Chapter 9
Exploring the Perspectives and Expectations of Special Educational Needs Coordinators on the Use of Special iApps for Children

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ABSTRACT

The digitalization of education has significantly transformed special education practices and the roles of Special Education Needs Coordinators (SENCOs). One

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area of rapid growth is the use of learning applications for children with severe intellectual disabilities, with many apps promising both new ways to engage and educational benefits. Despite this potential, research examining the impact of these tools remains limited. This chapter addresses this gap by exploring SENCOs' perspectives and expectations regarding learning apps, specifically Special iApps, for children with severe intellectual disabilities. Through qualitative research methods and an inductive approach, the study investigates the overarching question: "What do SENCOs perceive and expect from learning apps designed for children with severe intellectual disabilities?" The findings shed light on SENCOs' views on the educational effectiveness of these apps and offer critical recommendations to support the integration of mobile technologies in teaching practices.

INTRODUCTION

The rise of digital learning amidst pandemic lockdowns has the potential to become one of education's great levelers (Crampton & Billett 2021). Digital learning has so much to offer for the 21st century's learners, but it is the educators and wider learning communities who hold the keys for driving that positive change. With society getting increasingly digitalized comes rising expectations of the school to educate children to be able to work in and contribute to the digitalized society. Several arguments about the effects of this development have been published (Holmgren 2021) stating that school is going through a change of epistemology (Lund & Aagaard 2020), a change that challenges the traditional ways of teaching and learning (Bates 2019). If the view on knowledge and the ways of teaching and learning are changed, it is not bold to argue that the conditions for identifying, and organizing teaching and learning for students experiencing difficulties are changing as well (Holmgren 2022).

Children with Severe Intellectual Disabilities (SID) have delayed play and learning skills development (Edyburn 2020; Godin, Freeman & Rigby 2017). Characteristics of intellectual disabilities include a significantly reduced ability to understand new or complex information, a reduced ability to learn new skills, and a reduced ability to cope independently (Wyeth, Summerville & Adkins 2014). The body of research claims that use of digital technologies can have positive outcomes in special education is broad and still growing (Holmgren 2021). Previous work (Laurie, Manches & Fletcher-Watson 2022; Hof et al., 2010) suggests that introducing new technologies to autistic children's play provides opportunity for spontaneous social interactions as they create a shared understanding, which then drops off once the toy becomes less novel. A number of these studies have looked at the use of iPads or tablet computers to promote literacy skills amongst children with SID. For instance, Waddington et al. (2014), found that children with SID learned to perform a three-step communication sequence using an iPad. King et al. (2014) evaluated the use of the iPad involving children with SID and their results showed that training with device was effective for this purpose. Lorah et al. (2014) had success training children with SID to use the iPads as a speech generating device for labelling. Ganz et al. (2013) found that children with SID preferred to use the learning app as compared to the traditional PECS. Likewise, Kemp et al., (2016) found that children with SID were better engaged through using iPad apps than with picture books. Vandermeer et al., (2012) who examined the use of social stories on the iPad to increase on-task behavior and attention have found that children with SID demonstrated interest in using the iPad and an increase in attention in their study. Similarly, Chmiliar (2017) documented improvements in learning outcomes for children with SID using iPads in several areas including shape and colour recognition, letter recognition, and tracing letters.

Although there is evidence in the literature regarding the use of learning apps by children with SID, a voice that has yet not been heard about the digitalization of the school is the Special Educational Needs Coordinators or SENCOs (Holmgren 2021). A SENCO is the schoolteacher who is responsible for assessing, planning and monitoring the progress of children with special educational needs (SEN) and disabilities (Moloney 2019). Empirical enquiry into teacher agency for inclusion has focused on a variety of teaching roles, including general education teachers, special education teachers, subject teachers and pre-service teachers (Lin, Grudnoff & Hill 2022; Miller et al., 2020; Mu et al., 2015; Qu, 2021). However, little attention has been paid to SENCOs regarding their agency for disability inclusive education despite extensive international interest in the nature and enactment of the SENCO role (Lin, Grudnoff & Hill 2022; Klang et al., 2017; Maher & Vickerman, 2018; Rosen-Webb, 2011). This gap is what present study aims to create knowledge about, using the overarching research question: "*what do SENCOs perceive and expect from learning apps designed for children with severe intellectual disabilities"?*

SENCOs take a leading role in identifying SEN, coordinating inclusive practice, applying for resources related to SEN, advising classroom teachers, and liaising with families and outside agencies (Lin, Grudnoff & Hill 2022; Rosen-Webb, 2011). This suggests the important role SENCO agency plays in performing their service coordination role of ensuring students with SEN gain access to quality inclusive education. Although critical to the task of facilitating inclusion for children with SID, SENCO agency for disability inclusive education appears to be an under-researched area (Lin, Grudnoff & Hill 2022). With the digitalization of school, the special education practice and the roles of SENCOs change (Holmgren 2022). The use of learning apps specially designed to support children with SID is expected to increase rapidly with many claiming not only new ways to play, but also to have educational benefits. However, there is a lack of research examining this transformation, a gap which this exploratory study opens up for new understanding through the use of Special iApps as an exemplar.

To underpin and inform our interviews with SENCOs, a systematic review was carried out via reputable databases, including Scopus, Education Source, Education Resources Information Center (ERIC), PsycINFO, and Web of Science from 1997 onwards. These databases were selected for this study, because they were preferred in the systematic review studies related to the topic. Inclusion criteria for the review was guided by the selected research question. Considered criteria (Snyder 2019) were commonly used e.g., year of publication, language of the article, type of article (e.g., conceptual, randomized controlled trail, etc.), and journal. Key terms such as Special Educational Need Coordinators, Learning Apps, Playful Digital Learning, Intellectual Disabilities, Autism, Learner Engagement and Multimedia Learning were searched in full-text English articles. Studies related to play-based learning, learning apps and intellectually disabled children were identified and uploaded to Zotero. Two review authors independently applied the eligibility criteria. Data extraction was done by one author and checked by a second. The methodological quality of included studies was assessed independently by other authors. After providing an overview of the study's purpose, scope, and significance, we now the literature review.

