Journal of Infrastructure, Policy and Development 2024, 8(8), 5287.
https://doi.org/10.24294/jipd.v8i8.5287

Article

How to better integrate disabled people in developing countries into social life: A hybrid study on APP design for disabled groups

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CITATION

Min X, Guo M, Tan J, et al., (2024). How to better integrate disabled people in developing countries into social life: A hybrid study on APP design for disabled groups. Journal of Infrastructure, Policy and Development. 8(8): 5287. https://doi.org/10.24294/jipd.v8i8.5287

ARTICLE INFO

Received: 18 March 2024
Accepted: 22 April 2024
Available online: 21 August 2024

Abstract: The study, taking China as an example, employs a mixed-method approach of questionnaire surveys and in-depth interviews to explore the differing perspectives of disabled and non-disabled individuals on how to improve the social integration and quality of life of disabled people in developing countries. The study finds that the vicious cycle created by severe accessibility issues in developing countries is the root cause of the disabled's difficulty in integrating into society. The impersonal barrier-free facilities suppress the desire of the disabled to travel, resulting in fewer disabled people on the streets and less visibility and attention, which leads to poorer accessibility facilities. Secondly, the study also finds that non-disabled people unconsciously show excessive sympathy and compassion when helping the disabled, which affects their self-esteem due to being patronized and helped. This creates two separate "social circles" between the disabled and the healthy. To address these issues, we have designed an application called "AbleMind" where the disabled can share experiences, make friends, seek help, and better integrate into society.

Keywords: disabilities; travel barriers; product design; infrastructure; accessibility

1. Introduction

1.1. Question proposing

A diverse, heterogeneous population, persons with disabilities face discrimination, stigmatization and other barriers that restrict them from participating in society on an equal basis with others (Bostock et al., 2019). The integration of people with disabilities into society is an important issue. Independent living and community integration are prerequisites for people with disabilities to enjoy all their human rights and a fundamental platform for their social Integration (Council of Europe Commissioner for Human Rights, 2012), which intuitively and fundamentally reflects the degree of participation of people with disabilities in society. Accessible facilities can facilitate the smooth passage of the "last meter". However, among the 2.5 billion people in the world who currently require one or more assistive devices for daily life, nearly 1 billion people do not have access to these products, especially in low and middle-income countries. In these countries, only 3% of the demand for these lifestyle changing products is met (WHO, 2022). As a result, the issue of people with disabilities is particularly severe for global development, especially for the social development of developing countries.

As the largest developing country, China has a large group of people with disabilities, with a total population of over 85 million. It is facing prominent problems such as high risks of returning to poverty, low levels of social security. Therefore, our

study takes China, a developing country, as an example to conduct research. In the early stages of our study, we found that there are some confusing social phenomena in China, such as:

Phenomenon 1: Why are there 85 million disabled people in China, but they are rarely seen on the streets?

Phenomenon 2: Why does China invest 36 billion yuan annually to build accessible facilities, but the penetration rate is only 40%?

Phenomenon 3: Why are 75% of healthy people willing to help disabled people, but they are unwilling to seek help from them?

1.2. Research methods and findings

To explore these issues, our study conducts a study on how to better integrate disabled people in developing countries into social life.

Utilizing a mixed-methods approach, our study aims to understand cognitive differences between disabled and non-disabled individuals concerning the former's public social life participation. The research involved open-ended interviews with 11 disabled and 10 non-disabled individuals, exploring their perspectives on the survival and mobility challenges faced by the disabled. Findings indicate a significant cognitive gap, with non-disabled individuals lacking awareness of the disabled's difficulties and thoughts. Contrasting traditional disability research focused on internal problems, our study highlights the crucial role of non-disabled individuals in societal change. Additionally, a survey of 141 non-disabled individuals was conducted to assess their general perceptions, attitudes, and willingness to assist the disabled. This aims to identify public misconceptions and explore deeper reasons for the mobility challenges faced by disabled people, ultimately seeking better communication channels between the public and disabled individuals to address specific issues.

The research exposes the one-sided perception of persons with disabilities in society and that there is a significant perception gap between persons with and without disabilities. Consequently, this gap contributes to a persistently low optimism in the mobility rate of disabled individuals, evident in two main aspects:

Our research indicates that over 60% of non-disabled individuals rarely interact with or consider the issues of disabled people. A "vicious cycle" has been created: due to inadequate design, disabled people are less visible in public (only 40% facility popularity in China, despite annual investments of 36 billion yuan). Their reluctance to venture out leads the public to view them as a minority, further diminishing attention to facility design and maintenance. The result is a cycle of poor accessibility, reduced public presence of disabled people, and ongoing social integration challenges in developing countries.

Our research shows that while over 75% of non-disabled individuals are willing to help the disabled, disabled individuals often hesitate to seek help. This reluctance stems from the perception of 'overlooking assistance' offered by non-disabled people, leading to a feeling of being patronized. The lack of communication between disabled and non-disabled individuals results in two isolated social circles, with disabled people forming their own supportive groups. In developing countries, the situation is exacerbated by lower levels of awareness and education about disability, leading to

more pronounced social alienation of disabled individuals. In response to the above research results, we designed an app called "AbleMind". "AbleMind" is a community app aimed at empowering disabled individuals, offering mutual assistance, and improving the mental health of disabled individuals. It addresses travel challenges faced by the disabled, including empathy gaps and issues with accessible facility design. The app enables disabled users to report travel inconveniences and suggest facility improvements. It also includes a feature for sharing experiences, fostering communication between disabled and non-disabled individuals. Additionally, it provides a supportive community for disabled individuals to connect and enhance their mental well-being (see **Figure 1**).

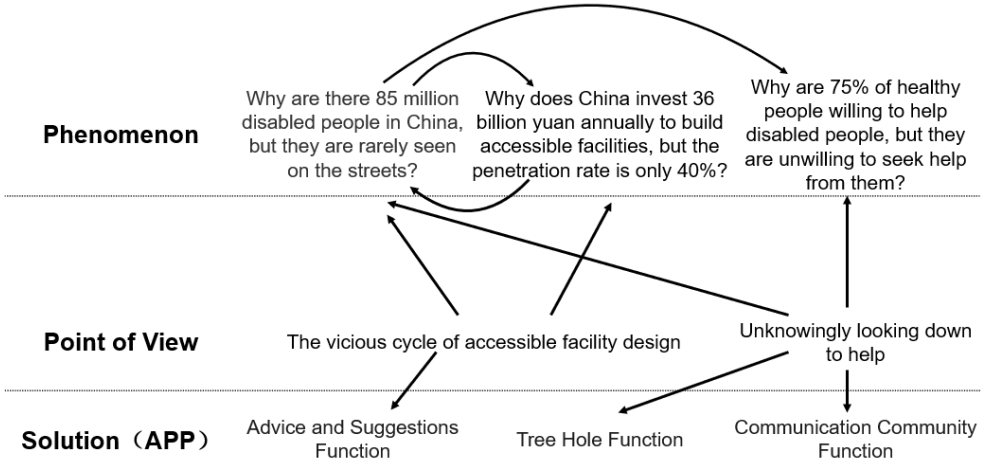

Figure 1. Design diagram of the research study.

1.3. Research significance

Overall, a mixed-method approach (i.e., correlation and discourse analysis) was used to analyze the research data to identify the cognitive gap between people with disabilities and healthy individuals. It proposes that the vicious cycle caused by the anti-human design of accessible facilities and the unwitting "overlooking assistance" during the assistance process of healthy individuals are two important reasons that hinder the smooth travel of people with disabilities in developing countries, and based on the research results, an application called "AbleMind" was further developed to promote the full integration of people with disabilities into society. Our study has the following three major values:

Study highlights the crucial social needs of people with disabilities, who face daily discrimination and barriers, impeding their equal social participation. The research, focused on the disabled's perspective, aims to identify their true needs through in-depth interviews. The goal is to facilitate their engagement in broader society, ensuring their rights, dignity, and equal opportunities. The study emphasizes the importance of creating appropriate communication channels and social support as a key responsibility for all nations.

