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# A SYSTEMATIC ANALYSIS OF AI-EMPOWERED EDUCATIONAL TOOLS DEVELOPED IN INDIA FOR DISABLED PEOPLE

**Abstract.** Artificial Intelligence (AI) plays a multifaceted role in educating impaired people and has significantly enhanced the learning experience of disabled students. AI is emerging as an influential tool that enhances accessibility, personalizes the learning process, and promotes inclusivity in educating students with disabilities. For visually disabled students, AI-powered braille devices help the children learn and rehearse braille independently. AI can be incorporated into mobile applications and learning platforms invented to help dyslexic students in India. These apps provide many features to make learning fun for learners with disabilities. The Notebook platform utilizes Machine Learning algorithms that provide students with a personalized learning experience. AACDD makes the process of learning easy for children suffering from neuro-developmental disorders. Augmenta11y app utilizes AR (Augmented Reality) to display the content in a form that dyslexic children can easily understand. DYSXA app provides many features for making learning fun for learners with disabilities. Using automation and the latest technologies, Stamurai provides speech therapy to such people at a meager cost. The authors have analyzed and discussed more AI tools developed to help disabled students with education. With the use of these tools, children with disabilities can communicate better, receive an inclusive education, be more accessible, be mentally prepared, and lead independent lives. These tools have shown promising potential in supporting children with disability. It is observed that AI holds much potential to strengthen the learning experiences of disabled students by providing them with personalized support and alleviating the difficulties they face in reading, writing, and learning a language with accuracy.

**Keywords:** Artificial Intelligence; Platform; Tools; Assistive Technology; Learning disorders; Dyslexia.

## 1. INTRODUCTION

Artificial Intelligence (AI) has evolved as a revolutionary force in almost all spheres of our lives, including education. It has shown an enormous potential in providing support to the disabled students. Disabilities bring about significant challenges in getting access to education and achieving success in academics. However, AI tools and platforms provide new possibilities that help the disabled access inclusive education and personalize their experience in learning [1]. Impaired students face many challenges that hinder their academic progress and limit their access to learning opportunities. AI offers creative and innovative solutions for bridging these gaps [2]. Using AI-enabled tools, disabled students can be provided with tailored support and accessible learning materials. In India, learning disorders are a significant concern, which affects the learning process of individuals and significantly affects a person's educational

 

journey. Children suffering from cognitive disabilities find it challenging to acquire and demonstrate skills such as reading, writing, learning spelling, pronouncing words, and performing mathematical calculations. These problems can significantly impact their academic performance and overall educational outcomes. Learning disorders comprise dyslexia, which means problems in reading; Dysgraphia, which means problems in writing; dyscalculia, which means problems in mathematics; and many more [3]. In the past few years, considerable efforts have been made by India to promote comprehensive education for children suffering from learning disabilities. AI technology has the capability to revolutionize and transform learning experiences for students with disabilities and strengthen inclusivity on a broader scale. By incorporating AI technology, dyslexic students in India can be provided many benefits, including customized learning experiences, improved accessibility, and tailored interventions. It is essential to make sure that AI tools and platforms are invented in collaboration with professional academicians, therapists, and disabled experts so that the specific needs of dyslexic learners can be addressed effectively.

AI techniques have been increasingly utilized to enhance the lives of children with special needs [4]. The AI tools discussed in this paper use ML (machine learning) algorithms and the AR (augmented reality) approach that helps analyze the performance of disabled users to provide them with customized support, adaptive content, and individualized attention. This personalized approach strengthens participation and motivation; thus, better learning outcomes can be obtained. AI-powered assistive technologies provide disabled learners with real-time support, access to several features, and accommodations facilitating inclusive learning and customized experience. AI is reshaping the digital outlook at an unprecedented rate as a dynamic and transformative catalyst. AI has become a powerful driving force that is transforming the digital world day by day. This remarkable transformation is due to the continuous influx of several AI-powered startups being developed in India. The authors in this paper have analyzed and discussed various AI-based tools, including I-STEM, DAAD, Tactopus, and others developed in India.

**Analysis of recent research and publications.** The field of artificial intelligence (AI) has gained widespread recognition in several disciplines due to notable advancements in recent years. The revolutionary potential of AI and its ability to bring forth advances in various domains, including education, can be linked to its increasing pervasiveness. Artificial intelligence has significantly improved in developing novel tools that meet the requirements of people with disabilities and foster inclusion and availability. Due to the continuous advancements in AI, it holds the possibility to additionally reform assistive innovations and add to making a more comprehensive and open world for individuals with disabilities. A. Samim, in an article, highlighted the implications of AI for persons suffering from disabilities and concluded that the AI-based tools and platforms can assist the disabled people in numerous aspects of their lives, by providing them support, empowerment, and opportunities for growth. In the future, more innovative ways can be developed to handle the most complex problems disabled people face and enhance inclusivity [5]. M. Wald assisted all the persons involved in the domain of AI in understanding various difficulties faced by people with disabilities and finding out the connection betwixt personalization and classification based on the inclusivity of disabled and concluded that AI technology fulfills the requirements of both disabled and non-disabled people. They also identified the difficulties faced by AI technology in providing help to disabled people, including determining the critical content in the visual information and an automatic audio description of videos [6].

Ongoing research and development is engrossed in enhancing the already existing tools and finding novel applications to cater to the diverse needs of these people. Artificial Intelligence (AI) can be a game-changer for disabled people and can provide a unique advantage for incapacitated individuals by making it more straightforward to make intuitive devices that

help actual openness and freedom. P. D. Barua et al. reviewed the utilization of Artificial Intelligence (AI) technologies in assisting students suffering from Hyperactivity Disorder, dyslexia, and autism disorder. They concluded that AI-assisted tools have addressed the needs of disabled children and have shown a positive effect on the learning of disabled students, but much work needs to be done to increase the impact of such AI tools, which includes the use of cloud systems [7]. Artificial intelligence innovation can alter how people with disabilities perform everyday tasks, further develop productivity and straightforwardness, upgrade correspondence and versatility, and provide them enough autonomy to make every moment count. K. Zdravkova et al. studied the impact of AI solutions on children with disabilities. They concluded that the swift improvements in AI have opened new ways for inventing novel tools for addressing communication problems. The various AI-powered applications and robots help children with disabilities by developing communication skills [8].

India has worked hard for several years to promote comprehensive education for kids with cognitive disabilities. Many tools have been created in India to assist those with disabilities. Initiatives have been taken to improve the accessibility of digital content. This incorporates the advancement of e-books, audio recordings, and multimedia content. These apps help improve specific areas, including mathematical skills, cognitive skills, and mental abilities, catering to the diversified demands of students. In this field, numerous researchers have produced a great deal of work. The writers have evaluated several recent studies conducted in this area in this publication. N. Chakraborty et al. found ways to fasten and improve the life of people with disabilities in terms of their daily routine activities and concluded that AI could prove to be a transforming force in the lives of people with disabilities. It can help improve the engagement level of disabled persons and bridge the gap. AI's impact on the lives of people with special needs is outstanding, and it can be anticipated much more in the near future [9].

