

# **Towards next-generation user interfaces: Chinese perspective of implementing Artificial Intelligence (AI) to support people with disabilities**

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**Abstract-** While several studies have investigated how artificial intelligence (AI) has shaped next-generation user interfaces, most of the literature is Western-based and scant information exists on the technological advancement for people with disabilities. To address this research gap, this study conducts an integrative review to show how AI in China has facilitated the development of next-generation interfaces, allowing more realistic and personalized interactions based on the different needs of people with disabilities. Specifically, it reports various cases adopted and implemented in various Chinese real-scenarios, beyond lab experiments or small tests. This study contributes to the Sustainable Development Goals (SDGs) by depicting different scenarios, techniques and interaction levels that could be adopted in various contexts to facilitate the life of people with disabilities in different fields.

**Keywords-** Artificial intelligence, next-generation, user interface, disability, special needs, accessibility, sustainable development goals

## **1. Introduction**

The UNESCO Asia Pacific Education Bureau in 2019 and some of the World Health Organization (WHO) data stated that there are more than 1 billion people worldwide having a disability, of which 93 million are children under the age of 14 [1]. China, particularly, has 85 million people with disabilities, making it the country with the largest disabled population in the world, accounting for 6.34% of the total population. It is expected that the total number of people with disabilities in China will reach 65.3% by 2050, which will be twice that of the current total number of people with disabilities in China [2].

Meanwhile, with rapid evolution of technology, several research studies and projects have started relying on assistive technology to help people with disabilities achieve several tasks. Artificial Intelligence (AI) as a technology, particularly, has allowed developing next-generation user interfaces where various human-machine interactions are now made possible to cater to the

different needs of various disability features. Human-machine interfaces are smart interfaces that provide more realistic interactions to achieve personalized human-machine interaction according to users' abilities and pre-existing knowledge [3]. Wigdor [4] highlighted the need to investigate how emerging technologies will develop next-generation user interfaces that provide a high quality, easy to use interfaces for experts and novices alike.

The rapid technological advancement in China, especially in terms of Artificial Intelligence (AI), has attracted international attention from different fields, including economists [5], US-based political analysts [6] and security experts [7]. In 2017, the Chinese government promulgated the "Development Plan for the New Generation of Artificial Intelligence," which proposed the guiding ideology, strategic goals, key tasks, and guarantee measures for the development of the new generation of artificial intelligence in China by 2030, deploying to build China's leading advantage in artificial intelligence development, accelerating the construction of an innovative country and a world-leading technological power. This AI advancement has catalyzed developing next-generation interfaces generally and for people with disabilities specifically.

However, most of the literature is Western-based, and little is known on how next-generation interfaces are developed for people with disabilities in non-Western countries like China. Therefore, this study provides an integrative review on the Chinese perspective of developing next-generation interfaces. Specifically, it reports various cases adopted and implemented in various real-scenarios, beyond lab experiments or small tests. This study contributes to the Sustainable Development Goals (SDGs) by depicting different scenarios, techniques and interaction levels that could be adopted in various contexts to facilitate the life of people with disabilities in different fields.

## **2. Chinese policies to support people with disabilities**

According to the State Council Information Office of the People's Republic of China [2], the Chinese government has taken several major measures to champion the programs of persons with disabilities and improve their lives, including founding of the China Foundation for Disabled Persons in 1984, the first national sample survey on disability in 1987, founding of the China Disabled Persons' Federation (CDPF) in 1988, and promulgation of the Law of the People's Republic of China on the Protection of Persons with Disabilities and the first five-year program for China's cause of these people in 1991. The State Council has released seven five-year development plans for persons with disabilities, making overall arrangements for the protection of their rights and interests. To further define the tasks and responsibility list for the protection of persons with disabilities, China has issued "Instructions of the State Council on Accelerating the Process Toward Prosperity for Persons with Disabilities", "Outline for Accelerating the Process Toward Prosperity for Persons with Disabilities in the 13th Five-year Plan Period", "Plan for Promoting Equal Access to Basic Public Services in the 13th Five-year Plan Period", "The National Disability Prevention Program (2016-2020)", and two documents of "Special Education Promotion Plan", for 2014-2016 and 2017-2020 respectively. Launched in 2009, the three documents of the "National Human Rights Action Plan" for 2009-2010, 2011-2015, and 2016-2020 specified the tasks and goals of this mission. By April 2018, more than 80 laws and 50 administrative regulations had been passed concerning the protection of the rights and interests of persons with disabilities. In terms of assistive technologies, during the "13th Five-Year Plan" (2016-2020) period, China formulated the vision that "over 80 percent of the

disabled adults (with disability certificate) and children can receive basic adaptive assistive technology products and services by 2020.” Additionally, the Ministry of Education and six other ministries jointly issued the “14th Five-Year Plan for the Development and Enhancement of Special Education” in 2021. The document states: “Strengthen the construction of digital education resources. Actively promote the digital and intelligent transformation and development of special education, explore the application of new technologies such as the internet, cloud computing, big data, virtual reality, and artificial intelligence.”