Study focuses on bridging the communication gap between disabled individuals and the general public in China, where the development of accessible environments is

in its initial stages. Despite efforts towards improving information accessibility, a significant disconnect remains between non-disabled and disabled individuals. Our research aims to build a bridge between these groups, enhancing public awareness and understanding of the disabled community's challenges and needs.

Study highlights the importance of improving mental health services for disabled individuals. Current accessible software lacks focus on social integration, which our approach aims to address by enabling disabled people to both seek and offer help. The study also promotes channels for volunteers to provide mental health support, enhancing the wellbeing and societal participation of disabled individuals.

2. Literature background

2.1. The barriers to interaction between people with disabilities and society

With the implementation of the United Nations Convention on the Rights of Persons with Disabilities and the 2030 Agenda for Sustainable Development, safeguarding the equal rights and interests of persons with disabilities and promoting their integrated development have increasingly become a common consensus and joint action of the international community and countries (UN, 2015). The scope of disability in our study adopts the definition in the United Nations Convention on the Rights of Persons with Disabilities, which refers to people with physical, language, hearing, mental, intellectual, or multiple long-term disabilities, including visual, hearing, language, intellectual, physical, and mental disabilities.

From the perspective of social "exclusion", the exclusion of concepts, systems, employment, education, and public facilities has caused difficulties in the social integration of people with disabilities (Peng, 2013). A study once examined the social inclusion and exclusion of people with disabilities in Ireland through four perspectives: education, earnings, poverty and deprivation, and social life and social participation. Survey results showed that across almost all research measures, individuals with chronic illnesses or disabilities fared worse than their peers in the same age group, reflecting the extent to which they are hindered by illness or disability in daily life (Gannon and Nolan, 2005).

Obstacles and challenges to the social integration of people with disabilities exist in various aspects, mainly cultural and social cognition, economic factors, and educational opportunities. Societal stereotypes and prejudices towards people with disabilities shape and influence their social status and further integration into society. Simultaneously, people with disabilities also face economic pressures, including employment difficulties and income inequality, which can exacerbate and further hinder their social integration. Additionally, accessing education remains challenging for people with disabilities. Numerous studies focus on the challenges faced by individuals with disabilities of different identities in terms of social integration. For instance, one study centered on disabled artists found that while they possess high creativity, social and familial backgrounds restrict the recognition and dissemination of their works (Vargas-Pineda, 2020).

In addition to social and physiological barriers, the psychological problems of

people with disabilities themselves are also a major obstacle to their integration into society. The main problem with this type of psychological problem also stems from society's perception of people with disabilities. In a qualitative study, people viewed disability as a deviation from the "normal" and a negative phenomenon (Soffer and Chew, 2014). During the process of obtaining medical or health services, people with disabilities encounter negative attitudes and behaviors from staff as barriers to communication with the outside world (Finkelstein and Orr, 2021). At the same time, many disabled individuals' express discrimination from their peers and families. The public is prone to exhibit negative attitudes towards people with disabilities (Shen, 2018), resulting in an inherent bias and stereotype towards them, leading to a sense of shame towards them (Forber-Pratt et al., 2017). This leads to people with disabilities becoming increasingly autistic and more inclined to stay within their own circles, unwilling to integrate into society.

2.2. The way of integrating the disabled into society

Many studies focus on improving the social integration of people with disabilities. One study, taking Bali Province as an example, introduces the application of the GEDSI (Gender Equality, Disability, and Social Inclusion) approach in disaster management policies, emphasizing social inclusion and the needs of people with disabilities, exploring ways to provide disabled-friendly facilities and services, and involving disabled groups in policy planning and evaluation (Rimbawan and Nurhaeni, 2023). Other studies adopt empirical methods. For instance, a study points out that disabled college students encounter difficulties in the process of social integration on campus, proposing practical and policy improvement plans such as expanding support services, increasing social integration opportunities for disabled college students, improving the quality of professionals, and promoting the rights and interests of campus activity participants (Hwang et al., 2023). Another study employs a focused ethnographic approach, conducting in-depth individual interviews with a university wheelchair basketball team in the United States, collecting data, and discussing how research on disability often examines the marginalization and challenges faced by people with disabilities, as well as strategies to amplify the voices of disabled youth and support their participation in advocacy roles and activism (Kayama et al., 2023). These studies consistently mention that social interaction with people with disabilities can foster the development of friendships and promote more positive language and cognition towards them (Meyer et al., 2011), while social contact that eliminates stereotypes of people with disabilities is particularly valuable (Barr and Bracchitta, 2015). Therefore, some studies aim to enhance communication between the public and people with disabilities, and to eliminate negative attitudes towards people with disabilities. For example, a study using a semi-structured interview method verified that volunteering can help increase participants' awareness of the needs of people with disabilities (Lindsay and Cancelliere, 2017). Therefore, based on previous research, our study focuses on the deep-seated problem of "unconscious overlooking assistance" in the travel barriers of disabled people, which is due to the lack of public understanding of disabled people, failure to take reasonable measures when helping, and the higher social status and status of people without

disabilities compared to those with disabilities (Jijun and Tongtong, 2018), while people with disabilities have stronger self-esteem (Moon and Kim, 2010).

In addition to communicating with others, we should also leverage technology, a double-edged sword. The widespread adoption of remote work technology designed for people with disabilities has opened up possibilities for social inclusion. However, on the other hand, some people lack access to these technologies, which increases social isolation and exacerbates various forms of exclusion (Barden et al., 2023). Some studies have also focused on this issue, exploring how technology and social media can facilitate the integration of people with disabilities into social life. One study conducted a qualitative analysis of social media users with hidden communication barriers, identifying four factors that affect users' disability/ability representation, and offering recommendations based on the findings.

Social media has a dual impact on strengthening and weakening social interactions for people with disabilities, thus we must utilize social media and social support networks correctly to enhance their social integration. In summary, our research aims to develop a user-friendly app for people with disabilities using social media platforms, providing a mutual aid platform for this community.

2.3. Assistance online platform for the disabled

With the popularity of smartphones, mobile applications can minimize the distance, time, and cost of accessing educational information and healthcare services, providing more possibilities for helping people with disabilities overcome many obstacles (Whitehead and Seaton, 2016). The World Wide Web Consortium (W3C)'s Web Accessibility Content Guidelines (WACG) mention that the main types of disabilities include visual impairment, hearing impairment, movement impairment, and cognitive impairment (WCAG, 2018). Many electronic devices are developing related auxiliary functions for people with hearing and visual impairments. For example, the vast majority of the rules for the accessibility function of IOS are aimed at visually impaired individuals. In addition to the built-in functions of the device, there are also some applications specifically developed for specific groups. For example, apps for people with visual impairments—"Be My Eyes", "Xiao Ai Bangbang", and Yun Tong volunteers. The usage of these three apps is similar. When someone asks for help, volunteers can help them identify objects and find things through videos; In terms of hearing impairment, there are applications such as "BuzzCards", "Live Transcribe", and "Yinshu" that provide functions such as translation, text translation, and sign language videos for hearing-impaired individuals; For disabled individuals with mobility disorders, there are smartphone applications such as "My Wheelchair Guide" aimed at providing basic information on wheelchair use and service provision for new wheelchair users, assisting wheelchair users in purchasing suitable wheelchairs on their own, and guiding them to use wheelchairs safely and effectively (Liu et al., 2018); The "EaseAccess" (EnA) application based on the Android platform can provide wheelchair assistance information, accessible maps, communication statements, and location distress signals for people with disabilities (Agarwal and Agarwal, 2019). In terms of cognitive impairment, software that helps individuals with autism use public transportation

(Rezae et al., 2020), mobile applications that help aphasic patients engage in non-phonological communication. There is a positive association between the use of mobile technology and the degree of social inclusion among adults with intellectual disabilities, suggesting increased access and usage of mobile technologies could lead to better social outcomes for this population (Martin et al., 2021).

