiceworks' app on an iPad. Students collected data on their own behaviours. On-task behaviours included sitting in seat, paying attention to the teacher (i.e. listening, eyes and face forward) and working on assignment.

During a 20-minute period each day the four students would receive an academic lesson from a special education teacher, during which time two teaching assistants as well as the individual student observed and recorded on-task behaviour using a checklist.

FINDINGS

On-Task Behaviours

Results indicate all four students presented with low mean percentages of on-task behaviours during initial baseline, this increased for all participants during the intervention stage when they used an iPad for self-monitoring. A group mean of 84% was recorded for target behaviours including facing forward, looking at teacher and working on assignment which indicates very effective treatment.

During the second baseline on-task behaviours reduced with a class mean of 40%; however, on-task behaviours increased to a group mean of 86% during the second intervention phase, again indicating very effective treatment.

Academic Performance

Students performed weekly quizzes; these scores were converted into percentages to demonstrate performance in vocabulary learning. All students' test scores increased from baseline, although their scores did not reach 80% accuracy.

IMPLICATIONS FOR PRACTICE (by the authors)

- The results from this study indicate that the use of self-modelling and self-monitoring increased on-task behaviour for students; this is consistent with previous studies on self-management of students with autism.
- Previous studies mostly used paper checklists for monitoring; this study used an iPad for modelling on-task behaviour and recording behaviours. It shows that teachers can use technology in the classroom to assist students with autism in their behaviour and academic improvement.

- The iPad provided an opportunity for students to learn appropriate on-task behaviours via self-modelling. This is an easily accessible tool which is portable and can be conveniently placed on the corner of students' desks for their use without disrupting the class or requiring teacher supervision.
- Previous studies have highlighted the cautionary use of iPads when teaching social communication skills; follow up practices in the real world without technology should be provided to increase skill generalisation.

Full Reference

Xin, J.F., Sheppard, M.E. and Brown, M. (2017). Brief Report: Using iPads for Self-Monitoring of Students with Autism. *Journal of Autism and Developmental Disorders*, 47(5), p.1559-1567.

TECHNOLOGY USE AS A SUPPORT TOOL FOR SECONDARY SCHOOL STUDENTS WITH AUTISM

BACKGROUND

Screen-based technology use has been found to be a preferred discretionary activity for many adolescents with ASD. In addition to recreation, technology support tools may also help adolescents with autism to deal with social and behavioural challenges. Well-designed technology offers clearly defined tasks and visually cued instructions that reduce the likelihood of confusion or misinterpretation by the user whilst increasing independence. Virtual environments show promise to practice social interactions. Furthermore, social media, texting, and email can expand opportunities for social interactions and be much less intimidating for young people with ASD. In the general population, adolescents are high adopters of technology with at least 95% of all teens online and 74% accessing the internet via mobile devices at least occasionally. However, little is known about their use of technology for supportive purposes.

RESEARCH AIMS

The goal of the current study is to provide insight to families, practitioners and researchers that may aid the broader implementation and uptake of technology-based supports for students with ASD. The specific questions posed by the current research include:

1. What forms of technology are high school students with ASD using?
2. For what purposes are they using technology?
3. What are their perceptions of the benefits and barriers of that technology?

RESEARCH METHOD

Questionnaires were administered to 472 high school students with ASD. All participants were between the ages of 14 and 21 years. The majority (77%) were without intellectual disability, and the majority were on track to graduate with a regular education diploma. The survey was conducted in a total of 60 schools spread equally across three States. The survey instrument was developed using a tailored method of questionnaire design and piloted before administration. Questions were grouped into sections related to technology use at school, using technology to communicate and socialise, and technology at home. Assessors administered the survey in paper form.

RESEARCH FINDINGS

The results of this study revealed that respondents are using a variety of forms of technology in a wide variety of ways across settings including to help support learning, stay organised, communicate, increase social opportunities and to reduce stress. Like typical teens, students with ASD use technology, especially hand-held technology, to increase their social opportunities by engaging in a variety of social media outlets. They are also using their hand-held technology to reduce their anxiety by listening to music and using calming apps. Participants also indicated that using technology helped them address areas of need; for example, using calendars and alarms to help with organisation, using a laptop in class to take notes, using the internet to research for assignments or to pursue their own interests such as publishing their own art.

