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Learning outcomes among the children with special needs through the use of constructivist approach and ICT Tools – A Review

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Abstract
The uses of ICT tools and constructivist approach among the children with special needs (CWSN) are becoming increasingly important. And for this, earlier work based on primary and secondary materials documented by various researchers are reviewed. From the study, it can be concluded that CWSN can execute the work successfully by using scaffolding, modeling and guided practices, problem solving, co-operative group learning, discussion and peer tutoring. Further, by using ICT tools, there is a positive impact in the academic performance too. Hence, it can be concluded that by using constructivist approach and ICT tools enhances the learning among the CWSN.

Keywords: ICT, Constructivist, learning outcomes, disability, reveal

Introduction
The uses of ICT tools and constructivist approach in education are becoming increasingly important and have brought profound changes. This has significant potential advantages for disabled learners in terms of increasing the accessibility of learning materials and techniques. ICT is identified as an enabler in the Convention on the Rights of Persons with Disabilities (2006), the first human rights treaty specifically addressing the rights and needs of persons with disabilities (Lord *et al*., 2012) [79]. According to the United Nation Department of Economic and Social Affairs Disability 182 countries have ratifications and 164 countries are signatories of that treaty. 15% or over a billion people in the world were identified as having a disability (World Health Organization, 2018). As per the 2011 Census of India, persons with disabilities comprise about 27 million people (2.21%) of the population. A report from the World Bank estimates the number of persons with disabilities in India is around 40-80 million individuals (The World Bank, 2007). Article 9 of the United Nation Convention on the Rights of Persons with Disabilities stresses that individuals have a right to participate fully in all aspects of life on an equal basis with others, with equal access to information and communication technologies (ICTs) and systems.
In the recent decade, the use of ICT tools and constructivist approach is important as it plays an essential role in supporting high quality education for learners with disabilities. The advantages of ICT and constructivist approach in the teaching and learning process enhances motivation for learning. For persons with disabilities, access to information and communications technologies (ICT) becomes a necessity and learns according to their abilities and needs. In discussing the efforts in curricular development and reform, National Curriculum Framework (2005) [91] emphasize the significance of making curriculum "an inclusive and meaningful experience for children" stating "this requires a fundamental change in how we think of learners and the process of learning." National Curriculum Framework (2005; 2009) [91] and RTE Act (2009) advocates that teachers should employ constructivist and critical pedagogy for translation of these guiding principles into reality in actual classroom situations. Attending to curriculum to define the classroom culture and the approach to the teaching learning processes is thus a significant aspect of teacher's work in fostering inclusivity in their work with students. It is a known fact that ICTs cannot solve all problems however educators should develop innovative teaching methods or to change and adopt the existing approaches to accommodate new concepts of special needs education and modern technologies. Activities instructed by the facilitators should be according to the individual needs and abilities. For this, ICTs must be fully integrated in special need education curricula.

The modified curriculum must preserve the skills or knowledge required for a particular course and distributes knowledge and training resources in a more creative way and on a more equal basis.

The aim of this study is to investigate how ICT tools and constructivist approach has an impact among the CWSN

1. To assess the level of response by CSWN as instructed by the facilitators in constructivist classes.
2. To assess the application and skill of different software and mobile apps.

There is a lack of empirical research on ICT among CSWN in a constructivist setting which will be beneficial to policy and decision makers. The importance of ICT in special needs education is a consequence of the many innovations that have occurred in the ways in which technology can support children with special needs.