However, most of the existing application software designs targeting the disabled population are still in the early stages, with many problems, such as low accessibility matching and poor daily operations. Taking Be My Eyes as an example, this software only provides the IOS version, which imposes certain restrictions on visually impaired individuals using the Android system. In addition, some apps that help people with visual impairments have weak voice interaction functions, which undoubtedly poses a challenge for those with more severe visual impairments.

In terms of technology acceptance, it is critical to ensure that the disabled population feels comfortable and secure using these applications. This involves not only user-friendly design but also ensuring that technology is accessible and practical for all types of disabilities. Furthermore, the ethical and privacy aspects of application development cannot be overlooked. It is essential to handle the data collected from users with disabilities with the highest level of confidentiality and integrity, ensuring their privacy is protected. When designing software targeted at the disabled community, ethical and privacy considerations are not just conceptually distinct, but also directly influenced by the technical underpinnings and the user interface of the application. These considerations entail ensuring that the application maintains the privacy and security of user data, adheres to ethical standards in technology deployment, and respects the rights and dignity of its users. APPA is a tool that helps users make privacy-enhanced decisions when installing apps. It evaluates app permissions, reviews, and privacy policies for compliance with privacy regulations like GDPR (Wettlaufer and Simo, 2019). Privacy-Enhanced BPMN integrates privacy-enhancing technologies into business process models to manage and analyze the flow of private information. (Pullonen et al., 2019).

In summary, after comparing existing apps targeting people with disabilities in the market, researchers believe that current application design mostly focuses on improving the comfort of people with disabilities in using electronic products and solving practical problems in life, while there are few software that focus on the social aspects and social integration of people with disabilities. Meanwhile, researchers have found that mutual assistance and communication among people with disabilities are beneficial in helping them solve psychological problems and alleviate negative emotions. This help model not only avoids the problem of "looking down to help" healthy individuals, but also allows disabled people to achieve self-identity through helping others on this platform, and effectively voice themselves on this platform, making their voices heard by more people. Based on this, our study aims to explore the real needs of the disabled population through a series of studies, and generate an information accessibility terminal product that has the above functions and is suitable for the disabled population. A holistic approach that simultaneously addresses the technical feasibility, user acceptance, and ethical and privacy concerns is essential for the successful deployment of mobile software. This integrated perspective ensures that the application not only functions efficiently but also aligns with user needs and ethical

standards, thereby fostering a sustainable and positive impact on the target user group.

3. Mixed-methods approach

Authors of previous studies tried to find the mobility difficulties of the disabled either based on statistical relationships or based on disabled people's opinions. Qualitative research helps to analyze the actual obstacles and inner thoughts faced by people with disabilities during travel (Corazon et al., 2019). Similarly, quantitative research can help investigate the overall appearance and basic situation of respondents (Burnett and Baker, 2001). Collecting, analyzing, and integrating quantitative and qualitative data can help to better understand this phenomenon (Fetters et al., 2013). Therefore, this study uses a mixed research method, combining qualitative and quantitative approaches with both disabled and healthy individuals. Employing a concurrent-convergent design, it gathers opinions on travel through open-ended questions and examines recognition and inclusion issues via close-ended questions. This balanced approach allows for a comprehensive analysis, comparing perspectives and identifying misconceptions about disabled individuals among the healthy population. The study aims to understand the cognitive gap between these groups and factors affecting disabled individuals' mobility, ensuring data validity, reliability, and credibility for robust findings (see **Figure 2**).

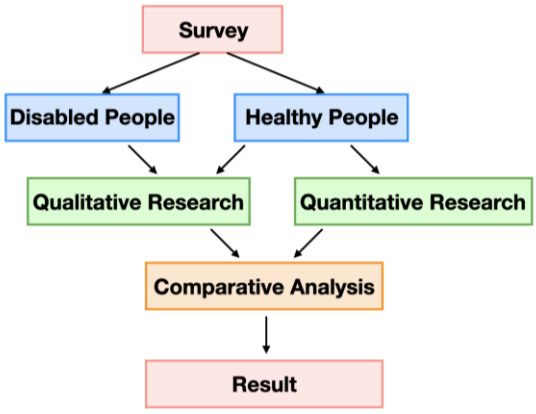

Figure 2. Design diagram of the research study.

4. The qualitative phase of the study

In-depth interviews are essential to understand people's true thoughts and needs, as well as the public's perception of disability issues, which is crucial for effectively addressing their most pressing concerns. Also, it was considered convenient and suitable as it enables one-on-one interviews between the researchers and the participants drawn from different backgrounds during data collection and other stages of this study (Creswell et al., 2017). Therefore, an exploratory case study research design was followed. In-depth interviews with open-ended questions were conducted after participants gave their ethical consent to participate in the study. The data adequacy in this study was informed by saturation point, which means there is almost no difference between the information provided by subsequent participants and the information provided by previous participants (Fusch et al., 2015). A total of 11 disabled individuals and 10 healthy individuals were conducted in-depth research,

with different genders, ages, occupations, etc. to ensure data validity. Essentially, the design provides an opportunity for in-depth interaction in the form of rephrased and follow-up questions to probe and explore participants' responses deeply on their standpoints about the current situation of integration of disabled people into society and travel barriers. The answers from open-ended interviews were consolidated and transcribed verbatim in typed format. And then a discourse analysis was used for thematic data analysis, that is, to study the structures or functions of underlying themes from participants' responses (O'Halloran et al., 2015). This approach is often referred to as a views-based analysis. Coding/annotation techniques are an ideal method for segmenting and organizing relevant information, which can aggregate large texts into a network graph to visually present the relationships between specific information. This technology is also suitable for generating cognitive points about the social participation of people with disabilities based on the participants' ideas.

4.1. Interviews with people with disabilities

In the interview stage with people with disabilities, this study contacted influential disabled people on online platforms and social media, who are actively speaking up for the disabled on platforms like Weibo, WeChat, TikTok, etc., trying to improve the status quo of the disabled through personal efforts. 11 disabled interviewees were selected with quite different personal conditions but typical representativeness. **Table 1** summarises the total sample from whom data was collected for the study.

Table 1. Basic information of interviewees with disabilities.

Personal information				
Pseudonym	**Gender**	**Age**	**Occupation**	**Disabled parts**
Melody	Female	17	Student, UP owner	Lower limbs
Leo	Male	18	Social media blogger	Lower limbs
Amy	Female	22	Student	Lower limbs
Lisa	Female	18	Student	Eyes
Julie	Female	81	Retired	Lower limbs
Betty	Female	32	Social media video blogger	Brain
Joan	Male	30	Unemployed	Brain
Helen	Female	16	Student	Spinal cord
Tom	Male	36	Project planning manager	Eyes
Eden	Male	32	Internet company employee	Brain
Dylan	Male	34	Social media video blogger	Eyes

In the summary following the in-depth interviews, the views of disabled people about barriers to social integration were analyzed using discourse analysis. These views were categorized into the following four dimensions.

4.1.1. Direct barriers to independent travel

Due to physiological impairments, limited mobility, and decreased vision and hearing, their work and lives are affected. They require assistance from others when

going out for medical appointments or shopping; they need accessible facilities at work; and they need sign language to communicate...

> *"In public places, other people either avoid me or pretend not to see me, very few people take the initiative to lend me a hand. Even when they help, they often do so in a condescending way. Sometimes I receive indifferent or even weird looks from passers-by, and I feel like an outsider."*

Some interviewees have physical deformities and need assistance to move; their speech is unclear, making communication difficult. They often receive indifferent treatment in public places and encounter condescending assistance. It can be seen that inaccessible facilities are the main reason hindering disabled people from traveling alone, and condescending assistance is the straw that breaks the camel's back, preventing them from traveling independently, which in turn prevents disabled people from truly integrating into society.