Artificial Intelligence (AI) has undergone remarkable improvements in recent years, leading to its universal acceptance across several domains. The escalating pervasiveness of AI can be attributed to its revolutionary potential and ability to bring about innovations in different fields, especially education. In recent years, India has made many efforts in promoting comprehensive education for children suffering from learning disabilities. In India, several tools have been developed for helping differently-abled persons. Many researchers have done much work in this domain. The authors in this paper have reviewed some recent research work done in this field.

Technology integration significantly impacts learning for students with disabilities in India. New opportunities for people with disabilities have emerged due to numerous artificial intelligence startups based on the latest technology to improve learning. AI-based platforms and applications are being created for fulfilling the requirements of students with disabilities. Artificial intelligence tools offer creative and innovative solutions to the problems of students with disabilities. Some important tools are the Annie device for visually impaired students, the Notebook application, readable.com for dyslexic children, AACDD to help children with dyslexia and Dysgraphia, and DAAD for deaf students.

**The aim of the study.** The goal of the study is to draw attention to the AI tools for impaired students that have the potential to revolutionize and improve educational opportunities for students with disabilities and to promote inclusivity more broadly.

## 2. ARTIFICIAL INTELLIGENCE (AI) TOOLS DEVELOPED IN INDIA FOR DISABLED CHILDREN

Technology integration is significantly influencing the learning of students with disabilities in India. New opportunities for people with disabilities have emerged due to numerous AI startups based on the latest technology for improving learning. AI-based platforms

and applications are being invented to cater to the needs of disabled learners. The AI tools offer creative and innovative solutions for solving the problems of disabled students. Some of the essential tools include the Annie device for visually handicapped students, the Notebook app, the readable.com website for dyslexic children, AACDD for assisting children who have dyslexia and Dysgraphia, DAAD for deaf students, and some more, which are discussed below:

### 2.1 World's first 'self-learning' braille device: Annie

In 2016, a team of four students of BITS Pilani comprising Sanskriti Dawle, Dilip Ramesh, Aman Srivastava, and Saif Shaikh, from Thinkerbell Labs, an Indian company, founded an ingenious and innovative braille device known as "Annie" to make education comprehensive for children suffering from visual impairments. Annie is a self-learning, lightweight, and compact braille device invented to assist people in learning and rehearsing braille independently. The device comprises a refreshable braille display and provides the facility of reading and writing in braille to the users. In order to guide the individuals regarding the process of learning, the audio instructions and feedback are incorporated into the device interactively. An in-built speech interface is incorporated into the device for the pronunciation of Braille characters, which helps visually handicapped people learn Braille effectively. The device utilizes AI and ML algorithms for analyzing user interactions and adapting the learning material as per the pace and progress of the user. Braille learning becomes more intriguing and captivating for visually impaired users due to the existence of a personalized approach in the device. It has gained much recognition and support for its creative approach to teaching Braille to the users. It is being utilized in several educational institutions, enabling visually handicapped students to learn Braille and, thus, helping to strengthen the comprehensive environment for learning [10]. The integration of voice resembling a human being helps improve the interaction between user and device and, thus, makes a child feel more connected and comfortable in interacting with the device. The device is incorporated with the Helios ecosystem and provides an inclusive tool that helps the teachers track and assess the progress made by the students. This ecosystem enables the teachers to collect data related to the performance of the students, identify the areas that need more attention and support, and modify their teaching methods accordingly. Sixteen states already use this device, which is available in 09 languages. Due to the multilingual facility provided by the device, the number of users has increased, resulting in a broader user base for the device. The founders of the device have made a significant step in expanding its reach by internationally launching it in the US. This has helped introduce the device to a large number of audiences belonging to different cultures and communities. The device gained Rs. 10 lacs as the winning amount at the Aarohan Social Innovation Awards of Infosys Foundation in 2019 [11]. Thinkerbell Labs won the National Startup Awards 2021 for Annie device, and its founders were invited to speak at the launch of the National Startup Awards 2021 being organized by the DPIIT (Department for Promotion of Industry and Internal Trade) [12]. The device also got success in raising Rs. 1.05 crores from Piyush Bansal, founder of Lenskart, Namita Thapar, CEO of Emcure, and Anupam Mittal, founder of Shaadi.com and People Group [13].

### 2.2 Notebook

It was launched in 2018 as an Android app and online portal by two brothers, Subhayu Roy, and Achin Bhattacharyya. It is an e-learning platform developed especially for dyslexic and visually challenged students. It helps the students study online according to their respective school curriculum. As dyslexic students learn better through comics, the founders created the content as a sequence of snapshots representing a comic series. This helps the students to learn quickly and interactively understand the problematic terms. At present, it does not have any

mechanism to solve the doubts or queries of students. The founders are trying to incorporate an approach of community learning in the app to enable students to solve the queries among themselves [14]. The platform utilizes Machine Learning algorithms that provide the students with a personalized learning experience. Notebook makes use of the Google Cloud to deliver video streams. It has implemented top-notch DRM (Digital Rights Management) to get protection from piracy. It is helpful for both dyslexic and visually impaired students. The cloud-based architecture provides the ability to stream videos on smartphones and other electronic devices. The audio-visual content is available in the form of stories on the platform and, thus, provides an interactive learning experience. It also incorporates extra notes, summaries, and word meanings. The name of the website is www.notebook.school. Notebook had about 300,000 users before COVID-19, which increased to about 2.32 million in November 2021. It bagged two awards – one for the pre-eminent website and another for the finest app for providing education at the World Digital Marketing Congress 2020, organized at The Taj Lands' End, Mumbai [15].

### 2.3 Readable.com

The in-house website, readable.com, was developed jointly by AIIMS (All India Institute of Medical Sciences) and IIT Delhi for children diagnosed with Dyslexia in 2022. This app and website were developed to help these children with reading and enhancing their writing skills from the start of schooling. Before the launch of the website, a study was conducted by AIIMS on 44 children who have dyslexia and underwent F-MRI (Functional Magnetic Resonance Imaging) at the time of using the app. The result of the study was analyzed, and it was found to be a success as most of the children could learn language and words like normal children. So, after this successful trial, the app and website were released for public use [16]. The main aim of this website is to help dyslexic children with reading, writing, and learning similar to normal children. It is designed so that once the parents of these children become familiar with this new app, they can assist their child in learning by overcoming the hardships faced by them in reading and writing.