Methods

Earlier researchers Steele, 2005 [111]; Snowman, *et al*., 2009 [122]; Rosenshine & Meister, 1994 [104]; Gersten *et al*., 2001 [110]; McMaster & Fuchs, 2002 [83]; Davis & Hopwood, 2002 [32]; Akpan & Beard 2016 [6]; Hattie, 2008 [55]; Patil & Pratibha, 2016 [103], reviewed on learning outcomes in constructivist classroom. Other researchers used different methods; Malmskog & McDonnell (1999) [82] used interview technique among the kindergartens students. Quantitative experiment and qualitative interviews were used by Loide *et al*., (2020). A number of researchers *viz*., Ali, 2008 [1]; Bender, 2012 [12]; Werner & Shpigelman, 2019 [137]; Hernández *et al*., 2020 [60]; Eaton & Wade, 2014 [38]; Chantry & Dunford, 2010 [24], reviewed on learning outcomes by using ICT tools among the children with intellectual, visual, hearing and motor disability. Allsopp *et al*., (2012) [5] collected data through classroom observations and use individual semi structured interviews, focus group interviews and field notes. Further, the data were analyzed using qualitative and descriptive methods. Guo *et al*., (2005) [49], use questionnaire method based on 5-point Likert-type scale. Feng *et al*., (2008) [43], analyzed the responses among the children with Down syndrome. Lazar *et al*., (2007) [72], used time diaries and recorded their frustrations using the Web among the blind. Bano & Qureshi (2017) [18] also used questionnaire among the students with visual impairment based on Likert scale. Ojok, (2018) [96] analyzed the data by using descriptive statistics (frequencies, mean, mode and standard deviation). Zhou, L., (2012) [139], analyzed the data by using correlation and multiple regression among the secondary school students having visual impairment and its significance were tested. Geist, (2014) [53], use tablets for shapes among 2-4 years based on short YouTube videos. Egaga *et al.*, (2015) [39], adopted a pretest and post-test among the control group for quasi-experimental research design on Economics Achievement Test (EAT). Analysis of covariance (ANCOVA) was used to analyze the null hypothesis and tested its significance. Chen & Yu (2019) [31], analyzed from multiple sources of data (pre and post-task interviews, stimulated recall interviews, pre and post-task surveys, reflective journals and pair talk). Hadjerrouit (2011) [58], used both quantitative and qualitative methods and frequencies were collected and analyzed. Karahasanović *et al*., (2012) [67] investigate user concerns regarding typical Web 2.0 applications such as blogs and SNSs as well as online participants. Noël & Robert, (2004) [90], used questionnaire tool. Wang, (2016) [134], investigate based on interview and analyzed the data using hierarchical linear regression. Fedewa & Houghton, (2017) [47], used collaborative writing process using Google Docs in the composition classroom based on anonymous invention, group annotated bibliographies, group agendas and project plans and also peer review. Experiment was conducted on children with Developmental Coordination Disorder (DCD) who have printing/handwriting difficulties Klein, *et al*., (2008) [65]. García *et al*., (2011) [51] used questionnaire to characterize the use of new technologies and assistive devices. Further experiment was also conducted on children with multiple disabilities on microswitch for accessing preferred environmental stimuli and a Voice Output Communication Aid (VOCA) Lancioni *et al*., (2011) [77]. Yamaç & Ulusoy, (2016) [138] use qualitative research techniques with the help of 6+1 Writing Traits Rubric and Story Elements Rating Scale and the scores were analyzed using Wilcoxon Signed Ranks Test. Hornof & Cavender (2005) [56] use 'EyeDraw' software program for controlling a computer with the eyes and writing software for children with severe motor impairments.

Review of literature

Learning outcomes among the CWSN through the use of constructivist approach

Teachers should increase their scaffolding if the learner fails to perform a task successfully whereas if it succeeds then the use of scaffolding should be reduce (Wood, 1991) [128]. Steele (2005) [111] reveals that special needs learner will benefit in constructivist model and also due to interactive settings (Snowman *et al*., 2009) [122]. Rees & Skimore (2008) [106] reveals that brain injury students could succeed at completing a task and facilitators should use fewer words, increasing wait time for compliance and physically showing the directions etc. Facilitators can help the students with neurological-based behavior to increase their participation in the classroom and enjoy the school environment (Watson, 2001) [130]. Some social constructivist gives work to the pupils through modeling and guided practice (Rosenshine & Meister, 1994) [104]. Caviglioli, (1999) [20] investigate on the use of 'mind-mapping' for Down syndrome kid which reveals positive response for understanding the stories. Swanson (2000) [110] use a combination of teaching strategies involving elements of 'direct instruction' and 'strategy instruction' which is more effective for children with learning disabilities whereas Gersten *et al*., (2001) [110] use explicit instruction with guided problem solving and discussion for transferring and generalization of learning with children of learning disabilities. (Lipsky & Gartner, 1996; Sebba & Sachdev, 1997) [69, 109]. Cooperative group learning produce positive outcomes for pupils in general but with learning disabilities is somewhat mixed and inconclusive (McMaster & Fuchs, 2002) [83]. Many studies were undertaken namely teaching young children with Down syndrome to read sight words (Buckley, 2000) [10], although further research on these reading comprehension is needed (Fletcher-Campbell, 2000) [41]. Participatory/active learning methods have positive impact on the child's social and behavioral development (Davis & Hopwood, 2002; Leybaert & Charlier, 1996; & Palmer (2000) [32, 70, 98] conclude that deaf children exposed to cued speech when used at home and school are more likely to use phonological coding. Deaf children's with proper social and emotional