RELATED WORK

Special education is a term that describes an educational alternative that has been implemented to meet the needs of children who are exceptional in some way. It refers to individualized programs, curricula, and instruction designed to address the needs of students with disabilities (WGU 2020). The intent of special education is to enable individuals with special needs to reach their fullest potential. Technology in special education has rapidly evolved and become more accessible to many teachers, parents, and students over the past couple of decades. Special education technology can improve learning by helping students engage with the material in new and interesting ways. The infusion of technology into special education programs predates even the invention of the microcomputer (Jeff et al., 2003). For instance, the first electrical amplifying device for the hearing impaired was invented in 1900. Later, Pressey developed a teaching machine that used programmed instruction in 1926. In 1928 Radios were distributed to blind citizens by the American Foundation for the Blind. Talking Books for the Blind were produced on long- playing records in 1934. The Waldman Air Conduction Audiometer was developed to detect hearing impairments in 1935. The megascope was invented to project and magnify printed material in 1953. The laser cane was developed for use by the blind in 1966. In

1968, a device was invented for compressing speech to more than 320 words per minute without distortion.

MACS (Multisensory Authoring Communication System) was distributed in the 1980's as public domain software by Johns Hopkins University that enabled teachers to create custom software for students with disabilities (Blackhurst & Edyburn 2000). During this early stage of interest in technology as an educational innovation, the main thrust of research was dedicated to how available technologies could be used to address the individual needs of students. Software programs were designed primarily for use as tutorials, to encourage drill and practice, or as enrichment in the form of games and simulations. From the beginning, there was a differentiation in the use of technology, which depended heavily on the exceptionality for which it was used. For example, in the areas that deal with students with disabilities, technology was viewed primarily as assistive, concentrating on facilitating student ability to communicate and promoting academic success (Jeff et al., 2003). As technology began to advance in the late 1980s and early 1990s, researchers working in the field of learning disabilities began to investigate the power of graphics, and multimedia for learning. Multimedia–a combination of graphics, video, animations, pictures, and sound provides diverse learning instruction and has been used for years in the classroom (Jeff et al., 2003). Similarly, word prediction software provided the student with learning disabilities a tool to make the writing process more approachable. In addition, the use of speech recognition to build remedial skills demonstrated an increase in word recognition, speed, accuracy, and reading comprehension. There have been tremendous advancements since 2000 in technological tools such as virtual agents, AI, VR, AR and the infusion of computers for instruction with students who are of special needs. With the advent of AI, the professionals in the field are at a critical juncture to move forward with future advancements for instruction and learning for students who are deaf/hard of hearing.

Play is central to early child development (Godin, Freeman & Rigby 2017), contributing to the development of motor, cognitive, social and emotional skills (Healey & Mendelsohn 2019; Weisberg, Hirsh-Pasek & Golinkoff 2013). Playfulness is the essence of play (Bross et al., 2008) as it captures the quality of children's play beyond the performance of play skills; it refers to the child's disposition and attitude towards play (Godin, Freeman & Rigby 2017; Bundy 1997). Today's children play with smart mobile devices that incorporate technology to provide play, thus, introduced a new concept i.e. Playful Digital Learning (PDL) into early childhood education and care (Hargraves 2022; Edwards 2018). Recent research conceptualizes PDL in two main ways. The first of these attends to the theorization of digital play. Much of this work adopts variations of existing play scholarship and applies these to observations of children's play with technologies (Marsh et al., 2016; Bird & Edwards 2015; Fleer 2014; Verenikina & Kervin 2011; Johnson & Christie 2009).

The second direction focuses on understanding the relationship between children's traditional play activities and their engagement with digital technologies (Edwards 2015; O'Mara & Laidlaw 2011; Marsh 2010).

A key reason for the popularity of smart mobile devices among children is related to technological features of these devices (Papadakis, Kalogiannakis & Zaranis 2016). Large screen displays, high resolution, lightweight, user-friendly and ergonomic design, short start-up time, multimedia content viewing ability, are just to name a few. Furthermore, smart device mobility and ease allow children to learn in a variety of settings instead of the traditional desk and chair (Ellingson 2016). Those features permit children the flexibility of laying the tablet in their lap, on the floor or moving with it to any area within their home (Papadakis & Kalogiannakis 2017; Wood et al., 2016). A mobile application or popularly known as 'app' is a computer program designed to run on mobile devices such as smartphones and tablet computers (Yusop & Razak, 2013; Bouck et al., 2016). Goodwin & Highfield (2012) distinguishes apps into three different categories (see Table 1).

Table 1. The 3-categories of apps (Goodwin & Highfield 2012)

Category	Example	Description
Constructive apps	Trello Evernote Forest	Characterized by an open-ended design that allows users to create their own content or digital artefact using the app e.g. cupcakes, robots, painting etc.
Instructive apps	Hangman Bingo Hot potato	Characterized by 'drill-and-practice' design whereby the app delivers a 'task' which elicits a homogenous response from the user e.g., game apps.
Manipulable apps	Toontastic Math Bingo Quizlet	Allow for guided discovery and experimentation within a predetermined context or framework e.g., apps for mathematics.

Research (Hirsh-Pasek et al., 2015; Papadakis & Kalogiannakis 2017) suggests that children learn best when they are cognitively active and engaged, when learning experiences are meaningful and socially interactive, and when learning is guided by a specific goal (Figure 1). Additionally, children progress quickly from novice to mastery when using a well-designed app (Cohen, Hadley & Frank 2011).

Figure 1. The 4-pillars of learning app

Children with SID have specific learning needs and requirements additional to mainstream learners (Paracha et al., 2023). Aspiranti, Larwin & Schade (2020) opine that educators should consider investing in tablets to use for students with autism as tablet interventions produce significantly higher scores than either traditional or computer-based instructions. Likewise, Sharma et al., (2022) have observed that tablet interventions improve children attention spans. Besides, learning apps provide opportunities for assessing learner progress with explicit feedback. Relevant learning apps for this population include picture-supported text, visual schedules, social skills training, video modeling and prompting, communication boards, and augmentative and alternative communication, audio books, alternative access, wearable AT, wayfinding etc. Some examples include Lola (Gupta 2020) which is web-based platform that works as a messaging and task management tool for special education students. ActivateTM (Bikic et al., 2015) is another example of a web-based platform that combines computer and physical exercises to develop the cognitive skills necessary to learn in the classroom and improve math and reading achievement. Similarly, Google Book (Keen, Webster & Ridley 2016) supports teachers in writing and teaching 'Common Core-based Individual Education Plans'. Likewise, MyChoicepad (Coulson & Doukas 2016), Brain Power (Charlton 2018) and Helpicto (Pertus, 2017) have shown significant progress in the areas of comprehension, attention and autonomy (Pertus, 2017).