### 2.4 Assistive Application for Children with Dyslexia and Dysgraphia (AACDD)

A team of three members invented this novel application - Braj Bhushan and Shatarupa Thakurta Roy, Professors at the Humanities & Social Sciences department in IIT Kanpur, and Alok Bajpai, a practicing psychiatrist in the year 2022. It makes the process of learning easy for children suffering from neuro-developmental disorders - Dyslexia and Dysgraphia [17]. Dyslexia creates difficulty in accurately recognizing words and spellings, whereas Dysgraphia creates difficulty writing coherently. As per the data provided by Indian Pediatrics, the number of cases of dyslexia is reported to be between 2% - 18%, Dysgraphia about 14%, and dyscalculia about 5.5%. So, additional support needs to be provided to these specially-abled children to make them learn quickly and work independently. This support is provided by the assistive technology invented by professors from IIT Kanpur. It helps children suffering from learning disorders complete their daily tasks, including communicating with others, getting an education, and achieving independence. This application helps integrate sensory inputs, including audible, ocular, and tactile inputs. It reconstructs the neuron network in the brain by manipulating fundamental geometric figures of words such as lines, circles, etc. This application is also available in Hindi Language. In addition, the app has features including auditory feedback, vibrations or tactile feedback, and motor movement to assist learners in learning and reenacting Hindi characters. Auditory feedback provides pronunciation guidance in the form of spoken instructions, allowing learners to hear the correct sounds of the Hindi characters. This helps beginners struggling with the pronunciation of unfamiliar phonetic

elements. Haptic sense provides the learners with a physical sensation while interacting with the app. While tracing the Hindi characters on the screen, the learners can receive haptic feedback, which imitates the feeling of using a pen or pencil for writing. This helps in reinforcing the muscle memory correlated with writing Hindi characters. Motor movement features include interactive exercises that need learners to physically imitate or reenact the generation of Hindi characters. By using guided movements or gesture recognition, learners can captivate their motor skills and kinesthetic learning, improving their understanding and remembrance of the characters. This application aids children using a tracing task in which the learners need to go after a blue and a pink colored dot to trace the Hindi symbols; a yellow line moves along the dot while tracing characters. The moment the learner diverges from the tracing path, the yellow-colored line moving along the dots disappears, and they must restart the tracing task. After succeeding in Level I, the learners are instructed about angular figures of Hindi characters by means of zigsaw puzzles. They are provided with a reading by the auditory response in Level II. The following levels incorporate audio, visual, and haptic inputs for writing and understanding words. Around 120 words of Hindi are present at this level, which increases the difficulty level. In the future, the founders are planning to add other languages to the application.

### 2.5 Augmenta11y

This app was developed in 2019 by four students - Tushar Gupta, Mudita Sisodia, Schezeen Fazulbhoy, and Mitali Raju to help dyslexic children with learning [18]. This app is available free of cost for Android and iOS users. Its primary purpose is to help children who suffering from dyslexia in reading books by making use of the camera on their smartphone. This app utilizes AR (Augmented Reality) to display the content in a form that dyslexic children can easily understand. It provides various customizable features that enable children to read easily. Various specialized algorithms have been implemented in this app, such as the detection of significant objects, stabilization of text, and changing the font size of content to make reading easier [19]. At the time of the beta stage, this app underwent testing by several users from different parts of the world, including India, the UK, the US, Canada, Malta, the Netherlands, Ireland, and Nigeria. The app does not inflict upon a single pattern of reading. It enables learners to tailor the contrast and space betwixt letters as well as lines, colors, and immediate translations and choose among 09 artificial voices available with changing playback speeds so as to fulfill their reading needs. In the coming years, the founders are focused on improving the app by introducing some more features to enhance accessibility for children who have dyslexia [20].

### 2.6 Dyslexia Assessment for Languages of India (DALI)

DALI app was founded in 2015 under the leadership of Dr. Nandini Chatterjee Singh, a cognitive neuroscientist. It was developed by the National Brain Research Centre and supported by the Indian government's Department of Science and Technology. This app is available in regional South Indian languages and acts as a screening tool for educators in school and an evaluation tool for psychologists who help identify dyslexia. It was released in the form of a booklet in 2015 and as an app on the Google Play store in 2018. It is currently accessible in 04 different languages - Hindi, English, Marathi, and Kannada and the future plan is to launch it in more regional languages. The tool screens children using the Junior Screening Tool, available for classes 1 to 2, and the Middle Screening Tool, available for classes 3 to 5. It considers the following six categories for screening: reading, writing, math, communication, memory, and motor coordination. The tool is administered by a Language teacher and the Class teacher so that the children can be screened in all the languages in which they are taught. After getting the positive results of screening, a detailed evaluation is done. After this, a formal

assessment is done, which helps make an Individualized Intervention Plan for the child. In order to fill the learning gap, the child is assigned a special educator who works according to the child's assessment report. This app was used among 30,000 children studying in government schools in Delhi, and positive feedback was received, especially from the teachers who needed help understanding the problems of some underachievers [21].

### 2.7 DYSXA

DYSXA app was created in 2020 by Souradeep Sarkar. Its main aim is to make the process of learning more accessible for children who have dyslexia. The app provides many features for making learning fun for learners with disabilities [22]. To improve the learning potential of students suffering from dyslexia, the app uses animations to explain words like a birdie, images of several objects, and more. The app is implemented with built-in words that help children learn the accurate pronunciation of these words. It helps dyslexic kids learn the alphabet as well as numbers in an easy way. Each letter appears in a different color and sound, which makes it easy for learners to recognize words and spellings accurately. The app provides some accessible quizzes and activities to make learning fun.

### 2.8 I-STEM

I-STEM (Indian Science Technology and Engineering Facilities Map) is a Government of India Initiative launched by PM Modi at the 107th Indian Science Congress held on 3-7 Jan 2020. It is an AI-powered platform and an element of UNICEF's Innovation Fund Investments, which was invented for disabled students. It is used to convert documents that are difficult to read into an accessible format for people with disabilities. The main aim is to encourage students as well as professionals suffering from disabilities so that they can realize their abilities and potential and get equal access to numerous information, resources, and opportunities. It is available as an Android app and can also be used as a web service. This platform has enabled academic professionals, students, and educators in India to use the MATLAB software package freely without paying any charges, as it is hosted on I-STEM’s cloud server and can be easily accessed by users from anywhere in India. This project has entered the second phase with new additions by getting an extension for five years in July 2021. The main focus of this new phase is to strengthen research and innovations and invent a dynamic online platform. Its special focus is on the primitive cities. It aims to enhance the use of research and development resources, emboldening the spirit of "Equal Opportunities to All" [23]. In 2023, I-STEM conducted Tech Management Conclave 2023 at the IISc from 21-22 Feb for women researchers across India. About 150 female researchers participated in the event and exchanged their ideas at the conclave developed by the I-STEM [24].

### 2.9 Digital Arts Academy for the Deaf (DAAD)

DAAD (Digital Arts Academy for the Deaf) was invented in 2018 by Remya Raj, Sulu Naushad, and Abey James. This startup has launched a hybrid web/desktop application that will help deaf students in getting access to both on-campus and virtual courses, most of which are in information technology. Courses are accessible in Indian Sign Language, Natural Sign Language, and contextually accurate sign language translation with English subtitles, which makes this model accessible to almost every learner. This platform offers free and paid courses on various subjects, including software usage and other information technology-related topics. The users need to get a subscription per course for learning. This startup started its operations by getting a seed fund of Rs. 1 lac from KSUM (Kerala Startup Mission) [25]. It was selected for the last round in the She Loves Tech Summit 2019, the world's greatest acceleration platform

for women and technology [26]. Daad.io, an enterprise for educating and up-skilling deaf women, was exhibited at the two-day exhibition being held as part of Huddle Global 2022 and received attention and recognition from a large number of people [27].