development actively taking part in extra-curricular activities Willoughby & Badawi (1999) [98] reported that children with special needs were more likely to be engaged in play. Also, Malmskog & McDonnell (1999) [82] reported that increased adult involvement with in children with disabilities resulted in greater engagement in the physical and social environment. Akpan & Beard (2016) [6], state that constructivist approach is the best paradigm particularly students with special educational needs. Further, constructivist activities should provide scaffolding strategies for all learners along with students with special educational needs (Steele, 2005; Shi, 2013) [111]. Activities like summarizing, predicting, and using visuals have an impact on students with special needs (Hattie, 2008) [55]. Botha & Kourkoutas (2016) [17] studied constructivist perspective among the children with behavioral difficulties. Students in a constructivist inclusive education setting would benefit most from the best practices through peer tutoring and cooperative learning Hattie (2008) [55]. Activity based learning and curriculum adaptations for children with special needs in constructivism were investigated by Patil & Pratibha (2016) [103], further the researchers explore constructivism teaching in Jordanian inclusive basic school. One key finding was that the use of constructivist teaching was in low level. Overall score on use of Arabic language and mathematics was moderate/low in level. Constructivism has been seen as a necessity in special education (Cobb 1994) [19] and the integration of constructivism in mathematics learning were based on group work, active participation, problem-solving and critical thinking (Briede, 2016; Major & Mangope, 2012) [16, 85]. Therefore, constructivism is appropriate for conceptual framework for guiding the use of the AT in the study. A study that tested an AT application for learners with dyslexia used seven primary school students (Fälth & Svensson 2015) [46] and a study that tested mobile phone usability used 18 participants (Liu *et al*., 2010) [77]. Investigate on constructivism led AT on teaching and learning of mathematics achievement in Grade 3 learners among the deaf students. The results reveal that it had a positive effect on the multiplication and division achievement by the learners. Lenjani (2015) [80], reviewed on constructivist and behaviorist ideologies and their influence on learner with special needs. Gately (2007) [50], reveals that students with severe disabilities acquiring literacy skills through conventional teaching should also be reconsidered. It suggests that students with severe disabilities must reconcile the constructivist position and help students with severe disabilities to become literate.

Learning outcomes among the CWSN based on ICT tools

Vicente & Lopez (2010) [125] reported that ICT benefits disabilities to eliminate the barriers that hamper them from participating in many activities. Ali (2008) [1] reveals that disabilities can communicate with each other and learn through the ICT tools. Osman (2015) [95], support that ICT performs an important function among disabilities. Adam & Tatnall (2017) reveal that ICT improve learning disability students' attitude to learning and significant attainment in skills and academic knowledge. Research on the use of ICT with Special Needs Students has been undertaken by Florian & Hegarty 2004; Adam & Tatnall 2008b; 2010; 2012; 2014; Williams *et al*., 2006a, Blackmore *et al*., 2003, their studies found that the use of ICT has a positive impact on the students. The highest impact of ICT for individuals with disabilities leads to independent living, employment, education, and access to government services according to Broadband Commission for Digital Development, 2013. ICT is used in different ways to offer differentiated instructions and learning according to the learners readiness level (Bender 2012) [12]. Classroom access to regular ICT tools engage students with different learning needs and facilitate collaboration and group learning between peers with and without disabilities (Allsopp *et al*. (2012) [5]. Guo *et al*.. (2005) [49] found that significantly improved frequency and quality of social interaction was found among the disabled people, who have access to the Internet. ICT has become a tool for enhancing teaching and learning (Mnyanyi & Mbwette, 2009). Assistive devices and specialized computer software and hardware increase mobility, hearing, vision and communication capacities. With these they are able to enhance their abilities and hence able to live independently and participate in their societies (World Health Organization, 2014).