4.1.2. Reluctance to be seen as a vulnerable group

Many interviewees have a strong sense of self-esteem and do not want to be defined by society as a vulnerable group to receive help. They would prefer to try their best to help others within their capabilities. Some respondents have faced various environmental restrictions since childhood, such as needing assistive devices to move and limited ways of communication. Through their own efforts and the support of their families, they can still lead independent lives. This ability and experience of independence allow disabled individuals to build a sense of self-worth and confidence. However, being treated as a vulnerable group by society tends to undermine this sense of self-worth.

> *"Once I excitedly went to a popular bookstore to check-in, but was blocked by a sign at the entrance saying 'wheelchairs and other mobility aids that may occupy the passage are prohibited from entering, please deposit them at the entrance'. Upright walking and wheelchair walking are both normal ways to get around, there is no problem of one hindering the other. I want to appeal to the public: I look forward to the day when 'barrier-free access' will no longer be labeled as 'individual cases'."*

When society defines people with disabilities as a "group in need of help", they feel resentment internally—because they are already used to rely on themselves, not needing others' pity and charity. Some people with disabilities are even more reluctant to be seen as "the weak" after getting a job. They have obtained their job with their own capability, able to support themselves and their families. Although facing all kinds of obstacles at work, they are not willing to give up, and still want to compete in the workplace. Being labeled as a "vulnerable group" would severely dampen the enthusiasm and work passion of these people with disabilities.

Some other people with disabilities demonstrate a strong willingness to help others. They take initiative to participate in volunteer activities. For example, some people with mobility impairments would use online platforms to do publicity and help those in need; some others would go to orphanages or nursing homes, spending time accompanying those lacking care and affection. Such proactive acts of helping others come from their empathy, and is also a way for people with disabilities to redefine themselves, from being helped to helping others.

4.1.3. Relying on the Internet to meet needs

Visually impaired interviewees have certain difficulties in communicating with and obtaining information from the outside world due to their sensory defects. But in the online world, they can learn about surrounding information through voice synthesis, subtitles, and other assistive functions. They can also freely express their own thoughts without psychological barriers caused by limited means of communication.

It is noteworthy that the Internet has become the main platform for socializing among disabled youth. Some interviewees with mobility impairments find it hard to participate in offline activities. Through social applications and interest communities, they have made many friends online. These friends do not discriminate against them because of their disabilities. Disabled young people can find like-minded friends online and obtain ideological and emotional support. They can obtain needed goods or food delivery services without leaving home, not only saving time and energy for traveling, but also avoiding potential inconvenience and discrimination (see **Figure 3**).

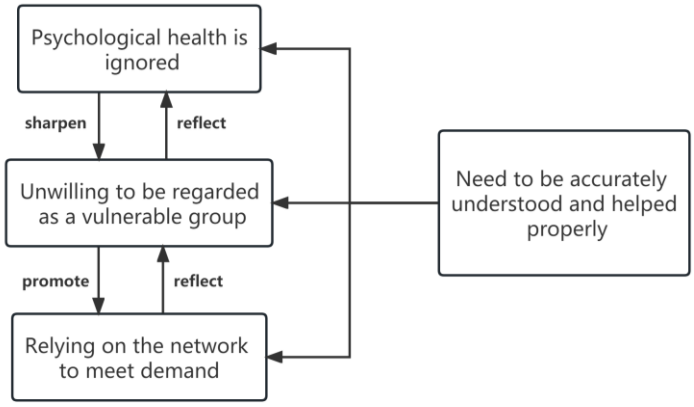

Figure 3. Interview results with people with disabilities.

4.2. Interviews with people without disabilities

In the interview stage with people without disabilities, this study adopted in-depth interviews to explore the public's attitudes towards people with disabilities, as well as their views on volunteer service and the app itself. Through online recruitment advertisements, 10 interviewees were recruited in a purposive sampling approach, including people of different ages and occupations without disabilities. **Table 2** summarises the total sample from whom data was collected for the study.

Table 2. Basic information of interviewees without disabilities.

Personal information			
Pseudonym	**Gender**	**Age**	**Occupation**
Jack	Male	16	Student
Louis	Male	20	Student
Barbara	Female	23	Actuary
Shirley	Female	32	Teacher
Emily	Female	38	Engineer

Table 2. (*Continued*).

Personal information			
Pseudonym	**Gender**	**Age**	**Occupation**
Johnson	Male	44	Accountant
James	Male	42	Teacher
Ava	Female	60	Teacher
Susan	Female	68	Retired
Sam	Male	65	Retired

After the interviews, four dimensions were summarized:

4.2.1. Attitudes towards people with disabilities: Willing to help despite limited contact

Under the influence of an inclusive and equal social atmosphere, more and more people are willing to care for people with disabilities, understand their needs, and take initiative to help them. Many interviewees said that although they rarely encounter people with disabilities in daily life, if they see someone with mobility impairments, they would take the initiative to go up and offer a hand, and actively ask if help is needed. When encountering people with hearing or speech impairments, they would patiently listen and try to communicate through gestures or writing.

> *"I almost have no contact with people with disabilities in my daily life. I feel their number is small and they should be a special minority group. So, I haven't paid much attention to or thought about their problems in life. I think the government should have provided adequate measures to support their self-care abilities, so they shouldn't have too many difficulties."*

Through the in-depth interviews, we learned that most healthy people have almost no contact with disabled people. They generally believe the government would provide necessary assistance for the disabled, without needing to consider barriers for them to live in society. But a small number of healthy people have contacted and taken initiative to help the disabled in daily life. We found that the public, especially young people, expressed willingness to participate in volunteer services to provide convenience for the disabled, such as explaining bus routes and stops regularly for the visually impaired, building ramps for wheelchair users during weekends, etc.

4.2.2. Cognition of apps for assisting the disabled: Endorsement of concept but limited participation

Over half of the interviewees in this study were aware of or had heard of some mobile apps or other electronic devices developed for people with disabilities. They all expressed that these are very meaningful in helping the disabled integrate into society.

> *"I've heard of and seen some apps and devices designed to help people with disabilities, such as apps that can convert text to speech output to help visually impaired friends obtain textual information. Or some communication translation tools to assist friends with hearing impairments, etc. I personally strongly approve of and support the development of such apps."*

However, when observing the actual usage of these products, it turns out the level

of participation is not high. In this study, nearly 60% of interviewees admitted using related software rarely or never to facilitate the lives of the disabled.

The reasons are mainly: firstly, the public's understanding of the needs of the disabled still stays on the surface, without forming true empathy; secondly, merely endorsing the concepts ideologically is not enough to motivate most people to invest time and effort; thirdly, there may be defects in related services and products themselves that are not close enough to user needs.

To better benefit the targeted users, it is necessary to increase public understanding of the disabled and cultivate true empathy. At the same time, design more convenient and interesting ways of participation to attract engagement of disabled groups in product design and needs research.

4.2.3. Expectations for the app itself: More practical and close to daily life

According to the interview data, the research team found that currently there are still relatively limited software and products developed for people with disabilities, with only a handful that can truly change their lives. On one hand, there are limitations in the coverage of such software, many real needs of disabled groups have not received attention, and the power of technology has not been fully leveraged. On the other hand, even for some existing applications, there are high usage barriers and high requirements for user training, so there are still difficulties in truly promoting adoption. It can be said that the potential and space for using information technology to improve lives of the disabled have not yet been fully tapped. Developers still need to continue efforts to develop more reliable, easy to use, and affordable products, fully empowering people with disabilities through technology, so that every friend with disabilities can enjoy life autonomously and with dignity (see **Figure 4**).