### 2.10 Attentionkart AI Platform

It is an AI-based platform founded by Karthik Rukmangada, Niranjan Swamy N, and Ranjana Girish on 07 May 2021. It was designed especially for students suffering from disabilities and facing problems in learning. It uses the latest computer vision technologies, including facial, emotional, and gesture recognition and eye gaze tracking for identifying the engagement insights of users. The engagement level of learners is decided based on their behavior and cognitive and emotional involvement. It also considers facial expressions, head turn around, and eye gaze for analyzing the participation level of learners. The analysis is obtained on the intelligent dashboards provided on the platform. It provides both online and offline analytics to enhance the process of learning. In 2023, this platform got the 49$^{th}$ position among the active competitors based on the Tracxn score. This exclusive score depends on the position of a company when compared to the other companies in the competition [28].

### 2.11 Stamurai

Stamurai was founded by Anshul Agarwal, Harsh Tyagi, and Meet Singhal in 2017. The problem of stuttering affects people's social and professional lives, and around 80 million people worldwide are affected by this problem. Stamurai provides speech therapy to such people at a meager cost using automation and the latest technologies. The instructional videos are provided in the app for performing speech therapy exercises. It also provides self-help groups, real-time analysis, and real-time consultations with the help of a speech therapist. It helps disabled students correctly pronounce words without any repetition of sound and improves their reading ability [29]. On 03 Dec 2020, Stamurai got third position in Prosus SICA (Social Impact Challenge for Accessibility) and won a grant of INR 1,200,000. This challenge helps identify and provide support to proficient and talented entrepreneurs aimed at developing and deploying the latest technology. Beyond the grant, this startup was also provided with mentoring from the Prosus Universe for business development. It also provided new opportunities for the founders of Stamurai to collaborate with the public sector and other innovators so that their ideas reach the marketplace [30]. Stamurai was awarded first prize in ZS's healthcare innovation program, which was held in 2021, and won Rs. 75 lakhs from ZS PRIZE to add more features to the app [31].

### 2.12 Tactopus

Tactopus was founded in 2017 by Chandni Rajendran and Saloni Mehta. Tactopus is an educational technology startup that aims to create comprehensive learning experiences for learners who are visually handicapped. It is focused on making visually handicapped students learn science and mathematics with the help of tactile graphics, including images that are embossed and textures that can be e-read using fingertips. Tactopus aims to bridge the accessibility gap in education by enabling visually handicapped students to access tools and materials that help them explore and engage with educational content in a multisensory manner. The products comprise tactile books, comprehensive learning kits, flashcards, game boards, and accessible learning apps. The interactive and tactile resources for learning are developed using a combination of 3D printing, computer vision, and AR technologies. The tactile graphics are provided with additional innovative technology support that acts as an attractive audio companion and helps children in learning independently. The tactile product comprises

Counting Books and Cards and Nursery Rhymes. This startup has been used in excess of 35 schools in different cities of India and Singapore. The founders have a partnership with the Maharashtra government after winning at Maharashtra Startup Week held in June 2018 and invented about 12 devices with entire 1st-grade mathematics chapters. In December 2018, the founders raised a venture amount of Rs. 83 lacs from Social Alpha, an initiative promoting science and technology enterprises. From this total amount, about Rs. 60 lacs were obtained as equity funding and the rest as a grant. In the year 2020, this startup was declared a winner in Elevate Karnataka, and the prize money was Rs. 20 lacs. The founders aimed to develop teaching materials to help educators and parents [32]. This startup won SheThePeople's Digital Women Awards 2020 under the category 'Social Impact,' which shows that the app was acknowledged for its commitment to creating social change and addressing the needs of visually handicapped learners [33].

## 3. ANALYSIS OF DIFFERENT TOOLS

AI has entirely transformed the lives of disabled people by enabling them to access numerous educational materials, tools, and platforms so that they can learn independently and perform tasks of reading as well as writing with precision and improved accuracy. In India, many tools and platforms based on AI have been launched that help disabled students in learning. AI has provided support to disabled children by providing them with personalized learning experiences. ML algorithms are used in AI tools that help analyze the learning patterns of different students, which helps in the adoption of customized learning pathways to cater to the specific requirements of each student. Popular artificial intelligence tools such as DAAD, Tactopus, I-STEM, Stamurai, and others, as discussed in the previous section, are analyzed in Table 1 based on their advantages and recognitions.

*Table 1*

**Analysis of Artificial Intelligence Tools**

| Sr. No. | AI Tools | Developed By | Description | Advantages | Tools Efficiency and Usage |
|---|---|---|---|---|---|
| 1. | **Braille device: Annie [10]-[12]** | Sanskriti Dawle, Aman Srivastava, Dilip Ramesh, and Saif Shaikh in 2016. | ➢ The device gained Rs. 10 lacs at the Infosys Foundation's Aarohan Social Innovation Awards in 2019.<br>➢ The device also successfully raised Rs. 1.05 crores from Piyush Bansal, founder of Lenskart, Namita Thapar, CEO of Emcure, and Anupam Mittal, founder of Shaadi.com and People Group. | ➢ It is a self-learning, lightweight, and compact device.<br>➢ Utilizes AI and ML algorithms.<br>➢ This device is already used by 16 states and is available in 09 languages. | ➢ A Smart Annie Class video is viewed by 8908 users on the official YouTube channel of Thinker Labs [34].<br>➢ At present, Annie is widely utilized in India. It is used in approximately 100 educational centers where about 50 students learn from this device at every center [35]. |

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| 2. | **Notebook [13]-[14]** | Subhayu Roy and Achin Bhattacharyya in 2018 | ➢ It bagged two awards – one for the best website and another for the best educational app at the World Digital Marketing Congress 2020, organized at The Taj Lands' End, Mumbai. | ➢ Developed primarily for dyslexic and visually challenged students.<br>➢ The content is created in the form of a sequence of snapshots that represent a comic series. | ➢ Notebook had about 300,000 users before COVID-19, which increased to about 2.32 million in November 2021 [14]. |
| 3. | **Readable.com [15]** | AIIMS and IIT Delhi for children diagnosed with Dyslexia in the year 2022 | ➢ In-house website | ➢ Developed to help these children read and enhance their writing skills from the start of schooling. | ➢ Readable.com is trusted by more than 3,000 authors, marketers, and educators for delivering accurate analysis of readability [36].<br>➢ A total of 84.23K visits were observed on this website in the analysis of traffic in Jan 2024 [37]. |
| 4. | **AACDD [16]** | Braj Bhushan and Shatarupa Thakurta Roy, Professors at the Humanities & Social Sciences department in IIT Kanpur, and Alok Bajpai, a practicing psychiatrist in the year 2022 | ➢ Also available in Hindi Language | ➢ It makes learning easy for children suffering from neuro-developmental disorders - Dyslexia and Dysgraphia.<br>➢ This application helps integrate sensory inputs, including audio, visual, and haptic inputs and reinforces the neuron network in the brain by manipulating fundamental geometric figures of words such as lines, circles, etc. | ➢ A video explaining usage of AACDD is viewed by 164 users on the official YouTube channel of the founder Braj Bhushan [38].<br>➢ AACDD won "Best Assisted Technology Initiatives by Educational Institutes" in ATF category awards 2023 during BTS (Bengaluru Tech Summit) 2023 [39]. |
| 5. | **Augmenta11y [17]-[19]** | Tushar Gupta, Mudita Sisodia, Schezeen Fazulbhoy, and Mitali Raju in 2019 | ➢ During the beta stage, this app was tested by several users from different parts of the world, including India, the UK, the US, | ➢ This app utilizes Augmented Reality (AR) to display the text in a format that can be easily understood by dyslexic children. | ➢ The app was downloaded by more than 5000 people on Google Play Store in just 03 months of release [40]. |