Intellectual disability

In their investigation among the children with intellectual disability (Jain *et al*., 2015) reveals that application of smart board technology shows significant improvement. Chadwick *et al*., (2016) reported that risks and benefits of using online were greater for people with intellectual disabilities compared with those without intellectual disabilities. According to Feng *et al*., (2008) [43], increase in number of young people with intellectual disabilities use Internet for learning. It is also observed that people with intellectual disabilities will gain from using the Internet but also at risk (Chadwick & Wesson, 2016). (Gutiérrez & Zaragoza, 2011), an experiment was conducted on intellectual disability to show their patterns of new technology (cell phones, Internet and television) use. Their studies are comparable to those of the general public but specific differences were found. Werner & Shpigelman (2019) [137], reported that internet access by persons with disabilities has increased. Benefits of ICTs for persons with intellectual disabilities are greater social interactions and access to information (Molin *et al*., 2015; Shpigelman, 2018) [120] and creativity (Chadwick *et al*., 2016). Mengual-Andrés *et al*., (2020), reviewed on intellectual disabilities focusing on usability and activities carried out online etc. Intellectual disabilities favored internet due to widespread use of computers and smart phones. (Van Dijk 2005; Borg *et al*., 2015, Chadwick *et al*., 2013) access to the Internet by Intellectual disabilities has increased among the researchers, (Jenaro *et al*., 2018; Harrysson *et al*., 2004; Molin & Sorbring, 2017). Sarasola *et al*., (2020) examine the impact of the ICT on the teaching and learning process on disabilities. Further, risks and benefit associated with internet by intellectual disabilities were reviewed by Chadwick, 2019. Hernández *et al*., (2020) [60] also reviewed intellectual disabilities on the use of ICT. According to Sauer *et al*. (2010), the effects of assistive technology among intellectual disabilities have a positive impact on accessibility and e-learning. Further, technology also helps people with intellectual disabilities in different areas (Dattilo *et al*., 2003; Davies *et al*., 2003a; Davies *et al*., 2003b; Davies *et al*., 2004). Vera *et al*., (2007) presented the use of 'Real Time' graphic applications for people with learning difficulties (attention, perception, memory, down syndrome and autism) which benefits the users and have the

chance to understand and control abstract concepts. Wilson *et al*., 2006, developed an adaptive computer game for intervention of dyscalculia by using numeral comparison task. The problem was introduced to adapt for every level of every individual. The results indicated that it is effective in the remediation of children having dyscalculia. Van der Molen *et al*., (2010) created the 'Odd Yellow' training, a computer-based working memory tool to train adolescents with mild to borderline intellectual disabilities and the results showed improvement of students' working memory. Dyslexic students who use ICT tools can improve their learning outcome by using adequate technology which can able to overcome the barriers (Fasting, 2008).

Visual disability

Blind can read using text-to-speech technology and deaf can communicate using chat programs while dictation software is used by people with difficulties in writing and communication (Fichten *et al*, 2009). Visual impaired students can access to study notes and handouts on the e Learning platform without the need of assistance (Seale, 2013). Eligi & Mwantimwa (2017), studied about the accessibility and usability of ICT facilities to facilitate learning among visually-impaired students and found that ICTs support innovative and independent learning, promote participatory and collaborative learning. Visually impaired students using the internet can access information and motivates them to use the internet at home for schoolwork (Waddell, 2000). However, for reading among the sighted people is holistic and hyper textual with the help of screen reader (Lazar *et al*., 2007) [72]. Relevance for visually impaired students using the internet (Waddell, 2000) and some software prototypes support graphical activity for the blind (Kamel & Landay, 2002). Raisamo *et al*., (2006) introduced a multimodal computer system to support children's conceptual learning which helps the child to explore the system by making suggestions and asking questions. Choi & Walker (2010) developed a software tool which allows users to take an image of a line graph with an optical input device (e.g. webcam) and then hear an auditory graph of the digitized graph image. The users understand the auditory output and help them create graphs easier and faster. Mobile enhances literacy among the female students followed by Laptop/Computer and web browsing respectively. Further, they use ICT more effectively for their digital literacy as compared to male students Bano & Qureshi (2017) [18]. Ojok, (2018) [96] investigated on visual impairment students where majority (70.4%) of the students connected to the internet via WIFI hotspots. 46% of the students were confident to produce text using a word processing program.. Potty, (2007) revealed that note takers account for 70% to 75% of the academic success of visual impairments students. Waqar *et al*., (2019) proposes innovative solutions where the visual impairment and people without visual impairment were engaged in collaborative writing. The users showed curiosity and can focus on the productive task instead of their disability. Hackett & Parmonto's (2006) examined six visually impaired computer users where six think-aloud assessments were conducted to compare access with the standard web display. The results showed that the visually impaired adults were more satisfied with transformed web site. Recent research shows that people with vision impairments using internet as the main means to access information and consider themselves as competent users (Van der Geest *et al*., 2014). Some blind students use dedicated electronic word processors for note taking in classes, producing files that saved electronically and transferred to a desktop or laptop (Presley & D'Andrea, 2009). Similarly, young people with vision impairments combine their use of assistive technologies with applications and portable devices (e.g. smart phones and tablets) for short and quick written messages (Scott, 2013). In addition to phone calls, video chats (e.g. Skype) and social media (e.g. Face book and Twitter) are tools that young people with vision impairments use regularly for communication (Kelly & Wolffe, 2012; Pfeiffer & Pinquart, 2013). It is argued that ICTs help students in enhancing their academic performance (Smith & Kelly, 2014). Zhou *et al*., (2012) [139] report improvements in the performance of high-school students with vision impairments who used the Internet to take comprehension, calculation and science tests. In another study, a group of students with disabilities, including some with vision impairments, reveals that ICTs supported their study and helped them to develop academic skills (Kim-Rupnow &Burgstahler, 2004). Fujiyoshi *et al*., (2010) introduced a testing system with a digital audio player for the blind users to take the National Center Test for university admission. This study showed that the audio tests results were almost similar to normal-print-format and braille-format tests in score. Choi & Walker (2010) developed the Digitizer Auditory Graph, which allows visually impaired users to take an image of a line graph by webcam and then hear an auditory graph of the digitized graph image. The results shows that the users are able to understand the auditory output while using the optical input helps them create graphs easier and faster. Haneefa & Syamili, 2014, found that a large majority of the visually impaired students are computer literates and frequently use screen readers in their mobile phones, internet and e-mail.