All those efforts and initiatives to support people with disabilities in line with the rapid technological advancements in China have raised the attention of people about the latest developed next-generation interfaces and how they used to cater to the different needs of disabilities, as discussed in this study.

### **3. Method**

This present study was framed through an integrative literature review [8, 9]. Integrative reviews are a type of non-systematic reviews [10] aiming to cover “new or emerging topics that would benefit from a holistic conceptualization and synthesis.” While systematic reviews might inadvertently amplify knowledge inequalities by focusing on specific databases or article types [11], the integrative approach on the other hand overcomes this issue by covering knowledge in different types from different sources, regions and languages [12, 13]. This is important in this present study as the goal is to exemplify case studies of implementing AI to support people with disabilities in real contexts beyond the lab experiment context, which is usually the common practice reported in research papers [14, 15].

Our approach distinctly adopts the methodology proposed by Raffo et al. [16], known as “conceptual synthesis,” which goes beyond synthesizing substantive research findings. Instead, it aims to identify the conceptual foundations from which these findings emerge. Particularly, this present study focuses on how AI has shaped user interfaces, referred to as “next-generation interfaces”, and the different types of interaction made possible for people with disabilities and special needs to achieve various objectives (education, information access, etc.).

### **4. AI-based next-generation interfaces and interactions for people with disabilities in China**

This section provides several case studies illustrating next-generation interfaces that have been implemented in various contexts to support people with disabilities.

#### **4.1. Accessible information search and retrieval**

China’s leading search engine provider Baidu has announced the Blind Search device (see Figure 1), a tool to assist blind and vision impaired people access “massive amounts of information online through touch” using a combination of tactile and voice-activated commands. The Blind Search tool provides a dedicated area for typing commands using finger gestures, which are converted to Braille output via a display at the top of the device so that the users can check if there are any typing errors. Once search terms have been entered, a button at the back of the

device can be pressed to display a list of text-based search results. These results are displayed in Braille output to be read by users or they are also converted to audio through text-to-speech functionality. Voice input is also supported, allowing users to press a button at the side of the device to speak search terms aloud, which are then converted into text or image-based results via the tactile display.

Images can also be searched and displayed using a “tangible image made from dot positions arranged in rectangles” which the user can interact with via touch, providing audio description as users navigate across different sections of the picture. As Baidu states, the combination of providing tactile imagery with audio description is intended to “help blind people understand [the] search results in a comprehensive stereoscopic way”.



**Figure 1.** Blind Search device [17]

#### **4.2. Easy communication and interaction**

Special Education College of Beijing Union University is the only college in Beijing that focuses on higher education for persons with disabilities. At present, 70% of the students in the college are students with disabilities, and 70% of the students with disabilities are hearing-impaired. The school uses an AI-based smart classroom, where teachers’ speeches in classrooms are automatically translated into subtitles and sign-languages and then displayed on a large screen in classes (see Figure 2).



**Figure 2.** Art and Design Professional Teacher is teaching to Disabled Students [18]

For blind people, the school has also developed and equipped students with reading pens which are used to scan the letters and these letters are then read out loud (see Figure 3). This tool allows self-studying and avoids issues, including having only four or five books for Braille, which is very inconvenient to check; the second obstacle is that the information they master through touch is sometimes incomplete, and they need to turn over the books to form a connection with the things they touch. This pen can also be used to read images which are converted into 2D convex images.



**Figure 3.** Diagram of the Voice QR Code Reading pen on the medicine cabinet [18]

#### **4.3. Cognitive Development in immersive virtual reality (VR) environments**

Shunde District Qizhi School is a comprehensive boarding special education school for children with moderate to severe intellectual disabilities. There are VR labs to develop students' cognition, overcome limitations and monotonous methods in safety education, as well as issues related to the difficulty and high cost of setting up training scenarios (see Figure 4). For instance, abstract concepts like 'up-down' and 'left-right' are traditionally taught using a point of reference. However, for children with intellectual disabilities, they might struggle to understand these concepts when the environment changes, yet real-life teaching cannot provide a variety of scenarios. VR can simulate numerous scenarios for intensive student training, enhancing their understanding of abstract concepts through continuous stimulation and fostering the ability to generalize these concepts.