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|---|---|---|---|---|---|
| | | | Canada, Malta, the Netherlands, Ireland, and Nigeria. | ➢ The app does not inflict upon a single reading pattern. It enables students to tailor the contrast, space between letters and lines, immediate translations, and choose among 09 automated voices available with changing playback speeds to fulfill their reading needs. | |
| 6. | **DALI [20]** | Nandini Chatterjee Singh in 2015 | ➢ This app was used among 30,000 children studying in government schools in Delhi, and positive feedback was received mainly from the teachers who needed help understanding the problems of some underachievers. | ➢ It was released in the form of a booklet in 2015 and as an app on the Google Play store in 2018.<br>➢ The tool screens children using two tools - JST and MST- for different classes. | ➢ The app was downloaded by more than 1000 people on APKCombo till now [41].<br>➢ DALIScreening app is rated 4.9 stars by customers on APKCombo [42]. |
| 7. | **DYSXA [21]** | Souradeep Sarkar in 2020 | ➢ Created by boy from West Bengal who was eight-year-old at the time of creation.<br>➢ The app provides some accessible quizzes and activities to make learning fun. | ➢ It makes the process of learning more accessible for children who have dyslexia.<br>➢ The app is implemented with built-in words that help children learn the accurate pronunciation of these words. | ➢ The app was downloaded by more than 100 people on Google Play Store till 2021 [43]. |
| 8. | **I-STEM [22]-[23]** | A Government of India Initiative, Launched by PM Narendra Modi on 107th Indian Science Congress: 3-7 January 2020 | ➢ In 2023, I-STEM conducted Tech Management Conclave 2023 at the IISc from 21-22 Feb for women researchers across India. About 150 female researchers participated in the event and exchanged their ideas at the conclave developed by the I-STEM. | ➢ It is an Android app and can be used as a web service.<br>➢ This platform has enabled academic professionals, students, and educators in India to use the MATLAB software package freely without paying any charges, as it is hosted on I-STEM's | ➢ The app was downloaded by more than 1000 people on Google Play Store till 2022 [44]. |

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| | | | ➢ This project has entered the second phase with new additions by getting an extension for five years in July 2021. | cloud server and can be easily accessed by users from anywhere in India. | |
| 9. | **DAAD [24]-[26]** | Remya Raj, Sulu Naushad, and Abey James in 2018 | ➢ This startup started its operations by getting a seed fund of Rs. 1 lac from KSUM.<br>➢ It was selected for the last round in the She Loves Tech Summit 2019.<br>➢ Daad.io, an enterprise for educating and upskilling deaf women, was exhibited at the two-day exhibition held as part of Huddle Global 2022 and received attention and recognition from many people. | ➢ This startup has launched a hybrid web/desktop application that will help deaf students in getting access to on-campus and virtual courses, most of which are in information technology.<br>➢ Courses are accessible in Indian Sign Language, Natural Sign Language, and contextually accurate sign language translation with English subtitles, making this model accessible to almost every learner. | ➢ Daad.io is rated 4.4 stars by customers on Trustpilot [45]. |
| 10. | **Attentionkart AI Platform [27]** | Karthik Rukmangada, Niranjan Swamy N, Ranjana Girishon 07 May 2021 | ➢ In 2023, this platform got the 49th position among the active competitors based on Tracxn score. | ➢ Designed especially for students suffering from disabilities and facing problems in learning.<br>➢ It uses the latest computer vision technologies, including facial, emotional, and gesture recognition, as well as eye gaze tracking for identifying the engagement insights of users. | ➢ Attentionkart.com platform is rated 4.6 stars by customers on Justdial [46]. |
| 11. | **Stamurai [28]-[30]** | Anshul Agarwal, Harsh Tyagi, Meet | ➢ Stamurai got the third position in Prosus SICA. | ➢ Using automation and the latest technologies, Stamurai provides | ➢ The app was downloaded by more than 100,000 people on Google |

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| | | Singhal in the year 2017 | ➢ Stamurai was awarded the first prize in ZS's healthcare innovation program, which was held in 2021, and won Rs. 75 lakhs from ZS PRIZE to add more features to the app. | speech therapy to such people at a meager cost.<br>➢ The instructional videos are provided in the app for performing speech therapy exercises.<br>➢ It also provides self-help groups, real-time analysis, and real-time consultations with the help of a speech therapist. | Play Store till Feb 2023 [47]. |
| 12. | **Tactopus [31]-[32]** | Chandni Rajendran and Saloni Mehta in 2017 | ➢ In December 2018, the founders raised a seed amount of Rs. 83 lacs from Social Alpha.<br>➢ This startup won SheThePeople's Digital Women Awards 2020 under the 'Social Impact' category. | ➢ It is focused on making visually handicapped students learn science and mathematics with the help of tactile graphics, including images that are embossed and textures that can be e-read using fingertips.<br>➢ The interactive and tactile resources for learning are developed using a combination of 3D printing, computer vision, and AR technologies. | ➢ This startup has been used in excess of 35 schools in different cities of India and Singapore [31].<br>➢ Tactopus.com is rated 4.0 stars by customers on AmbitionBox [48]. |

## 4. RESEARCH RESULTS

The AI tools discussed in the above section were developed in India to improve the learning level of disabled students. These tools have shown promising potential in supporting children with disability. It is observed that AI holds much potential to strengthen the learning experiences of disabled students by providing them with personalized support and alleviating the difficulties they face in reading, writing, and learning a language with accuracy. Tools such as Notebook, DAAD, Annie, Stamurai, and others help impaired students by helping them with the learning process and making it interactive and fun. Tools such as DALI help monitor the performance of disabled students while providing effective therapies. These tools are very efficient in helping the disabled people. A **Smart Annie Class video** is viewed by 8908 users on the official YouTube channel of Thinker Labs. **Notebook** had about 300,000 users before COVID-19, which increased to about 2.32 million in November 2021. A total of 84.23K visits were observed on **readable.com** website in the analysis of traffic in Jan 2024. A video explaining usage of **AACDD** is viewed by 164 users on the official YouTube channel of the

founder Braj Bhushan. The **Augmenta11y** app was downloaded by more than 5000 people on Google Play Store in just 03 months of release. **DALIScreening** app is rated 4.9 stars by customers on APKCombo. The **DYSXA** app was downloaded by more than 100 people on Google Play Store till 2021. **I-STEM** app was downloaded by more than 1000 people on Google Play Store till 2022. **Daad.io** is rated 4.4 stars by customers on Trustpilot. **Attentionkart.com** platform is rated 4.6 stars by customers on Justdial. The **Stamurai** app was downloaded by more than 100,000 people on Google Play Store till Feb 2023. **Tactopus.com** is rated 4.0 stars by customers on AmbitionBox. It is shown in Figure 1.

