

## Assistive Technology for Persons with Physical Disabilities: A Literature Review

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### Abstract

Physical disability is defined as a person who has a limb disability, either loss of function or lack of a limb in any part of the body, including the condition of an imperfect limb which will affect his ability. In improving the quality of life of individuals with physical disabilities, Assistive Technology (AT) is used as an aid and intervention. This literature review was carried out to empirically evaluate the impact of AT on individuals with physical disabilities and will systematically synthesize key findings and highlight limitations and directions for future research. Beside that, this research is important because of our focus on providing effective assistance to individuals with physical disabilities especially childrens in achieving their education and daily living. This study is a qualitative study that uses the literature review method. This methodology will systematically analyze previous studies to identify issues related to technology involved in the lives of individuals with physical disabilities. The findings of this study found that there are three main themes that are closely related to assistive technology for individuals with physical disabilities, namely (1) The use of technology tools by the physically disabled, (2) Skills in using assistive technology, and (3) Obstacles and problems in the use of assistive technology. Further research on the use of technology in teaching and learning sessions for children with physical disabilities can be done to improve the effectiveness of teaching and learning sessions at school.

**Keywords:** Physically Disability, Assistive Technology and Special Education Technology

### Introduction

Persons with Disabilities (PwD) are always exposed to obstacles in their daily lives. Disability describes a condition in which a person's function and ability were reduced when compared to a person with complete physical strength and their ability (Khalil et al., 2022). This refers to individual functions such as physical, sensory, cognitive, intellectual and mental health impairments. Disability can be present from birth or arise later. Those who face this situation are called Disabled or People with Disabilities (Krishnamoorthi et al., 2022).

The World Health Organization (WHO), defined disabilities as "a person who cannot fulfill all or part of his social life, as a normal individual, due to lack of physical or mental conditions" (Azman et al., 2014). Jabatan Kebajikan Masyarakat Malaysia (2023) defined a disabled person as a person with a long-term disability in terms of physical, mental, intellectual or sensory abilities when faced with various obstacles may not be able to fully and effectively engage in society. PwD can be divided into three categories : (a) Person with mental ability, (b) Person with emotional disability and need special attention, (c) Person with physical disability and need special attention including blindness or obstructed vision, deafness or difficulty hearing and any physical disability (Sanmargaraja & Wee, 2011; Abdul Munir et al., 2015).

Based on the definition above, it can be concluded that the disabled are individuals who have certain disabilities such as physical disabilities, vision and hearing problems. This has caused certain limitations that can prevent them from leading a normal life and need help from others in certain matters. Jabatan Kebajikan Masyarakat Malaysia (2016) has classified the disabled into seven main categories of disability, namely: (a) Hearing Impairment, (b) Visual Impairment, (c) Physical Disability, (d) Learning Disability, (e) ) Speech Disabilities, (f) Mental Disabilities, (g) Multiple Disabilities.

This literature review was carried out to empirically evaluate the impact of Assistive Technology on individuals with physical disabilities. The current review will systematically synthesize key findings and highlight limitations and directions for future research. Beside that, this research is important because of our focus on providing effective assistance to individuals with physical disabilities especially childrens in achieving their education and daily living. The use of AT will also increase the individual's learning level and guarantee a balanced development like other typical individuals. The assistive technology must give positive effects and can improve the quality of life for individuals with physical disabilities. In addition, AT also should be affordable, reliable, maintainable and of sufficient design quality that the AT device will enable the intended assistance.

## **Background Study**

### **Assistive Technology in Special Education**

Assistive technology refers to equipment, devices and apparatus, and services, systems, processes and adaptations made to the environment that support and facilitate their functions, used by people with special educational needs (Erdem, 2017). UNESCO (2006) defined assistive technology as a term that refers to the availability of assistive devices and adaptations to help people with disabilities; equipment products that improve, improve and maintain the functional abilities of people with disabilities. IDEA (2004) which states that assistive technology is defined as "any item, equipment or product system, whether commercially acquired, modified or adapted, that used to increase, maintain, or improve the functional ability of an individual with less ability.

Technology is referred to as a method or approach used to solve any problem and can be seen with several approaches such as changing the way an individual learns, the method of obtaining information and adjusting the information obtained (Najihuddin et al., 2016; Azman et al., 2021). Assistive technology refers to any product, device or tool, which is

commercially acquired, modified or adapted to maintain, improve the functional ability of an individual with a disability (Mustaffar & Azah, 2017).