Take safety education as another example, real-life teaching cannot allow students to touch fire or experience the pain of drowning by jumping into water. VR simulates such scenarios, and when students enter those virtual environments, the system triggers alarms or produces smoke signals to indicate danger. Through repeated reinforcement, students become aware of potential hazards, achieving the goal of training their safety awareness. Teachers can also monitor the virtual scenarios experienced by students in real-time on a pad device, providing timely instructional guidance and intervention. Students also receive feedback within the VR environment; for instance, if they perform well, the computer may emit an encouraging sound saying, "You did great!"



**Figure 4.** Special education students learn through VR [19]

#### **4.4. Early diagnosis and intervention for children with Autism**

In March 2024, the "China Autism Education and Rehabilitation Industry Development Status Report" was officially released. The report estimates that the prevalence of autism among children aged 6-12 is 0.7%. Conservatively estimated, there are about 2 million children with autism aged 0-14 nationwide, with an annual increase of approximately 160,000. Professor Xu Peng from the University of Electronic Science and Technology of China has combined artificial intelligence techniques such as deep learning, transfer learning, and manifold learning to establish an early diagnostic recognition system for children with ASD (Autism Spectrum



Disorder), focusing on the abnormal interaction information between brain networks and other source signal networks [20]. This system improves the accuracy of diagnosis and helps patients with autism receive early intervention, achieving better outcomes in lifelong rehabilitation.

Currently, intervention technologies for autism face issues such as a lack of personalized intervention and insufficient levels of intelligence. Over the past decade, Professor Chen LiangYing's team at Central China Normal University has been continuously tackling these challenges, focusing on refined assessment and personalized intelligent intervention for children with autism. Her research has explored intelligent recognition methods for children with autism that integrate multimodal data. By analyzing behavioral and cognitive data, significant differences were found between children with autism and typically developing children in eye movements, facial expressions, cognitive scores, and cognitive response time data. Furthermore, feature selection was performed using these data differences, and an autism recognition model integrating multimodal data was constructed. Figure 5 shows the data from a child with autism are being collected through a head-mounted device while he is playing games.



**Figure 5.** A child with autism is being assessed [21].

#### **4.5. Intelligent sports equipment aids in enhancing the physical fitness of special-needs children**

Since most children with disabilities are unable to express their adverse physical reactions normally using smart teaching devices such as jump ropes and wristbands to monitor their heart rate and other physical indicators can effectively prevent the occurrence of safety accidents. These intelligent devices provide teachers with a better understanding of students' physical conditions and offer precise exercise data to physical education teachers, allowing them to develop personalized teaching plans for students with different physical disabilities.

Xiangyang Special Education School has a total of 14 teaching classes with 180 students enrolled. In 2022, the school launched a smart physical education project, including a smart physical education platform and intelligent devices, which have now been fully implemented in each class. The school also conducted a comparative experiment on the one-minute rope skipping event, showing that the overall average score of students in the experimental group (using the smart physical system) improved by 20.3%. At the same time, the teachers stated that

“the smart physical system has made the physical education teaching process quantifiable and visual, promoting classroom communication between teachers and deaf students or students with intellectual disabilities, effectively enhancing the quality of physical education teaching.” Figure 6 shows the data on a student’s psychological baseline indicators, average heart rate curve, and exercise intensity index after exercising.