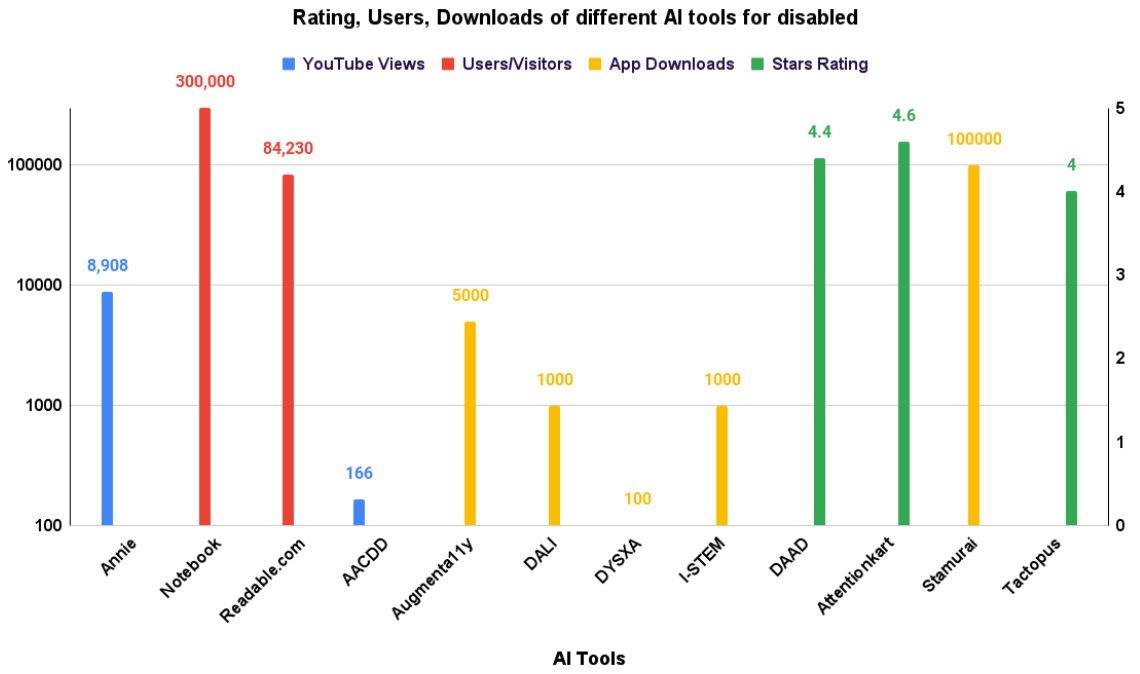


*Figure 1. Usage and efficiency of different AI tools in terms of users/visitors/YouTube views, app downloads and rating in stars*

These tools have won many awards under different categories and raised seed money, which enables these tools to get recognition from experts, industry professionals, and the wider community. The credibility of these tools has also been enhanced by getting recognition from experts. These tools aim to bring about a sense of equality among such students; thus, AI helps disabled people to live independently.

## 5. CONCLUSIONS AND PROSPECTS FOR FURTHER RESEARCH

AI has the significant potential to bring about a sense of empowerment among children with disabilities and improve the overall quality of their lives by supporting them with assistive technologies. AI tools have improved accessibility and personalized learning experiences and strengthened comprehensibility in education. AI enables the invention of creative and innovative platforms, tools, and apps that address the needs of disabled students. It helps such students by providing them with educational materials, improving participation in learning activities, and communicating effectively. By enabling personalized recommendations, feedback, and tailored interventions, AI strengthens learning pathways for each student. AI tools boost a more comprehensive, inclusive, and personalized learning environment for disabled students so that they can actively participate in educational activities and learn just like

normal children. The AI tools discussed in the above section have significantly changed the learning environment for disabled students. These tools have provided disabled students with learning material in formats that the visually impaired and deaf students can easily understand. The founders of these apps and platforms are working on improving these apps by adding new features. The collaboration among AI experts, professionals, and the disabled is essential for developing comprehensive and personalized AI solutions so as to meet the needs of disabled learners.

The tools developed to help people suffering from major problems, including Dysgraphia, dyslexia, blindness, and deafness, have been considered in this article. In future, more tools will be developed and the discussed tools will be improvised to help disabled people.

## REFERENCES (TRANSLATED AND TRANSLITERATED)


[1] A.P. Pedraza-Cardozo1, M. Campos-Sánchez1 and N. N. Castañeda-Ibáñez, “Inclusive education in children with Mucopolysaccharidosis IV-A: Case studies,” *Life Span and Disability*, vol. 24, no. 2, pp. 269-303, 2021. (in English)

[2] A. Zingoni, J. Taborri, V. Panetti, S. Bonechi, P. Aparicio-Martínez, S. Pinzi, and G. Calabrò, “Investigating Issues and Needs of Dyslexic Students at University: Proof of Concept of an Artificial Intelligence and Virtual Reality-Based Supporting Platform and Preliminary Results,” *Applied Sciences*, vol. 11, no. 10, 4624, 2021, doi: https://doi.org/10.3390/app11104624. (in English)

[3] M. Wang, B. A. Muthu, and C. B. Sivaparthipan, "Smart assistance to dyslexia students using artificial intelligence based augmentative alternative communication, "*International Journal of Speech Technology*, vol. 25, no. 2, pp. 343-353, 2022, doi: 10.1007/s10772-021-09921-0. (in English)

[4] P. Sharma, "Experiences of college teachers with visual disability using AT and AI-based solutions in India: Benefits, Issues, Challenges, and Prospects, "*Journal of Physics: Conference Series*, vol. 2007, no. 1, 012050, August 2021, doi:10.1088/1742-6596/2007/1/012050. (in English)

[5] A. Samim, "A new paradigm of Artificial intelligence to Disabilities," *International Journal of Science and Research*, vol. 12, no. 1, pp. 478-482, 2023, doi: 10.21275/SR23111022532. (in English)

[6] M. Wald, "AI Data-Driven Personalisation and Disability Inclusion," *Frontiers in artificial intelligence*, vol. 3, Jan 2021, doi: https://doi.org/10.3389/frai.2020.571955. (in English)

[7] P. D. Barua, J. Vicnesh, R. Gururajan, S. L. Oh, E. Palmer, M. M. Azizan, N. A. Kadri and U. R. Acharya, "Artificial Intelligence Enabled Personalised Assistive Tools to Enhance Education of Children with Neurodevelopmental Disorders-A Review,” *International journal of environmental research and public health*, vol. 19, no. 3, 1192, 2022, doi: https://doi.org/10.3390/ijerph19031192. (in English)