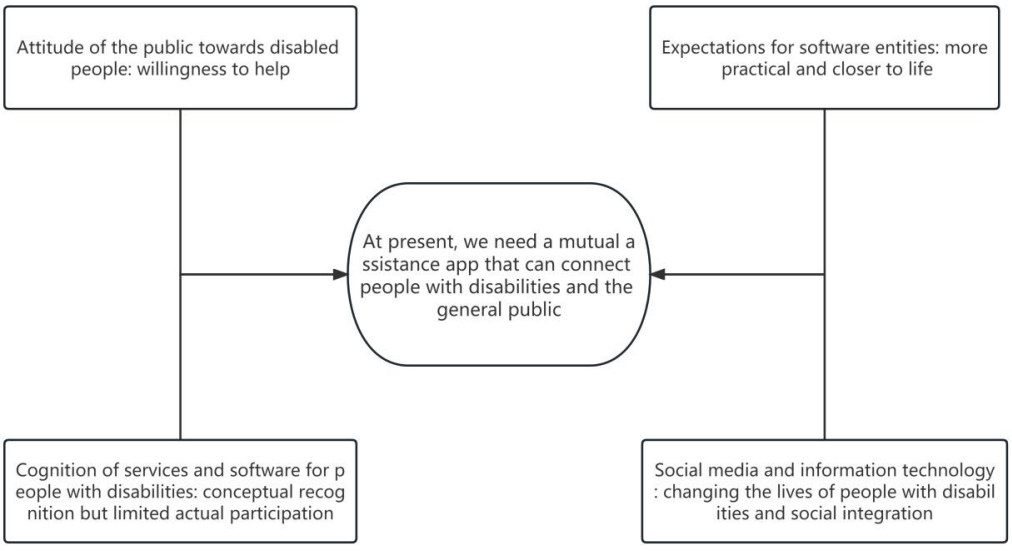

Figure 4. Interview results with people without disabilities.

4.3. Discussion

This study interviewed people with and without disabilities about their views on barriers and assistance for the disabled to integrate into society, aiming to obtain comparative data on the concepts and cognition of both sides using a mixed methods approach, which can help draw better conclusions. The answers from disabled people

and healthy people to the open-ended questions are put in one table (see **Table 3**) for side-by-side comparison, to integrate perspectives from both sides and understand the relationship between the cognition of disabled people and healthy people on issues related to the disabled. Through comparison, it is found that there are differences in cognition between disabled people and healthy people in aspects such as status quo of lives of the disabled, barriers in going out, assistance processes, etc. But both sides consistently expect the development of an assistance app tailored to the practical needs of people with disabilities. Traditional research on issues of the disabled has focused solely on disabled people themselves. Through this study, we have discovered the cognitive gap between disabled people and healthy people. As the main group in society, healthy people play a key role in leading social development and operation, so their cognition and attitudes towards the disabled are crucial for building an inclusive society. Therefore, we further conducted large-scale data research oriented at the healthy population to gain an in-depth understanding of their cognition of the disabled.

Table 3. Answers from disabled people and healthy people to open-ended questions.

Disabled people	**Healthy people**
1) More willing to travel alone, but current objective reasons make it impossible to travel alone, reducing the frequency of going out.	1) Think disabled people are a minority and have little contact with them.
2) Inconvenient to go out due to poor barrier-free facilities, hindering non-essential daily activities.	2) Ignore living difficulties of disabled people and think there shouldn't be too many unreasonable issues.
3) Dislike asking healthy people for help due to condescending assistance that makes them feel disrespected, resulting in inability to go out alone.	3) Rarely interact with disabled people, but very willing to help, and give full respect, care and assistance.
Both look forward to assistance apps tailored for disabled people.	

5. The quantitative phase of the study

5.1. Research method

At present, research methods such as text analysis and field observation are often used to investigate the attitudes of the general public towards people with disabilities. On the basis of mastering the current research status, the researchers have determined the research objectives in the form of a survey questionnaire, which includes the public's understanding and understanding of disabled people, as well as their willingness to assist them. In the questionnaire, they also inquire about the public's views on the design of disabled app, providing a research basis for later software design. The purpose of using hybrid methods in this study is to further confirm qualitative results and obtain new valuable conclusions through large-scale quantitative data. The integrated data obtained using hybrid methods can help to draw better conclusions (Bergman, 2018). Considering that the final outcome of the study is an online platform, and the youth group has a wider exposure and understanding of internet information, in order to ensure a more representative and effective sample, the subjects of this study selected young people aged 18–30. The data was collected between June and July 2022 and disseminated through social media and the internet. A questionnaire survey was conducted on young people aged 18–30, collecting and analyzing their attitudes and willingness to assist the disabled group.

In terms of data analysis methods in this study, our initial descriptive analysis was conducted to organize and assess the survey data, focusing on frequencies and percentages to uncover underlying trends and distributions. Subsequently, principal component analysis (PCA) was utilized to reduce the dimensionality of the data, revealing that the first principal component accounted for the majority of the variance, suggesting that several survey questions might reflect a broader latent factor. Cluster analysis further divided the sample into three distinct groups, enabling the identification of characteristic differences in attitudes towards disability issues among different social groups. The questionnaire's internal consistency was evaluated using Cronbach's Alpha, with a value of 0.751 indicating good reliability. Additionally, factor analysis was applied to assess the interrelations and centrality of the survey items, followed by regression analysis to predict behaviors such as the frequency of participation in disability assistance activities, based on factors identified by PCA. These analytic methods provided a robust framework for testing hypotheses and understanding public perceptions and behaviors towards individuals with disabilities.

5.1.1. Research questions and hypotheses

The core issue of this study is how the public perceives and attitudes towards the group of people with disabilities, and whether they are willing to help them through various channels, such as online or offline. After operationalizing this definition, the researchers raised other related research questions:

- The level of understanding of people with disabilities among social groups.
- The channels through which social groups establish daily connections with people with disabilities.
- Social groups are more inclined to assist disabled people with assistance and support activities.
- The frequency of social groups willing to help people with disabilities.
- Social groups' understanding of the difficulties faced by people with disabilities in their daily lives.

Considering the above issues, we propose the following research hypotheses:

H1. Social groups have less contact with people with disabilities in their daily lives.

H2. Social groups hold a positive attitude towards assistance activities for disabled groups.

H3. Social groups have limited understanding of people with disabilities, and there is even a huge gap.

The data collected from subsequent research samples will be applied to validate the above hypothetical statements.

5.1.2. Samples and participants

A total of 306 questionnaires were ultimately collected. After screening 6 invalid questionnaires such as short filling time and logical issues, a total of 300 valid questionnaires were collected.

5.1.3. Questionnaire design

In the questionnaire, gender, age, place of residence, and educational background are independent variables, while the dependent variable is the dimension of the

measurement object, namely: the level of understanding of disabled people, willingness to participate in volunteer activities for disabled people's assistance, and understanding of the living status of disabled people. In order to understand the level of understanding of social groups towards disabled groups, the questionnaire used the Likert 5-level scale and formulated three sentences. The participants selected different sentences based on their own situation to match their own, that is, their agreement, ranging from "strongly disagree" to "strongly agree" (Q1–Q3). In addition, in order to confirm the specific situation of the connection between the subject and the disabled and lay a foundation for subsequent design work, if the subject selects relevant options for understanding or close communication with the disabled in the questionnaire questions Q1–Q3, an additional topic will be set to study the channels through which the subject and the disabled can establish a connection (Q4). The questionnaire also conducted a survey on the social group's preference and willingness to participate in volunteer activities for helping people with disabilities (Q5–Q7). Afterwards, two open-ended questions were set up in the questionnaire to understand the current living difficulties of people with disabilities in the eyes of social groups and their views on "why it is difficult to see people with disabilities in daily life". At the end of the questionnaire, basic information about the subjects was inquired about, such as gender (Q10), age (Q11), city (Q12), and highest education level (Q13).