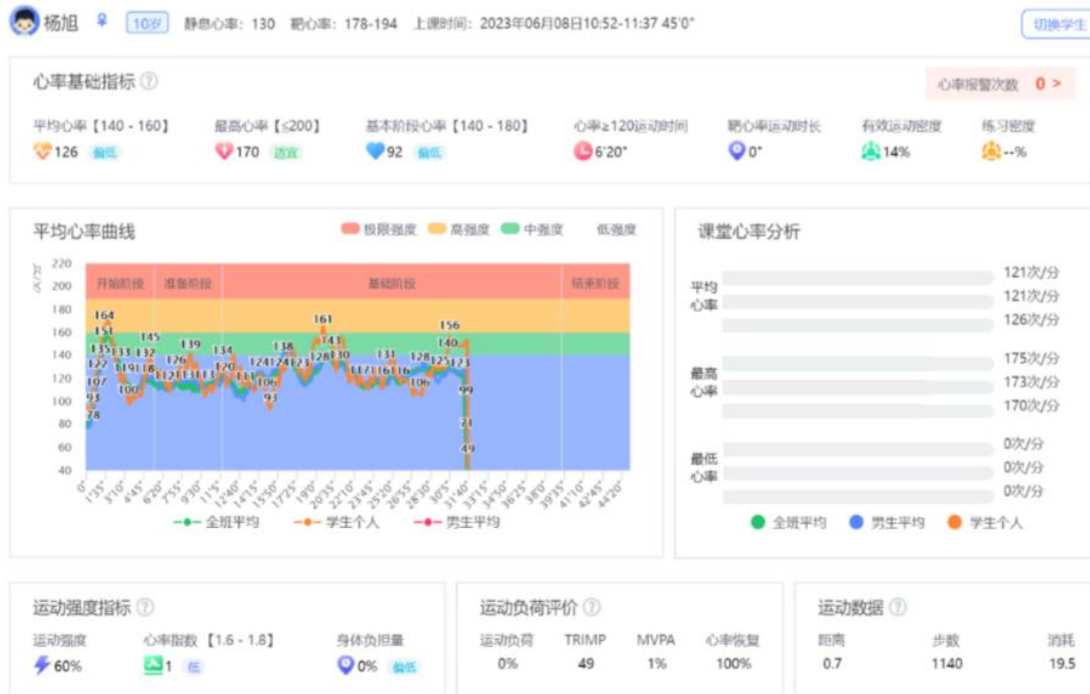


Figure 6. Student’s psychological data [22]

#### 4.6. Empower special education teachers through generative AI

On November 9, 2023, the Tianhe District Education Bureau in Guangzhou held a seminar on the exploration and practice of AI+ Special Education Practice Community. A teacher from Qihui School in Tianhe District presented an open class demonstration titled “Carmen Overture Music Appreciation - Rhythm.” Before the class, the teacher used generative artificial intelligence to create personalized learning objectives and strategies for eight children with varying degrees of intellectual disabilities. Figure 7 shows the generative AI system, iFlyTEK Spark, responds to the following prompt:

*“You are an esteemed professor specializing in special education. I have eight children with various disabilities, including three with intellectual disabilities, two with Down syndrome, two with autism, and one with cerebral palsy. Classified by the degree of impairment: one mild, two moderate, three severe, and two profound. Please provide an analysis of their learning situations when teaching ‘Carmen Overture,’ focusing on three aspects: musical perception ability, rhythmic expression ability, and social adaptation skills. The analysis should be presented in a tabular form for each type of child.”*



**SparkDesk** 阅书万卷，我是你的知识宝典 个人空间

你是一位特殊教育名师。我有八个障碍类型的孩子，其中：智力障碍 3名、唐氏综合征2名、孤独症 2名、脑瘫1名，从障碍程度的分类是：轻度1名、中度 2名、重度3名、极重度 2名，请你提供在教《卡门序曲》时，从音乐感知能力、律动表现能力、社会适应能力三个方面的学情分析。要求用表格形式列出每一类孩子分析。

在教学《卡门序曲》时，针对不同类型的特殊需要孩子进行学情分析是非常重要的。以下是一个简化的表格，用于分析每种障碍类型的孩子在音乐感知能力、律动表现能力和社会适应能力方面可能遇到的情况。请注意，每个孩子都是独一无二的，他们的能力可能会因个体差异而有所不同。