Assistive technology aims to add functionality for disabled individuals to increase their ability to perform daily life activities and interact with their environment. Technology enables us to provide fair learning opportunities to students of various abilities. Technology also could help create an equal opportunity and access for learning and access to the curriculum for all (Collinger et al., 2013). Chaurasia & Singh (2022) stated that assistive technology could help people with disabilities meet their needs quickly and effectively. Many organizations have defined assistive technology such as (1) The American Library Association (ALA) defines assistive technology as computer-based technology used to make it compatible with certain types of people, such as the disabled and enhance their potential. (2) The World Wide Web Consortium (W3C) sees assistive technology as programming or equipment specifically intended to help people with disabilities perform daily activities.

There are two types of technology that are often associated with special education, (a) assistive technology and (b) instructional technology. Assistive technology is technology that helps the physical needs of students with special needs such as hearing aids and wheelchairs while teaching technology helps students in learning such as braille machines (Altan, 2013; Nur'alia & Norshidah, 2022). All students including those with disabilities resulting in motor limitations, visual impairments, limited verbal speech, or severe cognitive delays have a legal right to access the general curriculum (Pugach & Warger, 2001; Coleman et al., 2015). In 1997, the act introduced by IDEA (*Individuals with Disabilities Education Act*) and now known as *the Individuals with Disabilities Education Improvement Act* (2004) requires each individual education plan (IEP) to state whether students need assistive technology devices to maximize the accessibility of education in the classroom (Coleman et al., 2015).

Special education teachers should have technological knowledge to help students learn the lessons effectively. Technological knowledge is knowledge of various technologies from simple technologies to complex technologies such as the internet, digital video, computer program software and many more (Mishra & Koehler, 2009; Nur'alia & Norshidah, 2022). Therefore, the achievement of a successful curriculum requires special education teachers to be more knowledgeable and skilled in using adaptation and the use of technology in the delivery of teaching and learning academic subjects. The addition of personal support, adaptation and accommodation, modification and assistive technology is required to provide curriculum access assistance to students with disabilities (Coleman et al., 2015). Computers are used as an aid technology to students and helps in aspects of difficulty in spelling, reading and writing (Borgestig, 2013).

### **Assistive technology for persons with physical disabilities**

People with physical disabilities were referred to as individuals with deficiencies in aspects of motor skills, lack of vision and hearing disabilities (Puschmann et al., 2019). As a step to realize the goals of the UN Convention on the Rights of Persons with Disabilities (UNCRPD), WHO has coordinated the Global Cooperation on Assistive Technology (GATE) to increase access to high-quality affordable assistive technology for people with disabilities worldwide (Kirstin van Dam et al., 2023). Assistive technology has great potential to help people with disabilities live

independently and to participate in social activities as well as to promote well-being (Gentry, 2009; Kirstin van Dam et al., 2023)

Brose et al (2010) describe how robotic systems enable people with physical disabilities such as neuromuscular diseases to eat, prepare meals, brush teeth, shave, dress themselves, open cabinet doors, load the dishwasher and take things in their daily life environment. In addition, assistive technology used in rehabilitation to increase strength and balance limitations such as exoskeletons is an interesting topic in the motor rehabilitation of physically disabled people (Wang et al., 2022). The use of computers in schools can be improved for students with physical disabilities and collaboratively created computer-based strategies can be implemented by teachers in learning and teaching in schools. Teachers, therapists and students should have the necessary expertise if they want to make computer integration as an assistive technology in schools successful (Borgestig et al., 2013).

Tam et al (2007) in a study related to the use of movement-to-music (MTM) computer technology on children with physical disabilities showed that these children can participate in play activities as playmates with their peers, parents and their family members. In some cases, these physically disabled children also take on the role of leaders when they play together. Van Den Heuvel et al (2017) in robots supporting games for children with physical disabilities shows that the existing IROMEC game scenario has the potential to support games for children with severe physical disabilities, especially in the functional domains of movement, learning and knowledge application, communication/interaction and interpersonal relationships and play.

The results of this study can be used to further develop meaningful robotic play interventions for children with severe physical disabilities. Van Den Heuvel et al. (2020) also conducted a study related to the contribution of the ZORA robot in achieving therapeutic and educational goals in rehabilitation and special education for children with severe physical disabilities and found that the use of ZORA-based interventions made a significant contribution in the domain of movement skills and communication skills.

Low-tech assistive technology can be used to help children with physical disabilities. Coleman and Cramer (2015) stated that assistive technology from the position of limbs can also increase access to art activities for students with gross motor and fine motor limitations. A simple change of position such as using a rolled towel to lift the student's arm can help fine motor movements become easier to perform. One example of a change in position is the use of a slant board. Changing the tilt of the surface by a few inches can move the student's hand into a better position to make it easier for the student to draw or color.

### **Research Methodology**

This study is a qualitative study using the literature review method. This methodology will systematically analyze previous studies to identify issues related to technology involved in the lives of individuals with physical disabilities. This study applies the literature review method including the background, problems, methodology and definition of the study. Each selected literature will be organized based on themes related to the research topic. Keywords *technology*, *assistive technology*, *physical disability* and *special education technology* have

been used to obtain research data. The article search was done using *Scopus*, *Web of Science (WoS)*, *Google Scholar* and *Researchgate* databases.