Sports-based applications have also been developed, such as the work of Kartiko et al., (2020). Paulino et al., (2016) presents a music application for people with intellectual disabilities called "Piano Teacher." To validate the approach of the application, they evaluated the use of the application by a group of people with intellectual disabilities, without much user experience with mobile technologies, to measure effectiveness, efficiency, and satisfaction. An evaluation of the current state and characteristics of mobile applications was also carried out under this paradigm (Llerena Sarcco, Diaz Zegarra & Sulla-Torres 2023). Barta et al., (2017) created an Android-based app that helps children ages 6-9 living with autism spectrum disorder learn everyday tasks and acquire daily routines. The application consists of two parts: the first is an application of classic daily routines based on an agenda to be carried out; The second part of the application is for the practice of tasks to be carried out by the child. Cuascota et al., (2019) indicates the importance of assistant applications for people with intellectual disabilities in their social inclusion. They developed a tool for Android smartphones designed to help people with cognitive disabilities in tasks for their social inclusion using Beacon technology to locate the user's position and evaluate their functioning within an educational center. The result of the evaluation was that the application called Tk-Helper managed to reduce the time, errors, help and assistance in the tasks of a specific activity carried out by each user (Llerena Sarcco, Diaz Zegarra & Sulla-Torres 2023). Similarly, Lancioni et al., (2017) evaluated a smartphone-based program to promote independent leisure and communication engagement in participants with visual impairment and mild intellectual disability. Masruroh et al., (2014) described the effectiveness of the educational games Marbel Huruf and Belajar Membaca in helping children with ID in early-stage reading. This study is limited to reading only due to the complexity of this skill. The result showed the subject's enthusiasm through the learning activities, high motivation, and increased ability, although it has not yet reached an optimal stage. The interaction and participation of the family were also necessary.

Having explored the related work, we discuss the theoretical underpinnings in the next section.

THEORETICAL UNDERPINNINGS

The literature on the teaching theory, method, or technique used in special education are mainly influenced by the behaviorist and constructivist approach. The behaviorist approach pioneered by the ecole Ivan Pavlov (Özer Şanal & Erdem 2023) which reflects a positivist worldview that focuses on how people behave (right or wrong). In this approach, the emphasis is on observable behaviors. If something is visible, it can be evaluated, measured, and controlled (Picciano, 2021). Although behaviorism is criticized for general education, it is an approach that is defended as a practical approach to special education practices (Özer Şanal & Erdem 2023). The constructivist approach, on the other hand, is a philosophy of the subject and is concerned with how people make their own world, perceptions, interpretations, activities, and actions (Erdem, 2019). Constructivism focuses on the construction of knowledge, that is, while the learning process takes place and what the procedures mean for students and teachers (Akban & Beard, 2016).

Edyburn (2001) highlighted 12 models that have impacted the special education technology knowledge base (see Table 2).

Table 2. Special education technology models and frameworks

Model Name	Description	Reference
The SETT Framework	designed to aid the process of gathering, organizing, and analyzing data to inform collaborative problem solving and decision-making regarding assistive technology and appropriate educational programming for students with disabilities	Zabala, J. (2002). Get SETT for successful inclusion and transition. Available at http://www.ldonline.org/ld_indepth/technology/zabalaSETT1.html Zabala, J. (1995). The SETT Framework: Critical areas to consider when making informed assistive technology decisions. Available at http://www.joyzabala.Com.
Education Tech Points	Education Tech Points was created to facilitate decision-making regarding the utilization of assistive technology services and resources when planning educational programs for students with disabilities. The six key points are (1) referral, (2) evaluation, (3) extended assessment, (4) plan development, (5) implementation, and (6) periodic review.	Bowser, G., Reed, P.R. (1995). Education TECH Points for assistive technology planning. Journal of Special Education Technology, 12(4), 325-338. Education Tech Points. (2002). Available at: http://www.edtechpoints.org/
Chamber's Model	It is a flowchart of the consideration process that illustrates key questions and decisions that must be made when considering assistive technology.	Chambers, A.C. (1997). Has technology been consid- ered? A guide for IEP teams. Reston, VA: CASE/TAM.

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Table 2. Continued

Model Name	Description	Reference
The AT CoPlanner Model	A groupware product that supports communication, collabora- tion, and co-planning. Additional content modules (i.e., Instruction CoPlanner, Transition CoPlanner, and Assistive Technology CoPlanner) provide electronic worksheets and planning systems that support specific applications of collaborative planning.	Haines, L., & Sanche, B. (2000). Assessment models and software support for assistive technology teams, Diagnostique, 25(3), 291-306.
The ABC Model	Technology benefits could be understood by noting that technology can Augment abilities and Bypass or Compensate for disabilities.	Lewis, R. B. (1993). Special education technology: Classroom applications. Pacific Grove, CA: Brooks/Cole, p. 7.
HATT Model	It involve the human, a person with a disability who controls a number of intrinsic enablers (sensors, central processing, and effectors or motor) as well as skills and abilities; activity (performance in areas such as self-care, work/school, leisure/ play); Assistive technology (extrinsic enablers such as human/technology interface, processor, environmental interface, and activity output); and the Context (such factors as setting, social contexts, cultural context, and physical).	Cook, A.M., & Hussey, S.M. (2002). Assistive technol- ogy: Principles and practices (2nd ed.). St. Louis, MO: Mosby, pp. 34-53.
Wile's Model of Human Performance Technology	suggests that performance can be affected by seven variables: (1) organizational systems, (2) incentives, (3) cognitive support, (4) tools, (5) physical environment, (6) skills/knowledge, and (7) inherent ability. This model helps us understand that technol- ogy is not a simple panacea for remediating performance problems.	Edyburn, D.L. (2000). Assistive technology and students with mild disabilities. Focus on Exceptional Chil- dren, 32(9), 1-24. Wile, D. (1996). Why doers do. Performance and Instruction, 35(2), 30-35.
King's Adaptation of Baker's Basic Ergonomic Equation (BBEE)	key factors associated with the successful use, or not, of assistive technology include: the motivation of the assistive technology user to pursue and complete a given task (M), the physical effort (P), the cognitive effort (C), the linguistic effort (L) and the time load (T).	King, T.W. (1999). Assistive technology: Essential human factors. Boston: Allyn & Bacon, pp. 67-86.