To determine fewer and more accurate questionnaire questions, a preliminary survey was conducted on 15 participants after completing the questionnaire design. The pre survey results and reliability and validity analysis showed that no issues were found in the specific distribution form and completion process of the questionnaire. After making minor adjustments to the questions, the researchers formed the final questionnaire.

Table 4 are the specific questionnaire question settings:

Table 4. Questionnaire specific question settings.

Number	Dimension	Specific problems
Q1	The level of understanding of people with disabilities among people	I am very familiar with disabled people.
Q2		I have some disabled people around me (relatives/classmates/neighbors, etc.).
Q3		I have had close communication with people with disabilities before.
Q4		What channels did you establish contact with people with disabilities through?
Q5	Willingness to participate in volunteer activities for helping people with disabilities	If you had the opportunity to participate in volunteer activities that care for people with disabilities, which type of activity would you prefer?
Q6		Would you choose to participate as a volunteer if you recruit volunteers on wired platforms and organize activities such as helping/comforting disabled people around you?
Q7		How many times are you willing to participate in disability assistance/condolence activities per month?
Q8	Cognition of the current living situation of people with disabilities	What difficulties do you think people with disabilities may face in their daily lives?
Q9		The total number of people with disabilities in China has exceeded 85 million, but we rarely see them in our daily lives. What do you think is the possible reason?
Q10	Personal information	Your gender
Q11		Your age
Q12		Your city
Q13		Your highest education level

5.2. Descriptive analysis

After organizing and analyzing 300 questionnaire data, the results are shown in **Table 5**:

Table 5. Q1–Q4 questionnaire results.

N° questions	Results (%)
Q1	Strongly disagree: 34.46%; disagree: 21.64%; neutral: 23.52%; relatively agree: 15.14%; strongly agree: 5.24%
Q2	Strongly disagree: 37.26%; disagree: 27.01%; neutral: 13.27%; comparatively agree: 14.12%; strongly agree: 8.34%
Q3	Strongly disagree: 32.83%; disagree: 31.62%; neutral: 20.93%; comparatively agree: 10.79%; strongly agree: 3.83%
Q4	Online promotion: 12%; introduction from friends and classmates: 16%; social volunteer organization promotion: 60%; other: 28%.

We first calculated the Cronbach's Alpha, mean, and variance for these four questions. The results were as follows: Cronbach's Alpha of 0.751; mean for Q1 is 3.96 with a variance of 0.43, mean for Q2 is 3.92 with a variance of 0.44, and mean for Q3 is 3.95 with a variance of 0.39. From the above data results, it can be seen that only 20.38% of the respondents believe they understand the group of people with disabilities. Therefore, H1 is validated. Most social health professionals are not actually familiar with and generally have less contact with people with disabilities. This reflects the communication gap between the two groups of health and disability in society.

We first conducted a principal component analysis on the data for the first three questions, with the results indicating that the first principal component explains about 77.7% of the variance, meaning it captures most of the variability in the data. The second and third principal components explain 15.1% and 7.2% of the variance, respectively. Therefore, most of the information is concentrated in the first principal component, suggesting that there is a very significant feature or pattern in the data.

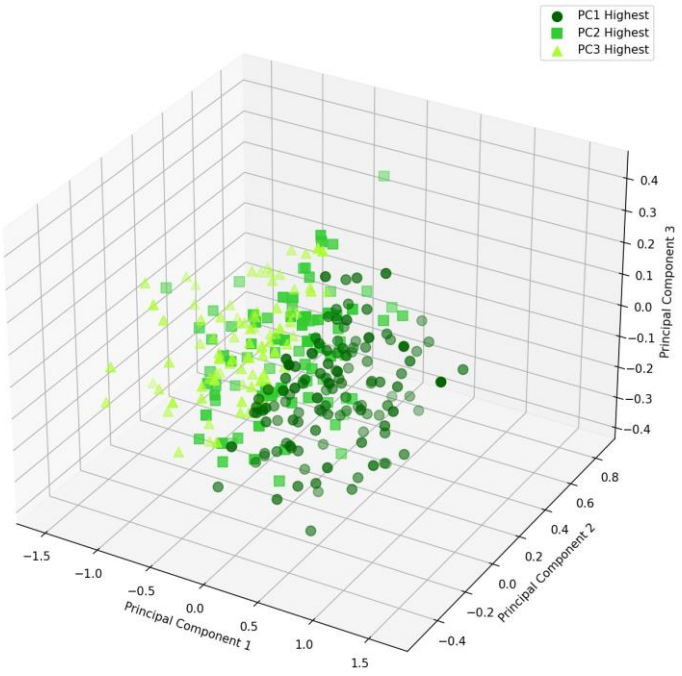

Figure 5. 3D PCA results.

Following the reduction in the number of features through PCA, we performed a cluster analysis. According to the elbow method, three clusters were identified as the optimal choice. Number of members in the clusters: Cluster 1 contains 139 samples, cluster 2 contains 92 samples, and cluster 3 contains 69 samples. Distribution of clusters: The number of samples in each cluster shows that cluster 1 is the largest group, while cluster 3 is the smallest (see **Figures 5–7**). This reflects the major differences in features among the different groups.

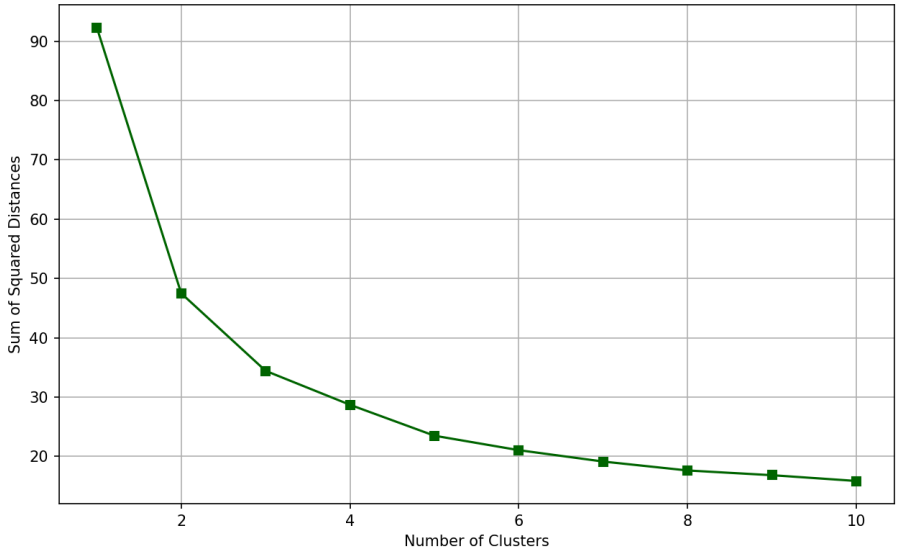

Figure 6. Elbow method for determining optimal number of clusters.

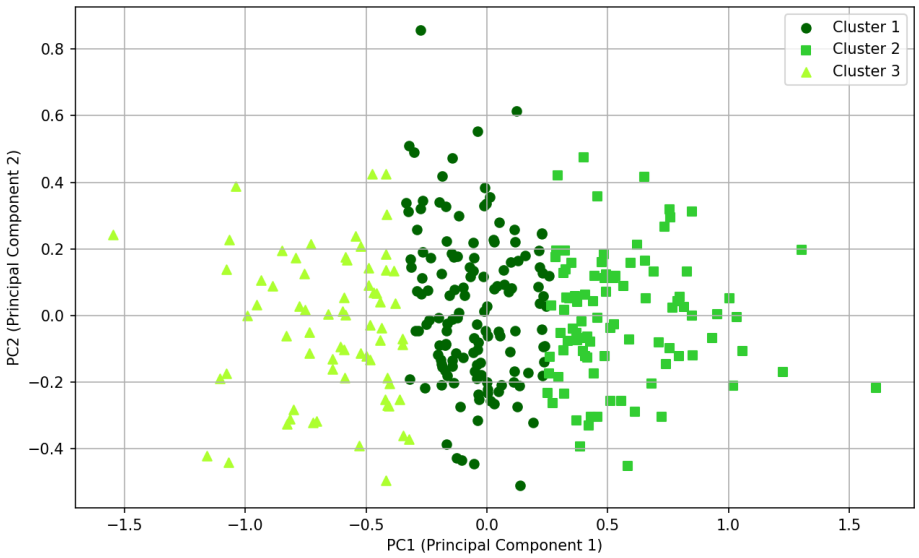

Figure 7. Cluster distribution on PC1, PC2 and PC3.