Hearing disability

There has been an impact on the use of computer software for children among the children receiving cochlear implants (Pisoni *et al*., 1999). By using Glaskalica app, a positive impact can be seen in phonological awareness in children with hearing impairment Konjevod *et al*., (2019). Nasiri *et al*., (2017) have developed a game by which children can learn words that they are expected to know by the age of seven. There is a positive correlation between the use of ICT and academic achievement of pupils (Egaga & Aderibigbe, 2015) [39] and a positive correlation between playing on tablet and self-esteem (Bahatheg, 2014). Use of ICT for hearing disability found that most of these students use chat applications like Face book, Messenger and face-to-face conversation apps (Lersilp & Lersilp, 2019). Chen *et al*., (2006) [21] created a computerized assessment tool which evaluates a student's pointing and selecting proficiency. They are designed to measure speed, accuracy and efficiency of each evaluation tasks. Chen *et al*., 2010 [23], developed MiCAT for pointing and selecting performance and has yielded positive results on a seven year old girl diagnosed with quadriplegia cerebral palsy. Research on the use of tablet and mobile devices on education and rehabilitation of children with a hearing impairment has shown positive results (Geist, 2014) [53]. Egaga *et al*., (2015) [39] investigate about the efficacy of ICT in enhancing learning outcomes of students with hearing impairment and the result showed that there is a significant effect of ICT on the participants' learning outcomes. Salaudeen (2015)

examined the people by providing them aid to learning capacities and hence increase their learning potential. Lasa (2010), investigate how ICT helps students in reading and writing with the help of hearing and seeing processes. According to Reitsma (2009) computer-based exercises for learning to read and spell by deaf children was developed and learning effects were determined. The results reveal that word spelling is the most effective for learning to read for deaf children and drawings are also more efficient. Liu *et al*., (2006) [71] investigate about the hard of hearing and whether wireless technology could enhance mathematics learning. The result showed that the highly interactive communication through the wireless network increased student participation in learning activities. Drigas *et al*., 2005 presented a Learning System designed for deaf people and the users evaluate the knowledge they have gained. Maiorana -Basas & Pagliaro, 2014, investigate the use of technology among adults who are deaf and hard of hearing which reveals that there is frequent use of smart phones and personal computers for text-based communication and web surfing.