The search results have found that there are 56 articles using the keywords that have been set. However, further evaluation and detailing was carried out on the 56 articles and the study found that there are only 20 articles that will be used for this research. The following is a table for articles based on journals.

Table 2  
*Articles based on journals*

Database	Total articles
Scopus	2
Web of Science (WoS)	4
Google Scholar	6
Researchgate	8

This literature review based on *Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)*. According to Moher et al (2016) the PRISMA protocol has the potential to improve the conduct of systematic reviews by assisting researchers in establishing a priority research roadmaps, as suggested by the initial reporting proposal. According to Nur Khaleeda et al (2023) there are four phases of the flow diagram and 27 items of the checklist in the PRISMA proposal that contains criteria for identification, screening, eligibility, and accompanying reports related to the scope of the review.

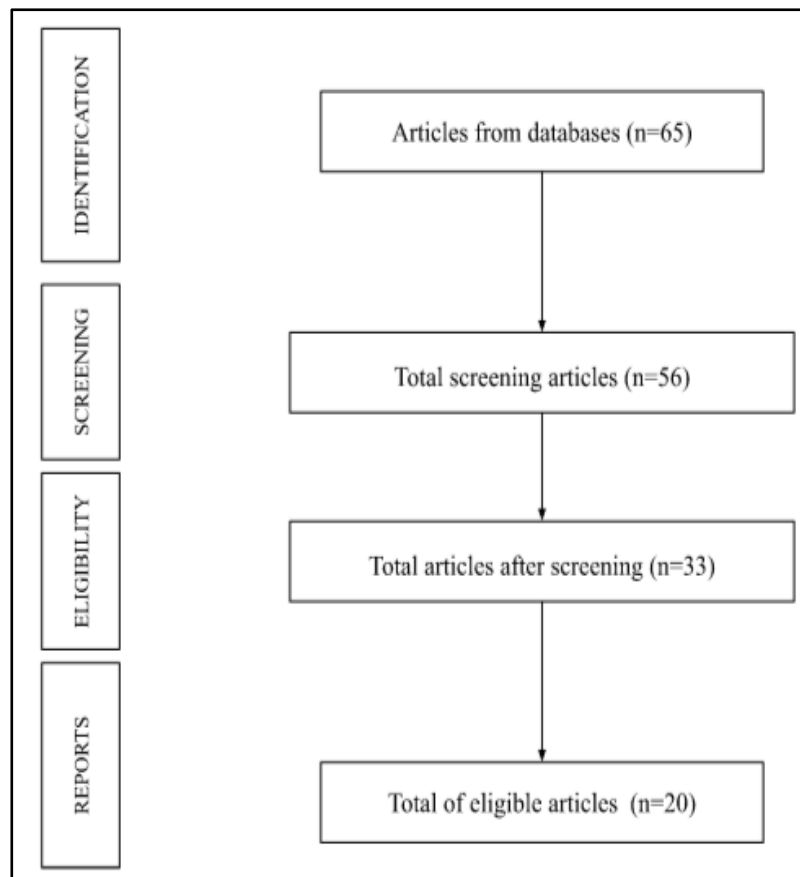


Figure 1. PRISMA flow chart

Figure 1 above shows the selection process of this research article goes through four stages based on PRISMA recommendations. In the first stage, which is the identification stage, articles are collected based on title searches and have not been read in depth. The total number of articles found in the first stage is 56 articles. In the second stage, which is the screening stage, the results of the article search performed in the first stage are classified according to suitability. In the third stage, which is the qualification stage, a detailed reading is done to ensure that the selection of articles used in this study is suitable and meets the study title, which is then accompanied by a report related to the study title.

### Literature Review

A total of 20 articles have been identified as related to technology for individuals with physical disabilities. The findings obtained have been systematically summarized as Table 3 and Table 4 below.