[8] K. Zdravkova, V. Krasniqi, F. Dalipi andM. Ferati, "Cutting-edge communication and learning assistive technologies for disabled children: An artificial intelligence perspective, "*Frontiers in Artificial Intelligence*, vol. 5, Oct 2022, doi: 10.3389/frai.2022.970430. (in English)

[9] N. Chakraborty, Y. Mishra, R. Bhattacharya, and B. Bhattacharya, "Artificial Intelligence: The road ahead for the accessibility of persons with disability,” *Materials Today: Proceedings*, vol. 80, no. 3, pp.3757-3761, Aug 2021, doi:10.1016/j.matpr.2021.07.374. (in English)

[10] S. Dawle and S. Ahmed, "Thinkerbell Annie: World’s First Self-learning Braille Literary Device–Winner of Mada Seedstars Award 2021, "*Nafath*, vol. 6, no. 19, pp. 18-22, 2021. (in English)

[11] K. Dsouza, Infosys Foundation Awardee, won Rs 10 lakh for self-learning Braille devices to help blind children study, Infosys Foundation, March 2023. [Online]. Available: https://www.thebetterindia.com/312087/thinkerbell-labs-self-learning-ai-braille-device-annie-wins-aarohan-social-innovation-awards/#:~:text=Meet%20the%20team%20behind%20Annie,Foundation's%20Aarohan%20Social%20Innovation%20Awards. (in English)

[12] Braille Literacy solution product Annie by Thinkerbell Labs gets recognition from the Indian Government, Financial Express, April 2022. [Online]. Available: https://www.google.com/amp/s/www.financialexpress.com/education-2/braille-literacy-solution-product-annie-by-thinkerbell-labs-gets-recognition-from-the-indian-government/2507670/lite/. (in English)

[13] B. Kumari, Story of B’luru startups after their Shark Tank win, Deccan Herald, January 2023. [Online]. Available: https://www.deccanherald.com/india/karnataka/bengaluru/story-of-b-luru-startups-after-their-shark-tank-win-1179790.html. (in English)

[14] P. Roy, 'Notebook' to help visually challenged, dyslexic students in their studies, The Bridge Chronicle, April 2019. [Online]. Available:

https://www.thebridgechronicle.com/pune/%E2%80%98notebook%E2%80%99-also-help-visually-challenged-dyslexic-students-their-studies-34630. (in English)
[15] Notebook bags the best website and app awards at the World Digital Marketing Congress, Media Brief, March 2020. [Online]. Available: https://mediabrief.com/notebook-bags-awards-at-world-digital-marketing-congress/. (in English)
[16] S. Ghosh, AIIMS' AI-based website for dyslexia offers fresh hope, The Times of India, July 2022. [Online]. Available: https://timesofindia.indiatimes.com/city/delhi/aiims-ai-based-website-for-dyslexia-offers-fresh-hope/articleshow/93196612.cms. (in English)
[17] A. Malhotra, IIT-Kanpur develops an application to assist dyslexic children, Dysgraphia, The Times of India, Aug 2022. [Online]. Available: https://timesofindia.indiatimes.com/city/kanpur/iit-k-develops-application-to-assist-children-with-dyslexia-dysgraphia/articleshow/93550463.cms. (in English)
[18] S. Sangwan, These 20-year-olds developed an app to help students with dyslexia learn better, May 2019. [Online]. Available: https://yourstory.com/socialstory/2019/05/dyslexia-children-elearning-app-augmenta11y. (in English)
[19] T. Gupta, L. Aflatoony and L. Leonard, "Augmenta11y: A Reading Assistant Application for Children with Dyslexia," *In Proc. 23rd International ACM SIGACCESS Conference on Computers and Accessibility*, no. 53, pp. 1-3, Oct 2021, doi: https://doi.org/10.1145/3441852.3476530. (in English)
[20] S. Das, Apps from Young Indian Developers Aim to Fix Colour Blindness, Dyslexia, Speech Issues, News 18, June 2021. [Online]. Available: https://www.news18.com/news/tech/apps-from-young-indian-developers-aim-to-fix-colour-blindness-dyslexia-speech-issues-3816467.html. (in English)
[21] C. Rao, T. A. S., R. Midha, G. Oberoi, B. Kar, M. Khan, K. Vaidya, V. Midya, N. Raman, M. Gajre and N. C. Singh, "Development and standardization of the DALI-DAB (dyslexia assessment for languages of India - dyslexia assessment battery)."*Ann Dyslexia*, vol. 71, no. 3, pp. 439-457,2021, doi: 10.1007/s11881-021-00227-z. (in English)
[22] West Bengal schoolboy creates app to boost learning abilities of dyslexic children, Education Times, Feb 2020. [Online]. Available: https://www.educationtimes.com/article/school-guide/73978666/west-bengal-schoolboy-creates-app-to-boost-learning-abilities-of-dyslexic-children. (in English)
[23] S. Tiwari, MATLAB on I-STEM National Portal launched, Mar 2022. [Online]. Available: https://abhipedia.abhimanu.com/Article/IAS/MzQ4MTQ1/MATLAB-on-I-STEM-National-Portal-Launched-Science-Affairs. (in English)
[24] S. Gupta, M. Gupta, and S. B. Gupta, "Analysis of AI-enhanced educational tools developed in India for linguistic minorities and disabled people," *Life Span and Disability*, vol. 26, no. 2, pp. 221-243, 2023, doi: 10.57643/lsadj.2023.26.2_09. (in English)
[25] A. Kuruvilla, Daad: A new start in education for hearing impaired, The New Indian Express, Aug 2019. [Online]. Available: https://www.newindianexpress.com/states/kerala/2019/aug/02/daad-a-new-start-in-education-for-hearing-impaired-2012740.html. (in English)
[26] R. Balakrishnan, This Thiruvananthapuram-based EDTECH startup aims to empower the deaf with quality education, Sept 2019. [Online]. Available: https://yourstory.com/herstory/2019/09/edtech-startup-deaf-technology-thiruvananthapuram. (in English)
[27] PTI. Kerala: 70 startups from India display products at KSUM's Huddle Global expo, Dec 2022. [Online]. Available: https://english.mathrubhumi.com/news/money/kerala-70-startups-from-across-india-display-products-at-ksum-s-huddle-global-expo-1.8136125. (in English)
[28] Competitive Landscape of AttentionKart, TracxnAttentionKart, Oct 2023. [Online]. Available: https://tracxn.com/d/companies/attentionkart/__nOX4IgLPm4E4_7N2G6nRYbCI3-imcXMeJpZLkqEYGGM/competitors. (in English)
[29] Stamurai – an app to help you learn and practice speech therapy exercises for stuttering, News Hook, Jan 2022. [Online]. Available: https://newzhook.com/story/stamurai-an-app-to-help-you-learn-and-practice-speech-therapy-exercises-for-stuttering/. (in English)
[30] Indian startups win big in bid to scale technology for persons with disabilities, Cision PR Newswire, Dec 2020. [Online]. Available: https://www.prnewswire.com/in/news-releases/indian-startups-win-big-in-bid-to-scale-technology-for-persons-with-disabilities-839146231.html. (in English)
[31] Stamurai wins the inaugural edition of ZS PRIZE, creating the path for many, ETHealthWorld, May 2021. [Online]. Available: https://health.economictimes.indiatimes.com/news/industry/stamurai-wins-the-inaugural-edition-of-zs-prize-creating-the-path-for-manyindia-has-8-winning-ideas-say-zs-prize-jury/84401066. (in English)
[32] T. Norzom, These IIT-Bombay graduates are building inclusive learning spaces for differently-abled children, May 2020. [Online]. Available: https://yourstory.com/herstory/2020/05/iit-bombay-entrepreneurs-inclusive-school-differently-abled#:~:text=Lack%20of%20accessibility%20becomes%20a,Industrial%20Design%20Centre%2C%20IIT%20Bombay. (in English)