Respondents reported few barriers to technology use; the most predominant was related to the distracting nature of technology. Though most of the respondents in this study have access to technology tools, there were times throughout the day in which they were not permitted to use them.

IMPLICATIONS FOR PRACTICE (by the authors)

There is sufficient empirical support to classify Technology-Aided Instruction and Intervention (TAII) as an evidenced-based practice. However, to be meaningful to student outcomes, teachers will need to provide students with access to technology and facilitate use of technology in ways that contribute to positive outcomes. An important finding from this study is that many students with ASD, especially those in inclusive settings, report they are using technology in a variety of supportive ways. However, the finding that some teachers are banning technology use in their classrooms points toward the need to find effective coaching and supports for teachers to successfully incorporate technology use as part of their instruction.

Full Reference

Hedges, S. H., Odom, S.L., Hume, K., and Ann Sam (2018). Technology use as a support tool by secondary students with autism. *Autism*, 22(1), p.70-79.

USING APPS TO DEVELOP SOCIAL SKILLS IN CHILDREN WITH AUTISM SPECTRUM DISORDER

BACKGROUND

Children learn about themselves and the world around them through early social interactions. The foundations for learning begin in early childhood through play and interactions with the environment. Research has stated that good socioemotional skills are predictors of later academic success. Abstract social skills are typically built through interactions with caregivers and peers. For some students diagnosed with ASD they may have delays in this domain. Those with underdeveloped socioemotional skills may have difficulties in school but also have lasting effects on their overall quality of life as social skills affect personal and working relationships. It has been highlighted in recent research that early years are a critical time for social skills intervention because they have such an impact on academic, interpersonal and behavioural skills.

There are a variety of interventions shown to assist the development of social skills in children with ASD. Some suggested strategies may include the picture exchange communication system; video modelling; visual supports, cues, and schedules; peer tutoring and peer-mediated; social stories; utilising visual processing; as well as sociodramatic play or improvisation games. While some of the named interventions incorporate technology, most used are low tech and do not allow direct student access to technology.

RESEARCH AIMS

The purpose of this article was to provide an overview of research into the use of technology as a socioemotional intervention tool for children with autism spectrum disorder. The author also aimed to provide a framework of steps for using apps to deliver socioemotional skill interventions, based on current best practice research findings.

RESEARCH METHOD

The author has summarised articles concerned with the education of young children and technology-based socioemotional interventions for children with autism spectrum disorder. The author has incorporated these findings into a suggested set of steps for the introduction of apps as socioemotional intervention tools.

RESEARCH FINDINGS

It has been reported that today's generation of children are becoming more technology literate at younger ages. Research suggests that although technology may be effective in building social emotional skills, this may not be the case for younger children. Some research has found that technology can increase a student's engagement and facilitate independent learning. In addition, technology was reported to motivate and engage students and develop emotional growth.

Although there is concern that technology may isolate children, research has shown that children spend more time talking to peers about the technology they are engaged in and show more collaborative work. Collaborative play on technology may assist with facilitating and improving communication. In addition, research has suggested that students with ASD are more likely to engage in activities which contain technology.

The author suggests that when using apps to facilitate socioemotional development in the classroom, the following four guidelines should be implemented (see *Figure 1*).

Establish Routines and Rules for Use

Within the classroom it is important to establish rules and routines around the use of apps and technology in order to build socioemotional skills. Professionals must analyse their daily schedule and include opportunities for structured app use within the daily routine. Also, research has suggested that practitioners should also think horizontally, i.e. incorporating technology across multiple settings or activities.

When establishing rules and routines, professionals must also determine how many students will use the device at one time. It is important when developing socioemotional skills that the app is carefully considered for more than one user as interaction is key to not only operating the app, but also building upon overall social skills. It has been reported that such peer engagement helps to increase social interaction and other generalisable social skills for students with ASD.

It is also important that professionals must directly teach the rules of technology use. For example, the practitioner should ensure that students are aware that (a) the iPad or portable device is to stay within the given area, (b) it should be used for the stated purpose, and (c) it should not be mistreated, but handled with care.