Table 3

*Articles and study findings*

No	Articles	Findings	Journal
1.	The Cybathlon promotes the development of assistive technology for people with physical disabilities	<p>Individuals with physical disabilities compete with each other to perform tasks in daily life by using technological assistance including robotics.</p> <p>The Cybathlon aims for the development of technology that can help individuals with physical disabilities that are easily available around the world.</p>	Journal of NeuroEngineering and Rehabilitation (2016)
2.	Scenarios of robot-assisted play for children with cognitive and physical disabilities	<p>Children use robots as intermediaries to make simple movements or sequences of simple movements or other actions in pretend play.</p> <p>This article describes play scenarios in five key developmental areas (i.e. sensory development, communication and interaction, cognitive development, motor development and social and emotional development).</p>	Interaction Studies 13:2 (2012)
3.	Art Educators' Use of Adaptations, Assistive Technology and Special Education Supports for Students with Physical, Visual, Severe and Multiple Disabilities	<p>The findings of the study found that there is no relationship between teaching experience and the number of students with disabilities with the frequency of use of assistive technology.</p> <p>Teacher training in Special Education needs to incorporate the use of AT in the classroom to increase the effectiveness of teaching in the classroom.</p>	Journal of Developmental Physical Disabilities (2015)
4.	Assistive technology: Impact on education, employment, and independence of individuals with physical disabilities	Lack of or inaccessible assistive technology (especially information technology) is one of the main obstacles in higher education institutions for individuals with physical disabilities.	Journal of Vocational Rehabilitation 30 (2009)

5.	Communicative Interaction with and without Eye-Gaze Technology between Children and Youths with Complex Needs and Their Communication Partners	<p>The use of Eye-Gaze Assistive Technology (EGAT) provides opportunities for children with physical and speech disabilities to communicate by using their eyes to control the computer interface.</p> <p>The use of EGAT shows the potential to support the communication process among the children involved.</p>	International Journal of Environmental Research and Public Health (2021)
6.	Improving computer usage for students with physical disabilities through a collaborative approach: A pilot study	The use of AT intervention shows a positive effect on the frequency of computer use among students. Support to teachers also needs to be given to improve teachers' skills in guiding students.	Scandinavian Journal of Occupational Therapy. (2013)
7.	Movement-to-music computer technology: developmental play experience for children with severe physical disabilities.	The results of this study support the use of MTM (Music to movement) technology for children with severe physical disabilities to play while developing critical personal, social and cognitive skills.	Journal of Occupational Therapy International (2007)
8.	ICT based technology to support play for children with severe physical disabilities	<p>There are several options that have great potential in helping children with physical disabilities in play activities. Due to constraints such as the level of awareness, the function of technology in helping children is limited.</p> <p>In addition to the use of technology such as robots to play, their use can also be used to achieve learning goals.</p>	Journal of Vocational Rehabilitation (2009)
9.	Robots supporting play for children with physical disabilities: Exploring the potential of IROMECS (Interactive Robotic Social Mediators as Companions)	<p>Using IROMECS robots in rehabilitation and special education for children with severe physical disabilities</p> <p>IROMECS games have the potential to support games in the functional domains of movement, learning and knowledge application,</p>	Journal of Technology and Disability (2017)



		communication/interaction and interpersonal relationships, and play.	
10.	A Systematic Review of Behavioral Intervention Technologies for Youth With Chronic Health Conditions and Physical and Intellectual Disabilities: Implications for Adolescents and Young Adults With Spina Bifida.	Behavioral Intervention technologies (BITs) become a delivery mechanism to overcome the problems of various specific conditions and access barriers for self-management interventions for adolescents and adults with spina bifida (AYA-SB).  Most of the BITs evaluated resulted in acceptable use and maintained or improved target symptoms.	Journal of Pediatric Psychology (2019)
11.	Creating Meaningful Art Experiences with Assistive Technology for Students with Physical, Visual, Severe, and Multiple Disabilities	AT is used to increase access to art activities (gross motor skills) and for students with fine motor limitations.  Can use larger or softer handles for pencils, paint brushes, markers, crayons and clay tools that can be made with simpler materials.	Art Education (2015)
12.	Eye-gaze control technology for children, adolescents and adults with cerebral palsy with significant physical disability: Findings from a systematic review.	Eye gaze control technology to facilitate communication for people with cerebral palsy and significant physical disabilities.  This technology is used to access laptops, tablets or computers.	Developmental neurorehabilitation (2018)
13.	Implementation of AI-Based assistive technologies for learners with physical disabilities in areas of innovation and special schools: a practical design thinking approach	To understand with the target group to enable accurate identification, evaluation and selection of appropriate AI-AT.  The results show an increased interest in the application and use of machine learning algorithms and	African Journal of Science, Technology and Social Sciences (2022)