[33] S. Kaushal, SheThePeople Digital Awards 2020 adds COVID impact, Solopreneurs as new categories; meet the winners, Newsd, Dec 2020. [Online]. Available: https://newsd.in/shethepeople-digital-awards-2020-adds-covid-impact-solopreneurs-as-new-categories-meet-the-winners/. (in English)
[34] Thinkerbell labs, Annie Smart Class: Made-in-India Innovation Solving a Global Problem | Disrupting Assistive Tech, April 2021. [Online]. Available: https://youtube.com/watch?v=LAwvuJWGToY. (in English)
[35] M. Bingaman, Braille Literacy Device Giving Students the Power to Self-Educate Anywhere, Solve, Jan 2023. [Online]. Available: https://solve.mit.edu/articles/braille-literary-device-giving-students-the-power-to-self-educate-anywhere#:~:text=Currently%2C%20Annie%20is%20most%20widely,offers%20on%20Shark%20Tank%20India. (in English)
[36] Readable, Jan 2024. [Online]. Available: https://readable.com/. (in English)
[37] Semrush, December 2023 Traffic Stats, Jan 2024. [Online]. Available: https://www.semrush.com/website/readable.com/overview/. (in English)
[38] Braj on Behaviour, Assistive Application for Children with Dyslexia & Dysgraphia (AACDD), July 2021. [Online]. Available: https://www.youtube.com/watch?v=91jzGhJALlY. (in English)
[39] S. Agarwal, Knocksense Shorts | IIT Kanpur wins Best Assisted Technology Initiatives at ATF Awards 2023, Dec 2023. [Online]. Available: https://www.knocksense.com/kanpur/knocksense-shorts-iit-k-wins-best-assisted-technology-initiatives-at-atf-awards-2023. (in English)
[40] Augmenta11y – Dyslexia-friendl, Oswald Labs, June 2019. [Online]. Available: https://play.google.com/store/apps/details?id=com.oswaldlabs.augmenta11y&hl=en&gl=US&pli=1. (in English)
[41] APKCombo, DALIScreening: Dyslexia Screening Tool,UNESCO MGIEP, 2023. [Online]. Available: https://apkcombo.com/daliscreening-dyslexia-screening-tool-unesco-mgiep/org.unesco.mgiep.dali/. (in English)
[42] APKCombo, DALIScreening: Dyslexia Screening Tool,UNESCO MGIEP, 2023. [Online]. Available: https://apkcombo.com/developer/Dali%20App/. (in English)
[43] S. Sarkar, DYSXA, March 2021. [Online]. Available: https://play.google.com/store/apps/details?id=com.subhaaspa.dysxa. (in English)
[44] CeNSE IISc, I-STEM, April 2022. [Online]. Available: https://play.google.com/store/apps/details?id=com.istem.india&hl=en&gl=US. (in English)
[45] Trustpilot. Digital Arts Academy for the Deaf LLP, 2023. [Online]. Available: https://www.trustpilot.com/review/daad.io. (in English)
[46] Justdial, Attentionkart, 2023. [Online]. Available: https://www.justdial.com/Mysore/Attentionkart/0821PX821-X821-230223221830-Q3P9_BZDET?srcterm=Attentionkart&predocid=0821PX821.X821.170925023410.M5J2. (in English)
[47] Stamurai Speech Therapy, Stamurai: Stuttering Therapy, Feb 2023. [Online]. Available: https://play.google.com/store/apps/details?id=com.stamurai.stamurai&hl=en&gl=US. (in English)
[48] AmbitionBox, Tactopus, March 2023. [Online]. Available: https://www.ambitionbox.com/reviews/tactopus-reviews. (in English)

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## СИСТЕМНИЙ АНАЛІЗ ОСВІТНІХ ІНСТРУМЕНТІВ НА ОСНОВІ ШТУЧНОГО ІНТЕЛЕКТУ ДЛЯ ЛЮДЕЙ З ІНВАЛІДНІСТЮ: ДОСВІД ІНДІЇ

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**Анотація.** Штучний інтелект (ШІ) відіграє велику роль в освіті і значно покращує навчання людей з інвалідністю. ШІ – важливий і потужний інструмент, який підвищує доступність, персоналізує навчальний процес і сприяє інклюзивній освіті. Наприклад, учням з порушеннями зору пристрої зі шрифтом Брайля зі штучним інтелектом допомагають самостійно вивчати та повторювати шрифт Брайля. ШІ можна інтегрувати в мобільні додатки та навчальні платформи, які поширюються в Індії для допомоги учням з дислексією. Такі додатки з багатьма функціями роблять навчання для дітей з інвалідністю цікавим. Наприклад, платформа Notebook використовує алгоритми машинного навчання, які уможливлюють персоналізоване навчання учнів. Зокрема AACDD полегшує навчання для дітей, які страждають на порушення нейророзвитку. Додаток Augmenta11y використовує AR (доповнену реальність) для відображення контенту у формі, яку діти з дислексією можуть легко зрозуміти. Додаток DYSXA надає багато можливостей для того, щоб зробити навчання цікавим для учнів з обмеженими можливостями. Використовуючи автоматизацію та новітні технології, Stamurai надає логопедичну допомогу таким людям за мізерну плату. Автори проаналізували велику кількість освітніх інструментів на основі штучного інтелекту, розроблених для допомоги в навчанні учням з обмеженими можливостями. За допомогою таких інструментів діти з інвалідністю можуть краще спілкуватися, отримувати інклюзивну освіту, бути відкритими та психологічно підготовленими до спілкування, а також вести незалежне життя. Представлені інструменти демонструють багатообіцяючий потенціал у підтримці дітей з інвалідністю. Крім цього, ШІ має значний потенціал для покращення навчального процесу учнів з обмеженими можливостями, надаючи їм персоналізовану підтримку та полегшуючи труднощі, з якими вони стикаються при читанні, письмі та вивченні мови.

**Ключові слова:** штучний інтелект; платформа; інструменти; допоміжні технології; розлади навчання; дислексія.