Select Appropriate Software

For an app to have a positive effect on the development of socioemotional skills, it must be carefully considered before use. Also, there must be a level of professional judgement around developmental appropriateness.

Some researchers strongly suggest the use of open-ended technology for young children. Such technology allows for free exploration of an imaginary world, rather than having a prescribed set of steps that must be followed, like a board game. This open-ended approach fosters collaboration and communication, two important aspects of socioemotional development.

Alongside this idea of open-ended or child-controlled technology, it is important that the app must be aligned with curricular goals or for those young children with special needs, the app must be aligned both with a child's individualised education programme (IEP) goals as well as with the core curriculum.

Arrange the Environment

The next step for implementation is for professionals to arrange the environment. This process is not only critical to implement the incorporation of a mobile technology intervention but is also a critical component of numerous interventions to be used for students with ASD. It has been advised that students using technology must be positioned close to each other to allow for the sharing of ideas and development of social skills. Because of this, the iPad or other tablets are ideal. The one screen is large enough for two students to use, but they would need to be next to or close to one another to share.

In addition, research suggested that when computer activities are paired with off-computer activities they have maximum impact. This encourages the children to use the technology to learn but also think about what they are doing and generalise this skill across different environments.

Allow for App Exploration and Application

After all other steps have been taken, the final step is to introduce children to the app and allow them to play together. Essentially, it is using the app to facilitate a structured play scenario which is typical of ASD interventions because an app only allows certain functionalities.

After experimenting with the app during structured technology time, students then should be immediately invited to apply and practice these newly acquired skills in a hands-on manner. For students with ASD, structured sociodramatic play has been used to successfully increase social skills.

IMPLICATIONS FOR PRACTICE (by the authors)

- Mobile technology is now an integral part of students' daily lives. Instead of excluding it from education and socioemotional learning it should be used to support and motivate development in this area.
- Students should be given the opportunity to learn acceptable rules of interaction and play when using technology.
- Skills learned should then be generalised into a less structured setting to help further develop socioemotional development.

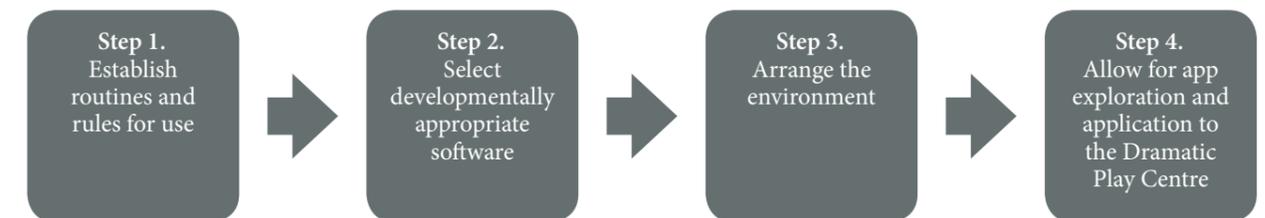


Figure 1: Steps for using apps to provide socioemotional interventions.

Full Reference

Withy, K. L. (2017). Using Apps to Develop Social Skills in Children with Autism Spectrum Disorder. *Intervention in School and Clinic*, 52 (4), p.250-255.

TECHNOLOGY-AIDED INTERVENTIONS AND INSTRUCTION FOR ADOLESCENTS WITH AUTISM SPECTRUM DISORDER

BACKGROUND

The unique appeal technology has to young people with autism spectrum disorder (ASD) has engendered much excitement, resulting in a rapid uptake of its use in ASD interventions in educational, clinical and community settings. Despite this growth, there is little knowledge about the efficacy of such interventions or potential collateral effects.

The authors focused on technology and interventions for adolescents as technology-assisted interventions are very important to this age group, yet to date, they are under-represented in studies on ASD interventions.

The authors identified that technology aided interventions involve interdisciplinary work yet carry different meanings for each discipline. For clarity, the authors used the Centre on Secondary Education for Students with ASD (CSESA) Technology Group (2013) definition, which is, technology refers to an electronic item/equipment, application, or virtual network that is used to intentionally increase, maintain, and/or improve daily living, work/productivity, and recreation/ leisure capabilities of adolescents with ASD.