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Table 2. Continued

Model Name	Description	Reference
Stages	Stages is a theoretical framework which serves to organize resources and assessment materials for documenting student growth and development and its implications for technology use.	Pugliese, M.K. (2001). Stages: An alternative curricu- lum and assessment philosophy. Special Education Technology Practice, 3(4), 17-26.
Edyburn's Model of the Technology Integration Process	Edyburn's model of the integration process was developed to (a) describe the various tasks involved in integrating software into the curriculum, (b) provide a planning guide for individuals interested in technology integra- tion, (c) serve as a tool for discussing the process among the major stakeholders, and (d) assist in the identification of methods and resources for facili- tating the process.	Edyburn, D.L. (1998). A map of the technology integra- tion process. Closing the Gap, 16(6), pp. 1, 6, 40.
The Quality Indicators for Assistive Technology Services	A set of descriptors that can serve as over- arching guidelines for evaluating the quality of assistive technology services, regardless of service delivery model.	QIAT Consortium Leadership Team. (2000). Quality indicators for assistive technology services in school settings. Journal of Special Education Technology, 15(4), 25-36.
The A3 Model	A theoretical work that seeks to describe a developmental process associated with efforts to provide access for individuals with disabilities to facilities, programs, and information.	Schwanke, T. D., Smith, R. O., & Edyburn, D. L. (2001, June 22-26, 2001). A3 Model Diagram Developed As Accessibility And Universal Design Instructional Tool. RESNA 2001 Annual Conference Proceedings, 21, RESNA Press, 205-207.

Engagement theory (Kearsley & Shneiderman, 1998) served as the conceptual framework for the study that holds if students are involved and enmeshed intellectually, socially, and behaviorally leads to enhanced learning. According to O'Brien & Toms (2008), *"engagement is a quality of user experiences with technology that is characterized by challenge, aesthetic and sensory appeal, feedback, novelty, interactivity, perceived control and time, awareness, motivation, interest, and affect"*. The core principle of engagement theory talks about students being meaningfully engaged in learning activities through interaction with others and worthwhile tasks (Malik 2021). It is a framework for technology-based teaching and learning processes. Kearsley & Schneiderman (1998) believe that technology can be used to facilitate engagement in ways that might be difficult to achieve otherwise. Its fundamental underlying idea is that students must be meaningfully engaged in learning activities through interaction with others and worthwhile tasks. While in principle, such engagement could occur without the use of technology, Kearsley & Schneiderman (1998) believe that technology can facilitate engagement in ways which are difficult to achieve otherwise. This theory promotes working collaboratively, project-based learning, and having an authentic focus.

Engaged learning happens when active cognitive processes such as problem-solving, decision making, and evaluating are involved. The end goal of applying engagement theory to the teaching-learning process is to develop an intrinsic motivation in students to be better learners. Knowledge is no longer limited to books and classrooms. Education technology has developed massively, and student engagement in classrooms is now a significant focus of educators and students. Several factors, including economic, geographic, and social aspects, have led to the decline of student engagement. However, the growth of education technology has helped us understand the importance of student engagement in classrooms. The three principles relate, create and donate focus on developing meaningful situations, requiring students to use their cognitive processes involving problem-solving, decision making, and evaluating. *Relate* emphasizes teamwork (communication, management, planning, social skills). Similarly, *Create* emphasizes creativity and purpose. Students have to define (or at least identify in terms of a problem domain) and execute a project in context. Likewise, *Donate* stresses usefulness of the outcome (ideally each project has an outside "customer" that the project is being conducted for). The end goal of each of these three principles is to develop intrinsic motivation in the learner's mind (Malik 2021).

The related principle deals with making students trade points of view with their peers and relating with what they give and receive. This can be achieved through active and meaningful collaboration between students. Interactive tutorials can play a significant role in this approach. Educators should involve students in activities that emphasize team efforts, communication, management planning, and social skills. In an ideal situation, students would hear, see and relate to how their peers approach the topic at hand and what they take from it. Special iApps feature easy-to-use and intuitive tools and interfaces to help students present their ideas more expressively and helps them defend their views better. To the listener, a tangible example or concept is more relatable than an example or concept which is not. This one-way technology can activate an intrinsic motivation in students' minds to be engaged in the learning process by making the whole procedure more relatable to them. According to Malik (2021), the creation principle is about approaching the learning process in a project-based manner. It requires educators to design activities that are both creative as well as purposeful. When a student approaches the learning process through an innovative project that involves them defining things in their way, organizing and creating something that helps them express what they understand, they can develop a sense of ownership of their learning. When a student feels responsible for their education, intrinsic motivation is created. Special iApps is such a tool that SENCOs and students in this process can use. Likewise, donation to an outside focus is essential for engagement theory-based learning. Donation involves understanding the requirements of a third party and catering to them (Malik 2021). Technology grants them access to people, groups, and organizations that would otherwise be inaccessible to them. Communication is made more accessible by the internet, delivery of solutions or products that are virtual. Understanding the requirement and its specifics is also made easy by the vast amount of knowledge that is easily available on the internet.

We use Activity Theory (Engeström, 1987; Vygotsky, 1978) to examine SENCOs within various systems of activity that orient subjects toward a goal or object, broadly characterized as mastery of teaching or pedagogical expertise. Activity theory begins with the notion of activity. An activity is seen as a system of human "doing" whereby a subject works on an object in order to obtain a desired outcome. In order to do this, the subject employs tools, which may be external (e.g. an axe, a computer) or internal (e.g. a plan). Engeström, (1987) developed an extended model of an activity, which adds another component, community ("those who share the same object"), and then adds rules to mediate between subject and community, and the division of labour to mediate between object and community. Activity theory recognises that each activity takes place in two planes: the external plane and the internal plane. The external plane represents the objective components of the action while the internal plane represents the subjective components of the action. Kaptelinin, (1996) defines the internal plane of actions as *"a concept developed in activity theory that refers to the human ability to perform manipulations with an internal representation of external objects before starting actions with these objects in reality."* Human creativity plays an important role in activity theory, that "human beings... are essentially creative beings" in "the creative, non-predictable character". Tikhomirov, (1999) analysed the importance of creative activity, contrasting it to routine activity, and notes the important shift brought about by computerization in the balance towards creative activity. He focused on problems and prospects of creativity and creative activity in conditions of rapid development and pervasive implementation of information technology in various spheres of human activity.