		learning techniques in the creation of Assistive Technology solutions.	
14.	Robot ZORA in rehabilitation and special education for children with severe physical disabilities: a pilot study	<p>ZORA is a robot with seven senses to help interact : move, feel, hear, speak, see, connect and think.</p> <p>ZORA-based interventions have potential in rehabilitation in special education for children with severe physical disabilities. The domains that show the most effects are motor, communication and cognitive.</p>	International Journal of Rehabilitation Research (2017)
15.	Young Children With Physical Disabilities Caregiver Perspectives About Assistive Technology	<p>A study related to the problematic activities of children with physical disabilities and the types of assistive technology used as a solution.</p> <p>Findings show the importance of using assistive technology interventions for children with physical disabilities and ensuring that early intervention providers are knowledgeable to train caregivers so that their children have maximum opportunities.</p>	Infants & Young Children (2010)
16.	ZORA Robot Based Interventions to Achieve Therapeutic and Educational Goals in Children with Severe Physical Disabilities	The data collected using IPPA during the ZORA-based intervention showed that the greatest contribution of the ZORA robot lies in the domains of movement skills and communication skills. Overall, ZORA can contribute positively to the achievement of individual goals for children with severe physical disabilities.	International Journal of Social Robotics (2022)
17.	Successful Implementation of Assistive Technology to Promote Access to Curriculum and Instruction for Students with Physical Disabilities	This study discusses some of the issues that hinder the effective implementation of assistive technology for students with physical disabilities and provides a checklist that teachers and related service personnel can use when considering	Physical Disabilities: Education and Related Services (2011)

		<p>assistive technology for curriculum access.</p> <p>Evaluation; exercise; appropriate timing and consistency of implementation; psychosocial, cultural and environmental factors; and motivation and effort can affect the use of assistive technology by students with physical disabilities.</p>	
18.	Exploring Environmental Factors Affecting Assistive Technology Strategies in Mathematics Learning for Students with Physical Disabilities.	<p>Hands-on manipulation promotes active learning in understanding early math concepts. Students with disabilities may have the opportunity to participate in active learning through assistive technology (AT).</p> <p>The use of AT strategies may depend on the objectives that rehabilitation staff and teachers want to achieve while carrying out the task. For example, robots can be used to adapt tasks according to the needs and abilities of students. On the other hand, computer programs can be considered if time and ease of use are appropriate.</p>	Disability and Rehabilitation: Assistive Technology, 1-12. (2022)
19.	The Contribution Of Nintendo Wii In Children's Motricity	The Nintendo Wii contributed significantly to the increase in children's Motricity's Index. The use of Nintendo Wii also increases the spirit of cooperation, healthy competition in children.	International Symposium on Computers in Education (SIIE) (2018)
20.	High-Intensity Interval Training To Improve Fitness In Children With Cerebral Palsy	Aerobic exercise capacity increased by 10% after 24 HIIT sessions in children with cerebral palsy. In addition, the quality of life improved after the exercise training period, according to the parents of the children involved. Children with Gross Motor Function Classification System levels III and IV can walk on a treadmill using a support system.	BMJ open sports & exercise medicine (2016)

Table 4

*Analysis of article themes*

No	Articles	Theme		
		Theme 1	Theme 2	Theme 3
1.	The Cybathlon promotes the development of assistive technology for people with physical disabilities	/		
2.	Scenarios of robot-assisted play for children with cognitive and physical disabilities		/	
3.	Art Educators' Use of Adaptations, Assistive Technology and Special Education Supports for Students with Physical, Visual, Severe and Multiple Disabilities	/		
4.	Assistive technology: Impact on education, employment, and independence of individuals with physical disabilities	/		
5.	Communicative Interaction with and without Eye-Gaze Technology between Children and Youths with Complex Needs and Their Communication Partners	/		
6.	Improving computer usage for students with physical disabilities through a collaborative approach: A pilot study	/		
7.	Movement-to-music computer technology: developmental play experience for children with severe physical disabilities.		/	
8.	ICT based technology to support play for children with severe physical disabilities	/		
9.	Robots supporting play for children with physical disabilities: Exploring the potential of IROMEC (Interactive Robotic Social Mediators as Companions)	/		
10.	A Systematic Review of Behavioral Intervention Technologies for Youth With Chronic Health Conditions and Physical and Intellectual Disabilities: Implications for Adolescents and Young Adults With Spina Bifida.		/	
11.	Creating Meaningful Art Experiences with Assistive Technology for Students with Physical, Visual, Severe, and Multiple Disabilities		/	
12.	Eye-gaze control technology for children, adolescents and	/		

	adults with cerebral palsy with significant physical disability: Findings from a systematic review.			
13.	Implementation of AI-Based assistive technologies for learners with physical disabilities in areas of innovation and special schools: a practical design thinking approach			/
14.	Robot ZORA in rehabilitation and special education for children with severe physical disabilities: a pilot study	/		
15.	Young Children With Physical Disabilities Caregiver Perspectives About Assistive Technology			/
16.	ZORA Robot Based Interventions to Achieve Therapeutic and Educational Goals in Children with Severe Physical Disabilities	/		
17.	Successful Implementation of Assistive Technology to Promote Access to Curriculum and Instruction for Students with Physical Disabilities		/	
18.	Exploring Environmental Factors Affecting Assistive Technology Strategies in Mathematics Learning for Students with Physical Disabilities.		/	
19.	The Contribution Of Nintendo Wii In Children's Motricity	/		
20.	High-Intensity Interval Training To Improve Fitness In Children With Cerebral Palsy		/	

## Discussion

Table 3 shows the general information of the research articles included in this literature review and Table 4 shows the themes identified by the researcher in the articles obtained. The thematic analysis was conducted to answer the objectives of this study. As a result of theme analysis, three main themes related to the research title : (1) The use of technology tools by the physically disabled, (2) Skills in using assistive technology, and (3) Obstacles and problems in the use of assistive technology. Each of these themes is discussed below.