Motor disability

Adam & Tatnall (2010) investigate the use ICT in the teaching of students with learning disabilities for acquisition of literacy and numeracy skills for enhancing learning outcomes. The use of ICTs in learning has shown positive effects on children's motor development (Strand & Nielsen, 2017). Using word processors improves basic writing skills such as graph recognition, directional left-to right writing and autonomous visual pursuit of the text line (Chiappe & González, 2014; Penuel, 2006). It is observed that improvement take place during the collaborative process the less experienced writers learned from the more advanced one (Chen & Yu, 2019; Hadjerrouit, 2011; Karahasanović *et al*., 2012; Noël & Robert, 2004; Wang, 2016) [31, 58, 67, 134, 90]. Students significantly improve their writing skills in terms of grammar, mechanics, writing style and referencing etc (Eaton & Wade, 2014; Fedewa & Houghton, 2017) [38, 47]. Adam & Tatnall, 2017 [7] ICT certainly does improve Learning disability students' attitude to learning and equips them with adequate skills. Chantry & Dunford (2010) [24], reported that computer assistive technologies can have positive impact on the participation of children with complex and multiple disabilities in education, communication and play activities. Hetzroni & Shrieber (2004) [94], investigated the use of a word processor for enhancing the academic outcomes of three students with writing disabilities. There are more spellings mistakes in paper and pencil as compared to computer equipped word processor. Klein *et al*., (2008) [65], there is an improvement in word processing skills using a keyboard for children with Developmental Coordination Disorder (DCD) who have printing/handwriting difficulties. Lancioni *et al*., (2009) [73], assessed the use of a voice-detecting sensor interfaced with a scanning keyboard emulator with extensive motor disabilities to write which show satisfactory results. Lidström *et al*., 2012 [78], compared the use of ICT technologies between who did and those who did not use a computer-based assistive technology device (ATD). The results showed that the most frequent computer users were students with physical disabilities, who used a computer based ATD daily. García *et al*., 2011) [51], determine the use of computers and assistive devices amongst children with cerebral palsy, the study revealed that more than half of the participants (17) regularly use a computer and 16 of them requiring some type of assistive device. Lancioni *et al*., 2011 [77], assessed the use of an optic sensor together with a scanning keyboard emulator among the pervasive motor disabilities to click keyboard and to write. The results showed that writing time per letter and words significantly improved. Yamaç & Ulusoy, 2016 [138], investigate the effects of digital storytelling in improving the writing skills which enhanced sentence fluency and writing quality. Hornof & Cavender (2005) [56] introduced 'EyeDraw' software program enables individuals with severe motor impairments to draw with their eyes and tested successfully on children and young adults with disabilities. Also, Tanaka *et al*., (2010) [122] designed a computer-based intervention consists of seven interactive computer games which aim at the specific face impairments associated with the condition of autism and reported positively tested on children diagnosed with ASD. Lange *et al*., (2009) [74] presented the effects of using an assistive software homophone tool on three groups of students with reading difficulties. The results indicated that there is improvement among the students' performance without any help. Gregor *et al*., (2003) [48] developed 'Seeword', a word processing environment which assist dyslexic computer users when producing and reading text where the students can able to read standard texts from a screen more accurately.

Discussion and Conclusion

From the above studies, it can be concluded that constructivist approaches plays an important role in learning outcome among the CWSN. It is observed that scaffolding, interactive settings, modeling and guided practice, direct and strategy instruction, problem solving and discussion, cooperative group learning, participatory/active learning, peer tutoring and activity based learning enhances the learner and perform a task successfully. Further, disability with brain injury disability, neurological-based behavior and Down syndrome reveals positive response however conventional teaching should also be reconsidered for severe disabilities. Constructivist approach is the best paradigm particularly students with special educational needs.

It is also observed that by using ICT tools there is a positive impact among the CWSN in learning outcomes. As a result it leads to independent living, employment, education and access to government services.

Among the children with having intellectual disability, using smart board technology shows significant improvement. However, by using internet it benefits them but also at risk. It is effective in the remediation of children having dyscalculia and dyslexic students. Children with visual disability can read using text to speech technology. Reading can be done with the help of screen reader and can draw graphical work, write text and take notes using a word processing program. They can understand the auditory output while using the optical input which helps them create graphs easier and faster. Hearing disability can communicate using chat programs while dictation software is used by people with difficulties in writing and communication. Glaskalica app can have positive impact in phonological awareness in children. There is positive correlation between the use of ICT and academic achievement of pupils and between playing on tablet and

self-esteem. MiCAT software is used for pointing and selecting performance and yielded positive results. Motor disability can use word processors improves basic writing skills such as graph recognition, directional left to right writing and autonomous visual pursuit of the text line. It improves in word processing skills using a keyboard for children with Developmental Coordination Disorder (DCD). Voice-detecting sensor interfaced with a scanning keyboard emulator helps extensive motor disabilities to write while computer is used regularly by cerebral palsy disability. Use of an optic sensor together with a scanning keyboard emulator and digital storytelling helps in writing skills. Eye Draw enables severe motor impairments to draw with their eyes. Further, interactive computer games have a positive impact on disability having autism. Seeword assist dyslexic users for reading standard texts. Learning among the students with intellectual, visual, hearing and motor disability shows significant impact of ICT on the participants learning outcomes.

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