Tikhomirov, (1999) posits that the delegation of certain human functions to computers presents the theory of activity with new problems. What is the nature of the activity performed by humans in the context of advanced computerization? How does human activity change when humans use computers? Computer science constantly uses the notions of routine and creative. Focusing on creativity reveals a large gap between psychological studies of activity and psychological studies of creativity. Theories of activity and theories of creativity have developed as separate domains of inquiry. It offers a developmental view of the ways that conceptual frameworks and technologies, practical actions in the world, individuals, and social institutions shape and are shaped by one another in the learning process Wiske &

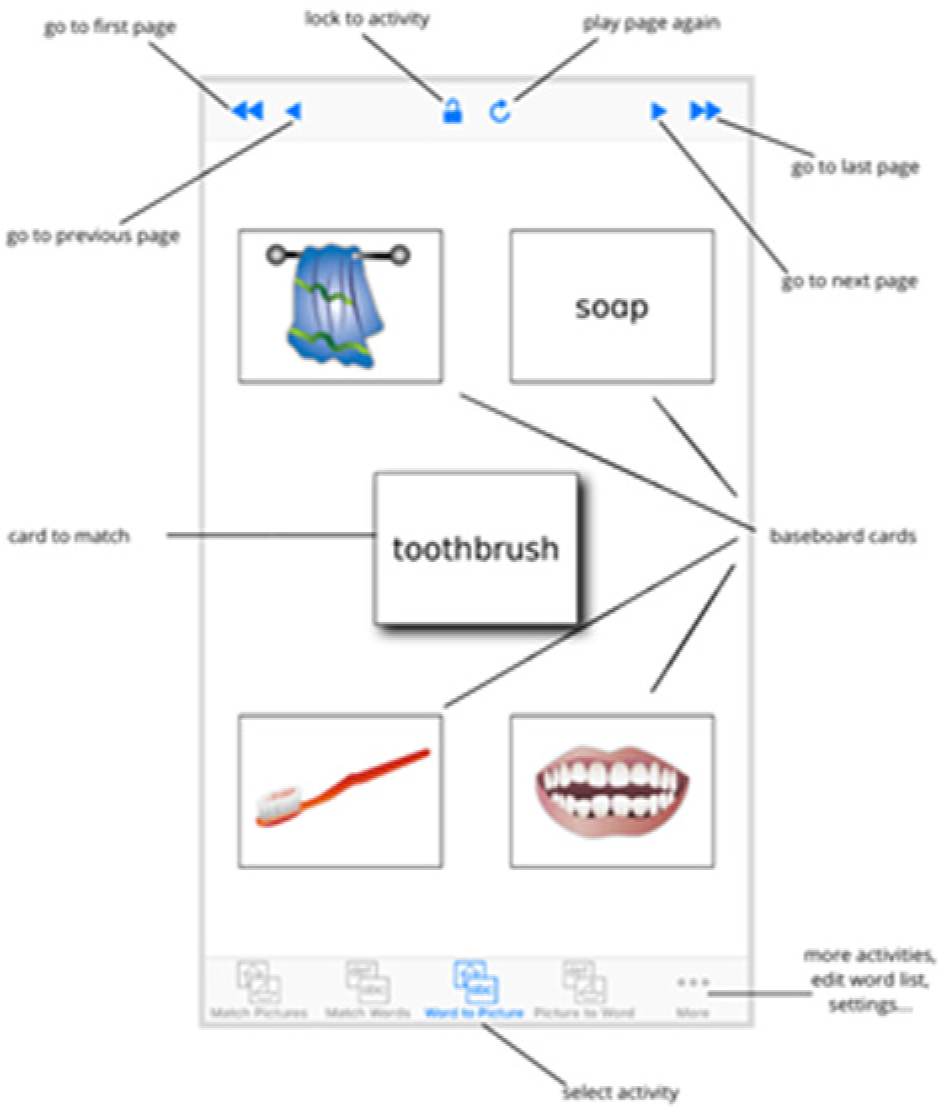
Spicer (2010). This makes it particularly suitable for analyzing the roles of the SENCOs and networked technologies. Furthermore, the study also has a relational perspective on education (Holmgren 2021), where a human is understood by its relations to the context (von Wright, 2002; Persson, 2008). With this view, analyses of both the education (e.g. pedagogy, instructions, individual adaptions etc.) and the physical learning environment (e.g. classroom settings, teaching materials, audio-visual conditions etc.) are important for understanding how and why special needs occur (Nilholm, 2007).

Having discussed the underlying conceptual theories, models and frameworks that support the use of technology-based educational tools, we now describe our Special iApps in the next section.

SPECIAL iAPPS

Special iApps is a non-profit social enterprise, developing learning apps for children with special educational needs (Paracha et al., 2023), including autism, Down syndrome, cerebral palsy, hearing impairment and other learning disabilities. These apps are specially designed to provide support to children with special educational needs, fostering language and communication development. Special iApps are used by schools, parents, health care professionals and therapists in more than 100 countries with 28 different languages supported. With Special iApps, users can effortlessly create personalised learning resources in minutes, making it easier for children to access the educational tools they need. The technology they create helps children learn at their own pace, its designed to build their confidence and independence. Their flagship apps ‘Special Stories’ and ‘Special Words’ focus on, not only developing skills for literacy and vocabulary, but they also allow children to build their fine motor skills and short-term memory. To help children, families and the support team around them, Special iApps have introduced Special Words Plus that promotes speech, language and communication through word-picture card and sound matching activities. It also includes matching pictures, written and real human voices, in 28 languages (see Figure 2).

Figure 2. Special words plus



Special Stories Plus allows us to create personalized social stories (see Figure 3). These apps can be used to teach and assess recognition of written and spoken words, to encourage speech and communication. They are also helpful in improving fine motor control, hand-eye coordination and attention skills. The app includes six activities: Match Pictures, Match Words, Word to Picture, Picture to Word, Sound to Picture and Sound to Word, offering alternative setup options for teachers and parents. Teachers or parents can personalize resources by adding their own words, pictures and audio, reordering and deleting words, and they can be easily synchronized to other devices. Match & Find is an interactive game to help develop memory, matching, searching, and sequencing skills. Six different activities are included, with their own settings so the app facilitator can adjust the level to suit the learner's ability. Teachers and therapists can use this app to help develop and/or test audio or visible memory by adjusting presets. Similarly, Special Numbers contains a set of activities to help develop early number skills, including counting, matching, ordering, comparing and selecting. This app has been designed in collaboration with parents, children, teachers and educational psychologists, and with reference to research into how children acquire mathematics skills.

The next section presents the step-by-step approach taken in this study vis-à-vis collection and analysis of data.

Figure 3. Special stories plus

METHODOLOGY

The research question: *"what do SENCOs perceive and expect from learning apps designed for children with severe intellectual disabilities?"* was explored using a qualitative approach with an inductive perspective. The critical steps at this stage are described below:

Step I

Samples in qualitative research tend to be small (Vasileiou, Barnett & Thorpe 2018) in order to support the depth of case-oriented analysis that is fundamental to this mode of inquiry (Sandelowski 1996). Additionally, qualitative samples are purposive, that is, selected by virtue of their capacity to provide richly-textured information, relevant to the phenomenon under investigation. Cresswell (2007) suggests that semi- structured/in-depth interviews require a minimum sample size of between 5 and 25. Morse (2000) argues that the more useable data are collected from each person, the fewer participants are needed. A purposive sample of ten SENCOs, who were familiar with Special iApps, were identified, and invitation emails were sent to them. Of the ten, six of those invited responded positively and four declined due to pandemic and pressure of work (see Table 3). All interviewees opted for online interviews via Teams. The interviews lasted from 30-45 minutes and included a brief demonstration of the current version of the Special iApps products.