### Theme 1 : The use of technological tools by the persons with physical disabilities

This theme is the dominant discussion in most of the articles. The use of technology tools in helping children with physical disabilities has a lot of positive effects and can improve their quality of life. Gil et al (2018) state the use of Nintendo Wii can increase the level of an individual's ability in the Motricity Index assessment. The use of this technology tool can be applied in teaching and learning sessions. Gross motor and fine motor skills can also be improved through various other technological tools. The positive impact of the use of technology on individuals with physical disabilities can be read from research conducted by (Van Den Heuvel et al., 2017 & 2020; Karlsson et al., 2018; Stumbo et al., 2009).

The positive improvement in gross motor and fine motor skills among individuals with physical disabilities shows that the use of technology tools is very helpful in their daily lives. This statement is supported by Kronreif et al (2005); Van Den Heuvel et al (2017) regarding LEGO Mindstorms and the PlayROB system. The LEGO Mindstorms game was found to be an excellent tool to facilitate play and learning activities for children with physical disabilities and the PlayROB system successfully increased opportunities to play with LEGO for children with physical disabilities. Improving gross motor and fine motor skills can also help children with physical disabilities learn optimally. Learning objectives can also be achieved effectively and further increase the level of self-confidence of children with physical disabilities. This statement is also in line with Loesl (2012); Coleman and Cramer (2015) who argue that art in school provides excellent opportunities for students to improve fine motor skills, practice various methods of mastery, and strengthen the ability to solve problems. This showed that the use of technology can help the physically disabled to perform physical activities better and perfectly in their daily lives.

**Theme 2 : Skills in using assistive technology**

Applying assistive technology to individuals with physical disabilities, skills in handling technology are very important. Skills in operating assistive technology play an important role in improving the effectiveness of assistive technology (Robins et al., 2012; Coleman, 2011). Without good skills in handling assistive technology, the objective of using such technology is unachieved and can't be used fully and optimally. The skill of operating this assistive technology includes aspects of the appropriateness of the assistive technology used and the duration of the use of the assistive technology. The suitability of assistive technology is based on the level of individual ability and the final objective after the use of assistive technology. According to Coleman et al (2015) access to assistive technology does not always guarantee an increase in learning because children with disabilities have various limitations of their ability depending on their ability to master the skills and use the assistive technology.

Before using assistive technology for individuals with physical disabilities, objectives should be set so that the use of assistive technology has a goal (Tam et al., 2007). The suitability of the use of assistive technology can also ensure that individuals with physical disabilities can use the technology. The time period of use of assistive technology also plays a role in ensuring the success and achievement of the goals of using the technology. The consistent use of assistive technology will increase the effectiveness and subsequently be able to achieve the goals of the technology (Lauglo et al., 2016). The consistent use of HIIT technology can increase the stamina level of children with Cerebral Palsy. Their ability level can also be increased slightly as a result of continuous HIIT technology training. Therefore, this finding proves that the skill of disabled children using assistive technology is very important to ensure that their ability can be improved when performing physical activities in daily life.

**Theme 3: Obstacles and problems using assistive technology**

Severe motor disorders in children or adolescents with complex needs require help from communication partners to provide eye-gaze controlled computers and adjust the content of Augmentative and alternative communication (AAC) to meet their needs in the aspect of communication (Borgestig, 2017). In addition, these children may take longer to operate the computer compared to using gestures or vocalizations, especially when they are

new users. Inadequate eye control skills in the early stages of learning and cognitive demands may cause children to tire easily which may reduce the efficiency of using EGAT over time. Until present, the time used to use EGAT is too low to allow children to reach their full communication potential (Hsieh et al., 2021).

Barriers commonly reported in descriptive research regarding the use of computers as assistive technology in schools are: lack of knowledge and teacher training on how computers can be used effectively as assistive technology in the classroom for students with disabilities, lack of collaboration between teachers and therapists, and lack of time in school for collaboration and integration of assistive technology into educational tasks. These barriers need to be considered and overcome when designing interventions to increase the use of computers as assistive technology in mainstream schools (Borgestig, 2013).