RESEARCH AIM

The purpose of this review was to examine the research literature underlying the use of technology in interventions and instruction for high school students with ASD in school, home, and community contexts.

To do this, the authors proposed a theoretical and conceptual framework for examining the use of technology by and for adolescents with ASD in these contexts. The framework was then used to describe the research literature on efficacy of intervention and instruction.

RESEARCH METHOD

The authors used a theoretical and conceptual framework to match user, technology and activity. The framework was then used to organise research findings. The authors used a standard article evaluation rubric. The CSESA technology conceptual framework for summarising current knowledge about the uses of technology in interventions for students with ASD was used.

Thirty single case and group studies met the inclusion criteria; 20 studies took place in school settings, 11 took place in the community and two occurred in the home, both these were combined with intervention in the community. One study occurred in a school and clinic context. The thirty studies included 238 adolescents with ASD aged between 13 and 22 years and three individuals supporting youth between these ages; 84% were male, 17 included participants with co-occurring conditions (15 being intellectual disability), three were racially diverse and none reported linguistic diversity.

RESEARCH FINDINGS

Multiple studies identifying technology as the preferred and more effective form of learning and support for adolescents with ASD were cited. The variety of technology used in these studies reflected the increasing sophistication of technology itself and its utilisation in practice.

The review addressed a range of activities/goals that reflect Persuasive Technology concepts and those that are a concern for adolescents with ASD in school: independence, vocational skills, academics, and social competence.

The authors identified seven types of technology-aided interventions and instructions: Video Modelling, Visual Prompting, Specific Training on social skills or academic content, Covert Audio Coaching to reinforce on-task performance, Speech Generating Devices, Performance Feedback, Reinforcement and Self-Management.

The CSESA conceptual framework found three overlapping factors affecting the successful use of technology-aided interventions for adolescents with ASD: the match between the individual and the purpose/activity for which the adolescent uses the technology, and the technological device/application, also referred to as the technology platform used.

Given the advances being made in the use of technology-aided interventions to generate speech and communication for nonverbal students with ASD, the authors were surprised to find only one study focused specifically on this. They identified that more research is needed in this area.

The authors identified multiple technology platforms and concluded that the number of platforms is growing, but not all have evidence of efficacy.

To date, only a few researchers have examined the use of technology by adolescents in schools, home, or communities. The authors call for a national study as this could identify the actual usage of technology in these contexts as well as the positive and collateral effects of technology-aided interventions, and potential barriers to technology use.

IMPLICATIONS FOR PRACTICE (by the author)

This literature review identified important positive outcomes of technology use for adolescents with ASD, however little is known about the collateral, and possible negative, effects that could occur (e.g. over-use of technology to the exclusion of engagement in other activities, cyber-bullying, social stigmatisation even when using popular devices). The authors call for a national study which could provide valuable insight into this as well as actual usage of technology in typical high school and community contexts, and the potential barriers to technology use.

The variety of technology used by researchers in these studies was broad and reflects the increasing sophistication of technology and its use in practice.

Literature supports the use of technology in interventions and instruction for adolescent students with ASD.

Technology-aided interventions have been used to provide adolescents with ASD with models or prompts for engagement in learning, to provide performance feedback or self-monitoring, and to systematically teach skills or concepts.

Full Reference

Odom, S.L., Thompson, J.L., Hedges, S., Boyd, B.A., Dykstra, J.R., Duda, M.A., Szidon, K.L., Smith, L.E. and Bord, A. (2015). Technology-Aided Interventions and Instruction for Adolescents with Autism Spectrum Disorder. *Journal of Autism and Developmental Disorders*, 45, p. 3805-3819.

CONCLUSION

This Bulletin commences with a comprehensive review of the current status of computers and technology within autism. The articles that follow support Professor Parson's conclusion that the potential drawbacks of computers and technology do not outweigh the benefits of their use in a supportive or educational context.