Table 3. Demographic details of SENCOs

Participants	Sex	Average Age	Ethnicity	Education	Location
6	*3 male* *3 female*	*30 years old*	*White*	*Graduate*	*North East England*

Step II

Template Analysis (King & Brooks 2017) emphasizes the use of hierarchical coding and central to the technique is the development of a coding template, usually on the basis of a subset of the data, which is then applied to further data, and revised, refined and reapplied. The analysis began after all interviews were transcribed and uploaded to NVivo. The first step was to carefully read through the first set of responses and colour-code the data (using highlighters) for each participant. For example, if three participants shared that the students had difficulty using Special iApps, the researcher highlighted all similar statements with the same colour. The highlighted data were reviewed to ensure the research question is addressed. Unrelated data was set aside for later review and reconsideration. Sets of similar phrases were labelled to identify the patterns that emerged from the data. This step-by-step process was completed for each participant. Duplicate patterns were added to the categories and labelled novel statements as new patterns. Results of the pattern-development process yielded several themes discussed below. The themes were then reported with supporting patterns to elucidate the results. Although presented as a linear, step-by-step procedure, the research analysis was an iterative and reflexive process (Byrne 2022; Fereday & Muir-Cochrane 2006; King 2004). To maintain the overarching principle of "goodness" (Tobin & Begley 2004), this interactivity applied throughout the process of qualitative inquiry. In this study, the data collection and analysis processes were carried out simultaneously, and we reread the previous stages of the process before undertaking further analysis to ensure that the developing themes were grounded in the original data. Our objective for data collection was to represent the subjective viewpoint of SENCOs who shared their experiences and perceptions of Special iApps during interviews. Researchers coded data separately and then compared and combined their codes to evaluate their fit and usefulness. In the case of emerging different codes, the researchers, instead of dismissing the codes, scrutinized how differences among coders might generate new insights.

The following section reports the findings of our study based upon the information gathered as a result of the methodology we applied.

RESULTS

The research question: *"what do SENCOs perceive and expect from learning apps designed for children with severe intellectual disabilities?"* was explored using a qualitative approach with an inductive perspective. The interview data was collected using a semi-structured interview protocol and analysed through Template Analysis. The following broad themes emerged from the analysis, as discussed below:

Playfulness

SENCOs mentioned that *"children like Special iApps because they need something to play with, but they don't realize that they're learning even though they are." (KC) "They've got to be playful" (KF)*. However, some disagreed that merely the presence of animations and graphics does not add to anything if there is no meaningfulness in them. *"I think extraneous animations, sound effects, and tangential games might be appealing to kids when activated but do not add to their understanding of the primary content." (KR).* Some suggested that teachers and parents should take the time to play and become familiar with apps to ensure that they suit their goals for learning with that particular age range of their children.

Fun

SENCOs opined that *“education should be fun anywhere! I think keeping these applications as fun and simple make learning enjoyable for children with severe intellectual disabilities. If something's falling in simple to them, they enjoy it.” (KR)* Children like learning apps because they think they are entertaining and fun. SENCOs believed that fun is the major factor that attracts children to use learning apps: *“Yeah, they've got to be fun” (KF)“they want learning apps for fun. They'll sit and play with it all day long, but if it looks like it's hard work, they're just like not interested in that anymore. So definitely, fun is a major element for them, especially the ones who aren't working at the level that they should be at.” (TJ)* SENCOs opined that digital play should involve some degree of agency, enabling children to take on an active role and ownership in their experiences: *“you know, the colorful images are fun for them if they're able to access them the way they want to manipulate those images and boxes around the screen at their own free will.” (KC) “It's still good to use an app than a worksheet. It's still a novelty. I think that's one of the things they enjoy it. So, I think it's still fun.” (MA)*

Engagement

SENCOs believed that engagement is key to learning and when a child is not engaged in a learning environment, the probability of child learning gets very low. Special iApps provide such affordances: *“I've seen children engaged (interacting with the Special iApps) and I think it's more child friendly.” (KR)* The level of mental involvement for children increases when apps include symbolic systems that promote learning potential. SENCOs stated that Special iApps are engaging and quickly spark interest: “*The kids haven’t got sick of it which is a good sign I think. They’re still keen every time and even though there’s that break in the middle, it’s still a two hours’ session.” (MA)*

Interactivity & Accessibility

SENCOs expressed that the Special iApps are interactive and intuitive: *“children like learning apps, because they need something to interact independently.” (KR) “the level of accessibility would be the only other thing really that would hinder the use of it.” (KC) “allows to be accessible in so many more ways for children who struggle with mainstream ways of learning and in certain lessons.” (MA), “Just watching her interact with apps. It was enough of an assessment to say, OK, she can't access this part and she's actually forming the sentence perfectly.” (AA) “Definitely something quite being very interactive. Just thinking my two loved things* *that are interactive and like a sort of a story game type thing, that's what they're like." (KR). "It needs to be colorful and interactive, but it also needs to be able to be paired down to keep it simple." (TJ)*

Ease of Use

SENCOs indicated that children prefer simple and easy-to-use interfaces. *"Touch screen technology is useful as it allows children to move things around because again, for someone with a visually impaired child, it's hard to see the mouse, cursor on a screen and have to use the mouse to navigate around. So, touch screen is always used by our children as far as possible." (KC)* SENCOs also indicated that if an app is easy to set up for them, the easier it is for the children to use *"it's easier for the child because then we can set it. It's so easy to set up. It's then handed over. So, I think the easier it is for us, the easier it is for child." (MA)* "*It's got to be easy for me. So, I'm not spending 5 minutes with child sat next to me gotta go to that screen. Something that can be set up and ready to go as soon as I get into school." (KF) The touch screen technology is a lot easier for children as compared to moving a computer mouse for matching images and text." (TJ)*

Satisfaction

SENCOs emphasized that customization and personalization improve learner satisfaction: *"Special iApps makes things so much more accessible for so many different reasons. And I think constantly having the light background. If you got a vision impairment where you need that is really helpful, making font sizes larger, being able to change colour, backgrounds and font colors even." (KC)* SENCOs expressed that Special iApps are appealing because they are filled with curiosity, challenge, fantasy, and game play. *"I find children highly engaged if they're listening to something, watching something and actually participating in as well. So, there's a bit of everything in there. They like everything to be animated. They like it to be noisy, interactive, ready to poke around and figure something out." (KR)* SENCOs mentioned that tablets allow children to access a multitude of educational games, activities and more. *"So iPads are great! (AA)*