### **Summary and Conclusion**

Physical disabilities can affect a child's learning environment. The limitations they face make it difficult for these children to learn in a conducive and optimal manner like other typical children. This will affect the children's acceptance of the knowledge and skills that are to be taught. The child's confidence level will also be low compared to other typical children. The use of technology in helping children with physical disabilities gives them the opportunity to improve their quality of life. The technological aid used in helping children with physical disabilities is widely used in daily life and in teaching and learning sessions. Daily routines such as communicating can also be helped using technology. In ensuring these technological aspirations, skills are required for individuals directly involved. Without sufficient skills, the objective of using this assistive technology for children with physical disabilities is not achieved holistically. Although there are some challenges in the use of assistive technology for children with physical disabilities, the use of assistive technology should be implemented consistently and regularly. Consistent and orderly implementation will increase the effectiveness of using technology to help children with physical disabilities.

### **References**

- Altan, T. (2013). The quest of TPACK in special education: The many faces of TPACK/special education teacher education. *Wikibooks, The Free Textbook Project*, 36, 90-98.
- Chaurasia, A., & Singh, A. P. (2022). Assistive Support Through Technologies for Persons with Disabilities in Libraries. *DESIDOC Journal of Library & Information Technology*, 42(2).
- Borgestig, M., Sandqvist, J., Ahlsten, G., Falkmer, T., & Hemmingsson, H. (2017). Gaze-based assistive technology in daily activities in children with severe physical impairments—An intervention study. *Developmental Neurorehabilitation*, 20(3), 129-141.
- Borgestig, M., Falkmer, T., & Hemmingsson, H. (2013). Improving computer usage for students with physical disabilities through a collaborative approach: A pilot study. *Scandinavian Journal of Occupational Therapy*, 20(6), 463-470.
- Brose, S. W., Weber, D. J., Salatin, B. A., Grindle, G. G., Wang, H., Vazquez, J. J., & Cooper, R. A. (2010). The role of assistive robotics in the lives of persons with disability. *American Journal of Physical Medicine & Rehabilitation*, 89(6), 509-521.
- Collinger, J. L., Boninger, M. L., Bruns, T. M., Curley, K., Wang, W., & Weber, D. J. (2013). Functional priorities, assistive technology, and brain-computer interfaces after spinal cord injury. *Journal of rehabilitation research and development*, 50(2), 145.

- Coleman, M. B. (2011). Successful implementation of assistive technology to promote access to curriculum and instruction for students with physical disabilities. *Physical Disabilities: Education and Related Services*, 30(2), 2-22.
- Coleman, M. B., Cramer, E. S., Park, Y., & Bell, S. M. (2015). Art educators' use of adaptations, assistive technology, and special education supports for students with physical, visual, severe and multiple disabilities. *Journal of Developmental and Physical Disabilities*, 27, 637-660.
- Coleman, M. B., & Cramer, E. S. (2015). Creating meaningful art experiences with assistive technology for students with physical, visual, severe, and multiple disabilities. *Art Education*, 68(2), 6-13.
- Erdem, R. (2017). Students with special educational needs and assistive technologies: A literature review. *Turkish Online Journal of Educational Technology-TOJET*, 16(1), 128-146.
- Gentry, T. (2009). Smart homes for people with neurological disability: State of the art. *NeuroRehabilitation*, 25(3), 209-217.
- Gil, H., Santos, T., & Honório, S. (2018). The Contribution of Nintendo Wii® in children's motricity. In *2018 International Symposium on Computers in Education (SIIE)* (pp. 1-5). IEEE.
- Hsieh, Y. H., Borgestig, M., Gopalarao, D., McGowan, J., Granlund, M., Hwang, A. W., & Hemmingsson, H. (2021). Communicative interaction with and without eye-gaze technology between children and youths with complex needs and their communication partners. *International journal of environmental research and public health*, 18(10), 5134.
- Individuals with Disabilities Education Act, 20 U.S.C. 1400 (2004; 1997; 1990).
- Jabatan Kebajikan Masyarakat. (2023). Definisi orang kurang upaya. Retrieved December 15, 2023, from <https://www.jkm.gov.my/jkm/index.php?r=portal/left&id=cCtGNGNKVE9obFhBRUI5RERPRjVoUT09>
- Karlsson, P., Allsop, A., Dee-Price, B. J., & Wallen, M. (2018). Eye-gaze control technology for children, adolescents and adults with cerebral palsy with significant physical disability: Findings from a systematic review. *Developmental neurorehabilitation*, 21(8), 497-505.
- Kirstin van Dam, Gielissen, M., Bles, R., Agnes van der Poel, & Boon, B. (2023) The impact of assistive living technology on perceived independence of people with a physical disability in executing daily activities: a systematic literature review. *Disability and Rehabilitation: Assistive Technology*, 1-10. DOI: 10.1080/17483107.2022.2162614
- Kronreif, G., Prazak, B., Mina, S., Kornfeld, M., Meindl, M., & Fürst, M. (2005). PlayROB- robot-assisted playing for children with severe physical disabilities. *Proceedings of the 2005 IEEE, 9th International Conference on Rehabilitation Robotics*. June 28 - July 1, 2005, Chicago, IL, USA.
- Krishnamoorthi, C., Shariff, A. A. M., Yahya, M. A., & Zairiasdi, M. M. A. (2022). Adakah Penyediaan Kemudahan Awam untuk Orang Kurang Upaya di Malaysia Mencukupi? Satu Tinjauan Sosio-Perundangan Ringkas: Does Provision of Public Facilities for the Disabled in Malaysia Sufficient? A Brief Socio-Legal Overview. *Journal of Muwafaqat*, 5(2), 73-84.
- Koehler, M., & Mishra, P. (2009). What is technological pedagogical content knowledge (TPACK)?. *Contemporary issues in technology and teacher education*, 9(1), 60-70.