In addition, the promotion of disabled groups by social volunteer institutions is the main way for social groups to understand the lives of disabled people. It can be seen that the disabled group has a relatively small voice in the online world, and internet platforms pose an invisible barrier for them. It is difficult for them to effectively voice themselves on internet platforms and make their voices heard by more people.

From **Table 6**, it can be inferred that H2 is supported. The general public is willing to help disabled people and hopes to extend a helping hand to them. It can be seen that on the one hand, the public lacks understanding of disabled people, and is not clear about their types of disabilities and their differences. The difficulties and needs of different groups with disabilities are not the same. On the other hand, the general public has not realized that in reality, people with disabilities face not only material difficulties, but more challenges in terms of social participation and mental health.

Table 6. Q5–Q7 questionnaire results.

N° questions	Results (%)
Q5	Direct donation: 41.04%; offline assistance/condolence for disabled people: 41.79%; participation in relevant promotional parties or activities: 15.67%; others: 1.49%
Q6	Yes: 75.37%; no: 24.63%
Q7	1–2 times: 77.23%; 3–4 times: 20.79%; 5 or more times: 1.98%

We also calculated the Cronbach's Alpha, mean, and variance for these four questions. The results were as follows: Cronbach's Alpha of 0.81; mean for Q5 is 3.62 with a variance of 0.41, mean for Q6 is 3.78 with a variance of 0.40, and mean for Q7 is 3.86 with a variance of 0.41. We conducted factor analysis on the data for Q5–Q7, and the results showed that the first principal component explained about 98.5% of the variance, the second principal component accounted for approximately 0.9%, and the third principal component explained about 0.6% (see **Figure 8**). The loadings for the first principal component were almost evenly distributed across the three variables, indicating that Q5, Q6, and Q7 are similarly important in this component.

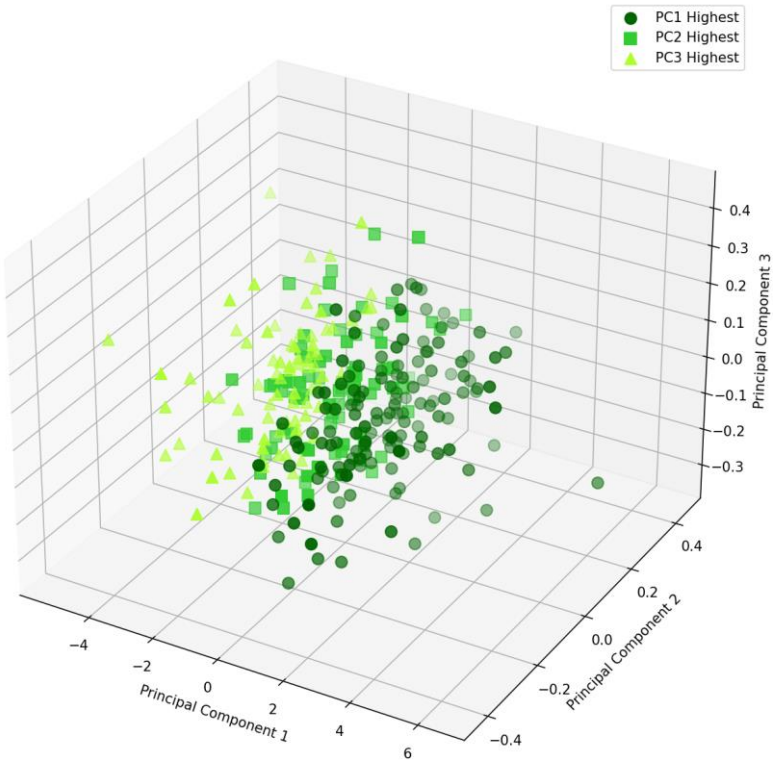

Figure 8. 3D PCA results.

Subsequently, we used the first two principal components as predictive variables for regression analysis on Q7. Due to the main influence of PC1 on Q7, the predicted values (red dots) generally follow the trend of the actual values (blue dots). Although the variance explained by PC2 is smaller, there is still a visible association between the predicted and actual values, although this relationship is not as pronounced as with PC1 (see **Figure 9**).

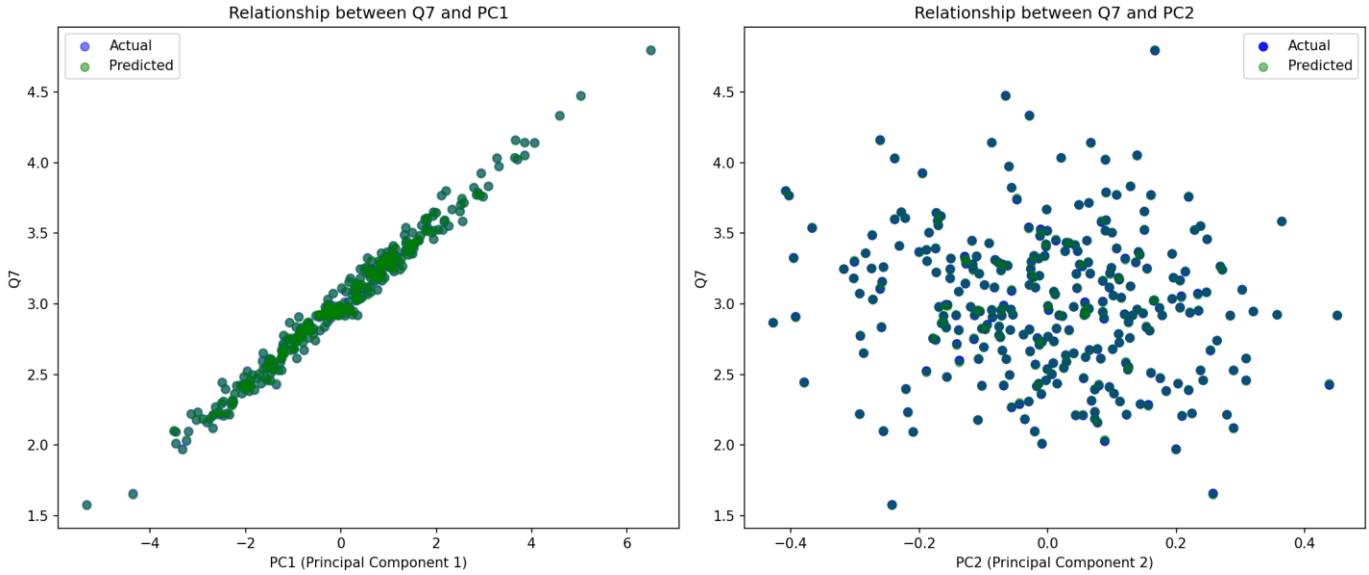

Figure 9. The regression of the two factors.

The coefficient for the first principal component is 0.287, and the coefficient for the second principal component is −0.405. We can construct the linear regression equation as follows: Q7 = 3.004 + 0.287 × PC1 − 0.405 × PC2.