Personalized Learning

SENCOs pointed out that *"tailoring a lesson is for their wellbeing, especially for children actually feel like they've achieved something. I think Special iApps would actually work really well for them. And I think that would be nice for my students." (KR)* They also proposed some more options and choices that could be very useful e.g., animated introduction to letters, and more variety of vowels, numicon etc. *"That's the big thing, isn't it? That you've a variety of option to create lessons as you want in Special iApps and being able to change font sizes larger/small, colour, backgrounds and font colors even." (KC)* As curriculum aligned learning apps are difficult to find personalized learning options in Special iApps helps in tailoring a lesson in accordance with the curriculum. *"Obviously, we've got to teach to the curriculum. I think being able to tailor and app will be really good." (KF)*

Assessment

Tracking student progress over time is a daunting task for teachers, *"assessment is always hard, yeah. There's a traditional view of assessment, you know as well as digital, you know. It's all subjective on my part. It can't be objective." (KF) "Special iApps is a really valuable tool to put in with the other ways that we assess our children." (AA)* They wanted to link with curriculum and include Numicon: *"children really should be getting challenged a little bit more. So, I'm just thinking about your Special iApps as well as if you've got your tailored curriculum, you could be going in and checking to see what they're accessing and how they're getting on with it. And then obviously if they're not doing as much as they should be, you could be targeting them to do a little bit more." (KR)*

Active Problem-Solving

Our interviews with SENCOs indicated that Special iApps may be a useful resource for engaging children in active problem-solving activities e.g., *"Apps get their attention straight away. You know like you said William, he could work out what to do without being told which I think is a good skill to encourage." (AA)* Another teacher said: *"Problem Solving activities are perfect for kids on a rainy day, a long car ride, or a day off from school. (KC)*

Difficulty in Selecting Appropriate Apps

The choice of appropriate apps can be a difficult process for teachers and parents. SENCOs mentioned *"the reason is that little information on the quality of apps is available, beyond the star ratings published on retailers' web pages and reviewers' comments. Parents and educators do not know how the algorithms work but make decisions based on the projected number of downloads and ratings." (MA)* "*Often schools or parents choose an application if they find the activities enjoyable without worrying about the content of the apps." (TJ)*

Digital Divide

No participant mentioned that using digital apps was purposeless, however, they expressed the decision to use or not use these applications depended on the level of technological skills than on pedagogical knowledge in relation to SEN. For instance, *"on the wider school level, we've very limited influence on decisions about digital apps, and this causes obstacles for students in need of special support." (MA) "advising teachers how to use digital tools is something I do continuously, but I do not have that much knowledge nor received any professional training in it so, sometimes it is difficult to advise others." (KC)*

Evidence of Educational Claims

SENCOs also expressed that "*most of the top apps scored low, with free apps scoring even lower than their paid counterparts on some criteria." (AA) "Several top apps in the market have interactive yet repetitive game formats with content could not be extended by the learner. Such apps rely on low levels of thinking skills and often do little more than promote rote learning colours, numbers, shapes or letters." (KF)* However, as one teacher commented ''*it would be hard to prove that educational apps didn't have a learning benefit, after all you can learn by playing with a toy. (KR)*

Summary of Key Results

SENCOs stated that Special iApps offer playful ways to engage children with SID in learning, without them even realizing it. For instance, Special Word Plus takes a fun playful approach to learning English language. They mentioned that the exercises in Special Word Plus are interactive and engaging and helping children learn new words and phrases. SENCOs accepted that the apps are purposeful and educational. The learning process happens in the form of quick quizzes that test children vocabulary and comprehension skills. Children with SID have difficulties staying engaged while learning, Special Stories Plus offers an active, enjoyable, and engaging context attuned to their educational needs. The apps encourage the child to be in control. They also mentioned that tailoring lessons to each individual student's needs is a challenging task. With the aid of technology, a lesson plan is no longer a bitter medicine, but a template with plenty of room for individual variations allowing children to find their own learning path. Some informants expressed that they were not influential in the school's decisions about the selection of apps which is an interesting finding of this study.

DISCUSSION

Overall, the results showed that SENCOs had positive beliefs regarding and experiences with using digital apps in special education. Still, not being involved and influential in the school's decisions about digital technology was something that the informants expressed raises the question of why digital tools are used infrequently in special education, causing obstacles for children in need of special support. SENCOs involvement in school decisions about which digital apps to invest in would be beneficial from a disability inclusive education perspective. With the digitalization of school, the special education practice and the roles of SENCOs change (Holmgren 2022). The strategic SENCO is at the heart of school improvement. Effective leadership for SEN means ensuring that all staff have the digital competence they need to provide high quality teaching and learning opportunities for children with SID. In relation to this, some participants expressed that they lacked digital competence. Although they all at some point have expressed positive experiences using digital apps, they also talked about lacking digital competence, highlighting a feeling of low professional confidence in this space. Thus, a question for future researchers to investigate is how these shortcomings can be addressed.

Children with SID enjoy and learn through play, just as typically developing children do. Supporting and developing the playfulness of these children is important given their deficits in social and play abilities (Bross et al., 2008). Playfulness is understood as a quality of a child's play involving flexibility and spontaneity rather than the child's skill in performing specific play activities (Hamm 2006). Playfulness can be determined within any transaction by the presence of four elements, namely, intrinsic motivation, internal control, the freedom to suspend reality and framing. SENCOs we spoke expressed that Special iApps encourage these four elements. The results also confirmed that play-based learning allows children to participate in purposeful activities additionally, the findings highlights simplicity, fun and playfulness as the most important determinants of a good learning app. In other words, simplicity and fun spark engagement and interest in children with SID to learn in a way most suited to their needs. Furthermore, the study supports the view that play should involve some degree of agency, enabling children to take on an active role and ownership in their playful learning journey.

The participants expressed that majority of the apps fail to keep their promises to support learning in a purposeful, effective, and enjoyable way. This study indicates that a bulk of apps being marketed to children as 'educational' have no or little educational value for children with SID. The choice of appropriate apps can be a difficult process for teachers and parents as very little information on the quality of apps is available, beyond the star ratings published on retailers' web pages and reviewers' comments. The findings also extend previous special education research

(Holmgren 2022; Lin, Grudnoff & Hill 2022; Olakanmi et al., 2020; Anderson & Putman 2019; Roberts-Yates & Silvera-Tawil 2019) adding new understandings about special education in a digitalized school, especially regarding digital playful learning and how they are expected to develop this practice not only for special education but also teachers at large in digitalized schools. The discussions with SENCOs confirmed the long-term effects of Special iApps. SENCOs noticed that Special iApps have positively influenced their children's disruptive behaviour. After play, they are not becoming aggressive or annoying doing things that should not be done. The study has shown that the skills and behaviors acquired through Special iApps tend to persist over time, with children maintaining and building upon their gains even after the interaction is over.