- Lauglo, R., Vik, T., Lamvik, T., & Moholdt, T. (2016). High-intensity interval training to improve fitness in children with cerebral palsy. *BMJ Open Sport & Exercise Medication*, 2(1): e000111. DOI:10.1136/bmjsem-2016-000111
- Loesl, S. D. (2012). The adaptive art specialist: An integral part of a student's access to art. *The intersection of arts education and special education: Exemplary programs and approaches*, pp. 47-68. Washington, DC: The John F. Kennedy Center for the Performing Arts.
- Abd Majid, M., & Safran, N. A. A. (2017). Penggunaan teknologi bantu dalam pengajaran dan pembelajaran pendidikan khas. *Proceedings of International Conference on Special Education*, Volume 2. Retrieved from <https://publication.seameosen.edu.my/index.php/icse/article/view/165>
- Nawi, N. M., & Salleh, N. M. (2022). Pengetahuan dan Kemahiran Teknologi Guru Pendidikan Khas Integrasi Untuk Menjalankan Pengajaran dan Pembelajaran Dalam Talian. *Malaysian Journal of Social Sciences and Humanities (MJSSH)*, 7(5), e001494-e001494. <https://doi.org/10.47405/mjssh.v7i5.1494>
- Pugach, M. C., & Warger, C. L. (2001). Curriculum matters: Raising expectations for students with disabilities. *Remedial and Special Education*, 22(4), 194-213.
- Puschmann, S., Daeglau, M., Stropahl, M., Mirkovic, B., Rosemann, S., Thiel, C. M., & Debener, S. (2019). Hearing-impaired listeners show increased audiovisual benefit when listening to speech in noise. *Neuroimage*, 196, 261-268.
- Robins, B., Dautenhahn, K., Ferrari, E., Kronreif, G., Prazak-Aram, B., Marti, P., ... & Laudanna, E. (2012). Scenarios Of Robot-Assisted Play For Children With Cognitive And Physical Disabilities. *Interaction Studies*, 13(2), 189-234.
- Sanmargaraja, S., & Wee, S. T. (2011). Kajian penyediaan fasiliti orang kurang upaya (OKU) di institusi kerajaan di Nusajaya, Johor Bahru. *Persidangan Kebangsaan Geografi dan Alam Sekitar kali ke-3, Universiti Pendidikan Sultan Idris*.
- Stumbo, N. J., Martin, J. K., & Hedrick, B. N. (2009). Assistive technology: Impact on education, employment, and independence of individuals with physical disabilities. *Journal of Vocational Rehabilitation*, 30(2), 99-110.
- Tam, C., Schwellnus, H., Eaton, C., Hamdani, Y., Lamont, A., & Chau, T. (2007). Movement-to-music computer technology: a developmental play experience for children with severe physical disabilities. *Occupational therapy international*, 14(2), 99-112.
- Van Den Heuvel, R. J., Lexis, M. A., Janssens, R. M., Marti, P., & De Witte, L. P. (2017). Robots supporting play for children with physical disabilities: exploring the potential of IROMEC. *Technology and Disability*, 29(3), 109-120.
- Van den Heuvel, R., Lexis, M., & de Witte, L. (2015). ICT based technology to support play for children with severe physical disabilities. *Assistive Technology*, 573-577.
- Van den Heuvel, R. J., Lexis, M. A., & de Witte, L. P. (2017). Robot ZORA in rehabilitation and special education for children with severe physical disabilities: a pilot study. *International journal of rehabilitation research. Internationale Zeitschrift fur Rehabilitationsforschung. Revue internationale de recherches de readaptation*, 40(4), 353.
- Wang, T., Zhang, B., Liu, C., Liu, T., Han, Y., Wang, S., ... & Zhang, X. (2022). A Review on the Rehabilitation Exoskeletons for the Lower Limbs of the Elderly and the Disabled. *Electronics*, 11(3), 388.