The summaries highlight the use of computers and technology, including wearable technology across a range of areas including:

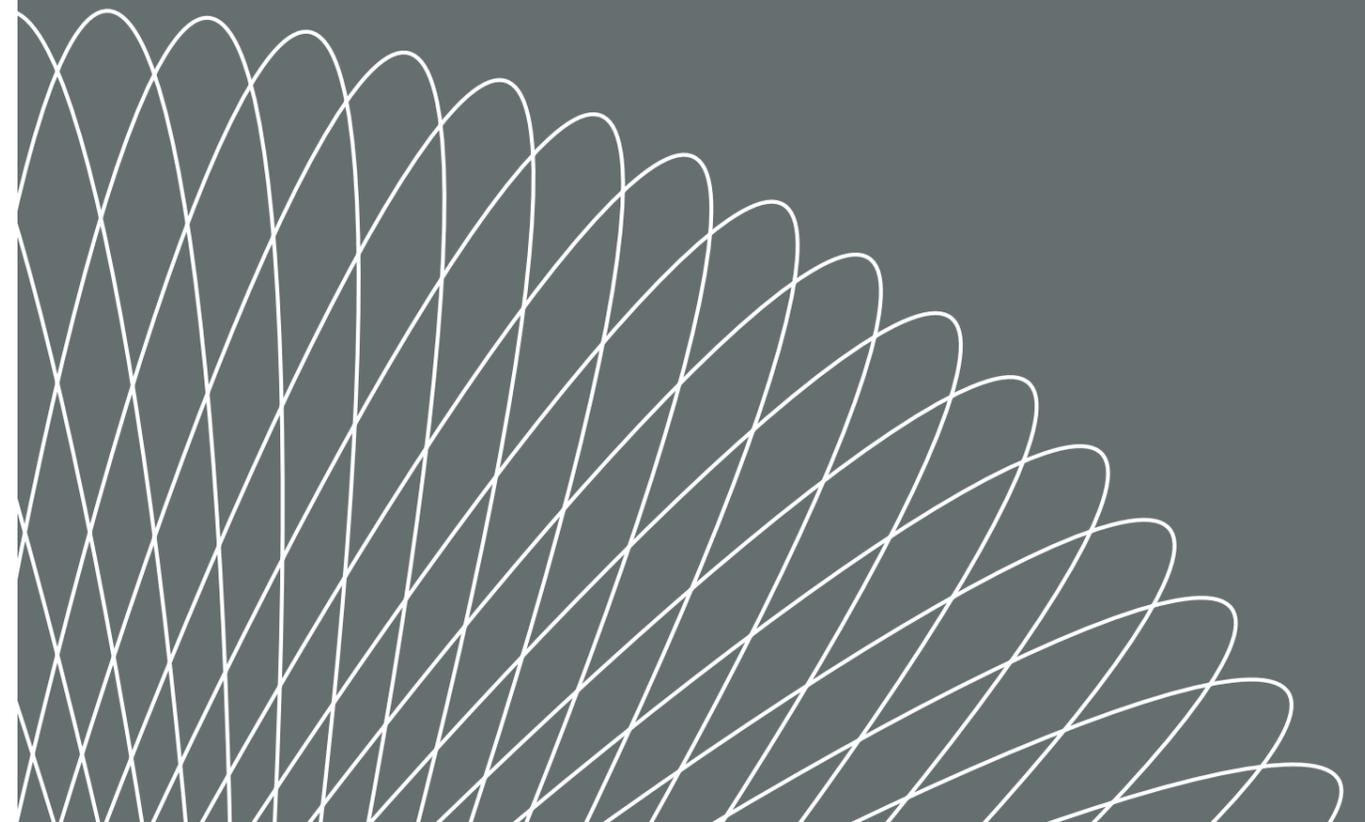
- The development of communication
- Social skills
- Self-monitoring
- Academic engagement and performance.

The use of technology can be seen as a useful addition in the work with children and young people with autism as it can provide a degree of autonomy and also remove the personal engagement aspect to some potentially stressful situations. Further research is needed to further develop the area, particularly in wearable technology where there is considerable potential to develop regulation supports for mood and wellbeing.

YOUR OPINION

The Centre trusts that you have found this Research Bulletin informative. It would be appreciated if you would take a few minutes to provide the Centre with feedback in relation to this bulletin by clicking on the survey link below.

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