Type of Disability	Music Perception Ability	Rhythmic Expression Ability	Social Adaptability
智力障碍 (轻度)	可能对音乐有基本的理解，能够辨别简单的旋律和节奏。	能参与基本的律动活动，可能需要简化的动作。	能理解简单的社交指令，与同伴互动需适度支持。
智力障碍 (中度)	对音乐的理解可能有限，难以理解复杂的旋律和节奏。	律动能力受限，需要高度简化的动作和大量练习。	社交能力较弱，需明确的指导和结构化的社交环境。
智力障碍 (重度/极重度)	可能几乎不理解音乐概念，反应可能更多是对声音的基本反应。	律动能力极为有限，可能只能参与非常简单或被动的律动活动。	需要密集的支持才能参与集体活动，可能需要一对一的支持。
唐氏综合征 (轻度/中度)	可能对音乐有一定的感受性，能够跟随简单的旋律和节奏。	律动能力可能较为协调，但可能需要动作的适应性调整。	通常喜欢社交，但可能需要额外的提示和支持来理解社交规则。
唐氏综合征 (重度/极重度)	对音乐的理解可能很有限，但可能对某些音乐元素有情感反应。	律动表现可能不协调，需要大量的实践和物理支持。	社交能力可能较弱，需要特别的社交技能训练和持续的支持。
孤独症 (轻度/中度)	对音乐的感知可能是强烈的，但对复杂的音乐可能感到困惑。	律动能力可能不一致，对于非常规的律动可能有独特的反应。	社会适应能力参差不齐，可能对社交互动有兴趣但不总是理解如何参与。
孤独症 (重度/极重度)	可能对音乐有极端的反应，从强烈喜欢到极度排斥。	律动能力可能非常受限，可能对任何形式的律动活动都感到不适。	社交适应可能极其困难，需要特别设计的干预和支持。
脑瘫	对音乐的感知能力取决于脑瘫的影响程度和其他感官功能。	律动能力可能受到身体限制的影响，但可以通过适应性设备或支持来增强。	社会适应能力可能因个人情况而异，但可能需要特定的沟通和社交技能支持。

Figure 7. Response of the generative AI tool

It should be noted that iFLYTEK Spark is a general-purpose large language model and is not specifically designed for the field of special education. In China, there are also GAI that specifically serve special education teachers, such as the one shown in Figure 8, namely QiWei special education AI partner. It can provide teachers with functions like lesson plan writing, rehabilitation training activity design, special education encyclopedias, and special education event planning assistants and so on.

**欢迎使用 七维特教AI伙伴! QiWei special education AI partner**

工作提效 生活助手

**教案灵感ai助手**  
给定教案主题，生成一篇教案草稿  
**Teaching Plan Inspiration AI Assistant**

**康复训练活动ai灵感助手**  
给定训练目标，生成一些训练活动建议  
**Rehabilitation Training Activity AI Inspiration Assistant**

**万能文案ai助手**  
提出您的需要，我们帮您实现  
**Versatile Copywriting AI Assistant**

**特教百科**  
为您解答，关于特教的专业问题  
**Special Education Encyclopedia**

**文本润色**  
一键为您润色文案  
**Text Polishing**

**专业翻译 (中英)**  
专业文献的中英互译助手  
**Professional Translation (Chinese-English)**

**特教活动策划ai灵感助手**  
给定一个主题，生成一个活动策划草案  
**Special Education Event Planning AI Inspiration Assistant**

**特教活动通知ai帮写助手**  
给定活动信息，生成一篇活动通知草稿  
**Special Education Event Notification AI Writing Assistant**

**特教活动总结ai帮写助手**  
给定活动信息，生成一篇活动总结草稿  
**Special Education Event Summary AI Writing Assistant**

**特教公众号ai灵感助手**  
给定一个主题，生成一篇公众号文章草稿  
**Special Education WeChat Public Account AI Inspiration Assistant**

**功能教室环境创设方案ai助手**  
给定教室信息，生成一个教室布置的草案  
**Functional Classroom Environment Creation Plan AI Assistant**

Figure 8. The webpage of QiWei special education AI partner [23]

## 5. Conclusion and future directions

This study conducted a review to highlight how emerging technologies like AI in China have sharpened next-generation interfaces. The obtained results revealed that Internet of Things (IoT) and immersive technologies like AR have helped to provide more natural interactions, where multimodal data are collected and analyzed in immersiveness environments stimulating real-world scenarios. This reveals that such technologies can provide new types of interaction beyond the traditional ones which usually relies on clicking (through mouse) and typing (through keyboard). It is also seen that China has relied on portable and open source technologies to cater to the different needs of people with disabilities. In this context, several studies highlighted the importance of harnessing the power of “openness” to promote accessibility and inclusivity [24, 25].

Additionally, it is seen that several case studies have relied on large language models (LLM) and generative AI (Gen AI) to generate different solutions (content, teaching strategies, etc.) for people with disabilities based on their needs. While Gen AI is a great technology to support inclusivity and accessibility, Tlili et al. [26] also pointed out the need to keep a close eye on the ethical issues of such technology as it might harm users instead of helping them.

This study also revealed the close relationship between research and development (R&D) in China which facilitated the rapid development of next-generation interfaces for people with disabilities. This was seen where various leading industries and companies have closely worked with special education schools to develop low-cost and portable assistive technologies.

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