After describing, analysing, and interpreting our findings, we list some recommendations on what actions to take based on our findings and discussion in the following section.

RECOMMENDATIONS

- The results indicate if, and how, the SENCO profession is affected by school's increasing level of digitalization i.e., indicating new or changed competences needed for working in special education sector. Thus, highlighting the need of how higher education can adapt to train SENCOs capable of working in a digitalized school. The results are also of interest for school management and special teacher educators as important actors in the process of digitalizing schools and education.
- The study emphasizes the need for educational researchers, educators and software companies to find a common framework for consultation, given the growing demand for SENCOs to integrate mobile technologies and apps into their teaching to assist children in meaningful learning.
- There a significant need for interdisciplinary and intersectoral research exploring the educational claims and potential of learning apps for children with SID. Such research needs to be broad, covering a wide range of users, from experts as in this study others including stakeholders, policy makers, parents and children.
- Greater innovations in the learning apps sector require increased collaborations amongst the mobile apps sector, SENCOs, academia and researchers. The mobile app sector needs to consider the design and production of content creation in constructive apps, in order to capitalize on the unique functionality and capabilities of the tablets.

- Children with SID may face psychological distress in writing and reading comprehension and math. This can be addressed by standardizing training methods and system adaptations as per children needs.
- Keeping such applications fun-filled with graphics, animations, sounds and music, make learning more enjoyable for children with complex needs. To help visually impaired children, the future apps should increase the thickness of outlines and simplify the drawings, remove colors, make it more like Makaton symbols or simple thick black outlines for the images.
- A critical issue for children with SID is assessment. Integrating AI plug-in and eye-tracking technology offers an effective approach to supporting parents, carers and teachers in creating tailored learning experiences based on assessing children's comprehension, attention and autonomy when engaging in numeracy, literacy and social skills learning.
- In the realm of education, ethical practices are paramount for ensuring the well-being and development of students. However, when it comes to children with SID, though, the needs are more unique and not always straight forward. SENCOs must prioritize their ethical decisions in the best interests of all the students (inclusion) involved while treating each as individuals. Furthermore, the ethical use of technology in special education involves ensuring that digital tools are accessible and appropriate for each student's needs while respecting students' privacy and data security. Lastly, SENCOs must employ fairness strategies that address the personal needs of their students. This may include tailoring instruction, assessments and support services to each student. Aside from this, SENCOs must also be educated on the ethics and equity of differentiated instruction for some students and not others.

In the following section, we present the limitations of the study and set our priorities for the future.

LIMITATIONS AND FUTURE DIRECTIONS

Although the present study provides exploratory insights into the special education practice vis-à-vis PDL in a digitalized school environment, yet the findings have to be seen in light of some limitations: Firstly, the study was conducted during the COVID-19 pandemic, which means that results could look different before and after this period. Secondly, the small number of participants limits the results' generalizability. Lastly, the SENCOs all worked in school years K-6, so there still is a lack of in-depth knowledge about the practice in school years K-12. In addition, the SENCOs in this study were interested in integrating the iPad/ learning apps into the classroom. Others may not be as willing or as interested in investing the time, energy, or commitment implementation of learning apps require. One of the main dilemmas in the development process is to establish ‘what to put in’ and ‘what to leave out’, and what is necessary for learning and what could distract from the learning process. These are important considerations that have direct implications for those who create educational apps and for those who choose them for a specific educational purpose (Somerton 2022).

Given this, we suggest that future studies can add game-based approaches (Honorato et al., 2024) and technologies such as VR and AR. The use of technological advancements such as virtual agents, artificial intelligence, virtual reality, and augmented reality undoubtedly provides a comfortable environment that promotes constant learning for children with SID (Valencia et al., 2019). Closer collaboration between developers and educators in the design and development process could negate some of the difficulties associated with producing genuine educational apps. We suggest that future studies involve other professionals in observing children using learning apps approaches. Incorporating diverse professionals into studies and interventions can enhance understanding of children with SID’s behaviour, thereby facilitating the development of effective approaches. We also suggest that future studies seek to go beyond conventional environments, proposing approaches that involve other types of environments. These studies and interventions can broaden the perspectives of children with SID, fostering greater engagement with their surroundings and potentially enhancing their social skills. As a result, more apps could be available that meet the educational needs of targeted populations or suitable across a range of contexts. This reinforces the importance of matching the user, the technology, and the activity (Edyburn, 2003; Odom et al., 2015; Somerton 2022) which are important considerations and can inform future research design.

CONCLUSION

This chapter has reported SENCOs’ views and perspectives of learning apps. The findings reveal how SENCOs perceive the educational effectiveness of Special iApps. SENCOs stated that Special iApps offer playful ways to engage children with SID in learning, without them even realizing it. The apps encourage the child to be in control. They also mentioned that tailoring lessons to each individual student’s needs is a challenging task. With the aid of technology, a lesson plan is no longer a bitter medicine, but a template with plenty of room for individual variations allowing children to find their own learning path. Still, not being involved and influential in the school’s decisions about the selection of appropriate learning apps, and lack of digital competence were something that the SENCOs highlighted, raise the question of why digital tools are not commonly used in special education, causing obstacles for children in need of special support. Therefore, a question for future researchers to investigate is how these shortcomings can be addressed. Currently, in a world that is so connected and where technology innovatively mediates across most aspects of life, there remains a lack of novel learning apps for children with SID, with real opportunities available for playful learning using connectivity, the IoTs and voice-enabled interaction. To achieve this and to provide children with SID in new ways to play and learn demands increased collaboration between HCI researchers, teachers, technology corporates and innovators.

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ADDITIONAL READING

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KEY TERMS AND DEFINITIONS

SENCOs: Acronym for Special Educational Needs Coordinators. SENCOs are teaching staff members responsible for overseeing and supporting special educational needs within a school, ensuring appropriate provisions and strategies are in place.

Children with Severe Intellectual Disabilities (SID): Individuals with neurodevelopmental deficits characterized by significant limitations in intellectual functioning, including challenges in intelligence, learning, and daily living skills necessary for independent living.

Educational or Learning Apps: Software applications designed to facilitate virtual teaching and learning for students, educators, and professionals, offering tools to enhance education, skill development, and knowledge acquisition.

Special iApps: Educational applications specifically developed for children with special educational needs, such as autism, Down syndrome, cerebral palsy, hearing impairments, and other learning disabilities. These apps aim to provide tailored and accessible learning experiences.