The answer to open-ended questions validates hypothesis H3. In answering the open-ended question ‘What difficulties may people with disabilities face in their daily lives?’, many respondents mentioned terms such as employment, travel, and socializing, which are particularly common in daily news and publicity. And the participants also developed a shallow understanding of disabled people in such a “media environment”.

Regarding the issue of “the total number of disabled people in China has exceeded 85 million, but we rarely see them in daily life. What do you think is the possible reason?”, social health professionals generally express that they are not aware that disabled people rarely appear in public view, thinking that the number of simply disabled people is relatively small. When we conveyed to the participants that there were approximately 84.8 million people with the Chinese surname Zhang, which was similar to the total number of disabled people, but the probability of encountering the two on the street was completely different. The participants expressed that due to not seeing people with disabilities frequently, they did not pay much attention to the issue of people with disabilities rarely appearing in their field of vision, and further speculated that it may be due to their own inconvenience in going out, facing discrimination, communication problems, and incomplete accessibility facilities. However, apart from this, no participants mentioned the issue of healthy individuals’ ‘overlooking and assisting’ disabled groups. In in-depth interviews, we also learned

that in fact, some unintentional or unfriendly behaviors of healthy individuals towards disabled people also cause irreversible harm to them. This is a major reason why disabled people are unwilling to go out, and healthy people are not aware of this.

5.3. Discussion

The cohesion of social consensus on "volunteer services for the disabled" in China is still in a relatively loose stage, and society is generally facing difficulties such as a lack of integrated macro perspective, insufficient attention to the needs of disabled people, and insufficient social participation.

5.3.1. The public's impression and attitude towards people with disabilities

People with disabilities have always been classified as marginalized groups, and the mainstream of society lacks a true understanding of them. This kind of estrangement stems from the insufficient general education in society, and people with disabilities, as a minority group, rarely appear in the daily communication and knowledge of most healthy individuals. Few media portray the real living conditions of people with disabilities, and most stories and impressions still remain within a framework that requires care and sympathy from others. This unfamiliarity and misunderstanding result in two groups of people having their own social circles, with fewer daily interactions.

5.3.2. Volunteer assistance for social groups

The questionnaire survey shows that there are currently the following problems in the volunteer service of social groups: low service quality, lack of distinctive services, increased volunteer turnover rate, incomplete incentive and guarantee mechanisms for volunteers, lack of long-term and normalized services, and mismatched professional abilities of volunteers. These issues may lead to the stagnation of public assistance to disabled groups at the level of willingness.

The key to truly helping lies in eliminating misconceptions and changing the conceptual framework for people with disabilities. Society should provide more opportunities for contact and communication to truly understand the needs and possibilities of people with disabilities, and eliminate vague impressions of them. Only by starting from understanding can the general public provide aid to people with disabilities and promote social inclusion and diversified development. In these situations, building a bridge to communicate with disabled groups is crucial.

6. Results and discussion

6.1. Accessible facilities cause numerous conflicts among people with disabilities

The phenomenon of people with disabilities not liking to go out is becoming increasingly serious in developing countries. The true needs of people with disabilities cannot be known to a wider audience, making the design of accessible facilities even more unreasonable. This creates a vicious cycle of disability issues in developing countries, leading to a series of existing conflicts among people with disabilities.

Taking China as an example, first of all, due to the lack of full understanding of the disabled, accessibility facilities in public places in China are not perfect. The lack

of humanized design has dampened the enthusiasm of Chinese disabled people to travel alone. Therefore, we seldom see disabled people in our daily life, which leads to the subconscious use of disabled people's travel as an example. Therefore, the barrier free facilities in the society are increasingly ignored. It is precisely because of these inhumane designs that people with disabilities are increasingly unwilling to go out alone. There are fewer people with disabilities in society, and accessibility facilities are less valued, ultimately forming a dead cycle caused by design issues (see **Figure 10**).

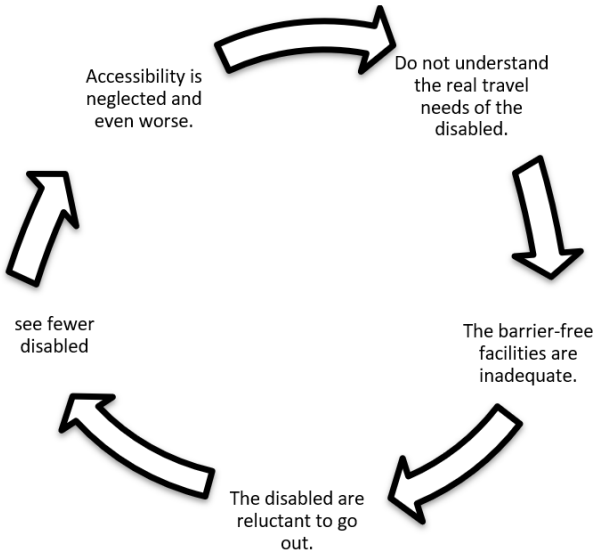

Figure 10. Schematic diagram of the vicious cycle.

6.2. The gap between disabled and healthy individuals

In our research, we found significant psychological barriers and communication barriers between disabled individuals and socially healthy individuals. Due to a lack of understanding of disabled people, even if they are eager to provide aid, some seemingly harmless "looking down to help" behaviors often harm the self-esteem and personality of disabled people. Furthermore, social assistance often manifests as excessive protection and compassion, exaggerating the difficulties of people with disabilities. This sense of superiority brings stigma and shame to people with disabilities. Finally, due to the lack of understanding of the living conditions of people with disabilities, social figures have misconceived their abilities and needs. And then provide unrealistic ways of help. These behaviors actually negate the status of disabled individuals as dignified individuals. Although out of goodwill, it brings a sense of being treated as an object rather than a subject to help disabled people, causing psychological barriers.

6.3. The survival of persons with disabilities from the perspective of disabled people

Among the disabled people interviewed, almost everyone mentioned that they do not want to receive help from others, do not want to be seen as a special person by others, but rather want to become a person who helps others. They do not like to be seen as a weak person who needs too much help, labeled as "a vulnerable group", and

yearn for equal and just treatment in society. Although disability brings them physiological and functional limitations, people with disabilities are not only satisfied with living on the margins of society as beneficiaries, but are more willing to become helpers by leveraging their unique abilities to help others.

And this model of material or spiritual mutual assistance for disabled people can not only promote their own better development and realize their self-worth, but also help society raise attention to disabled people and improve their broad tolerance. Therefore, researchers believe that the mutual assistance model for people with disabilities can be effectively promoted.

We can provide a unique platform for mutual assistance and exchange for disabled people through various diversified support methods and policy interventions, and provide a platform for interaction, communication, and self-worth realization for disabled people. On the platform, in addition to normal volunteers, disabled individuals can form their own communities for daily communication, share their difficulties or negative emotions, share experiences, and solve physical problems in life. At the same time as providing a communication platform, expand the voice of people with disabilities, so that they can anonymously put forward suggestions for improving the living conditions of people with disabilities, such as accessible facilities or social environments, that they are unwilling to communicate and express, and provide timely responses, effectively enhancing the sense of happiness for people with disabilities. On the other hand, strengthen the content review of the platform, and provide professional psychological counseling or effective intervention for disabled individuals if negative emotional abnormalities are found. The above is the preliminary idea of the research result app “AbleMind”.

7. App design and introduction

7.1. Overall function introduction

The research further developed the APP—AbleMind. The core objectives of this platform are “resolving mental health issues of the disabled”, “building a mutual assistance platform for the disabled”, and “building an influential platform for the disabled to speak up”. It builds an exclusive community for the disabled to facilitate deeper understanding and inclusion of the disabled by healthy people. the product mainly consists of four functions, including “homepage”, “community”, “suggestions” and “me”. In addition, there are also clear access screening mechanisms, incentive mechanisms, and security mechanisms. Specific contents are shown in **Figure 11** below:

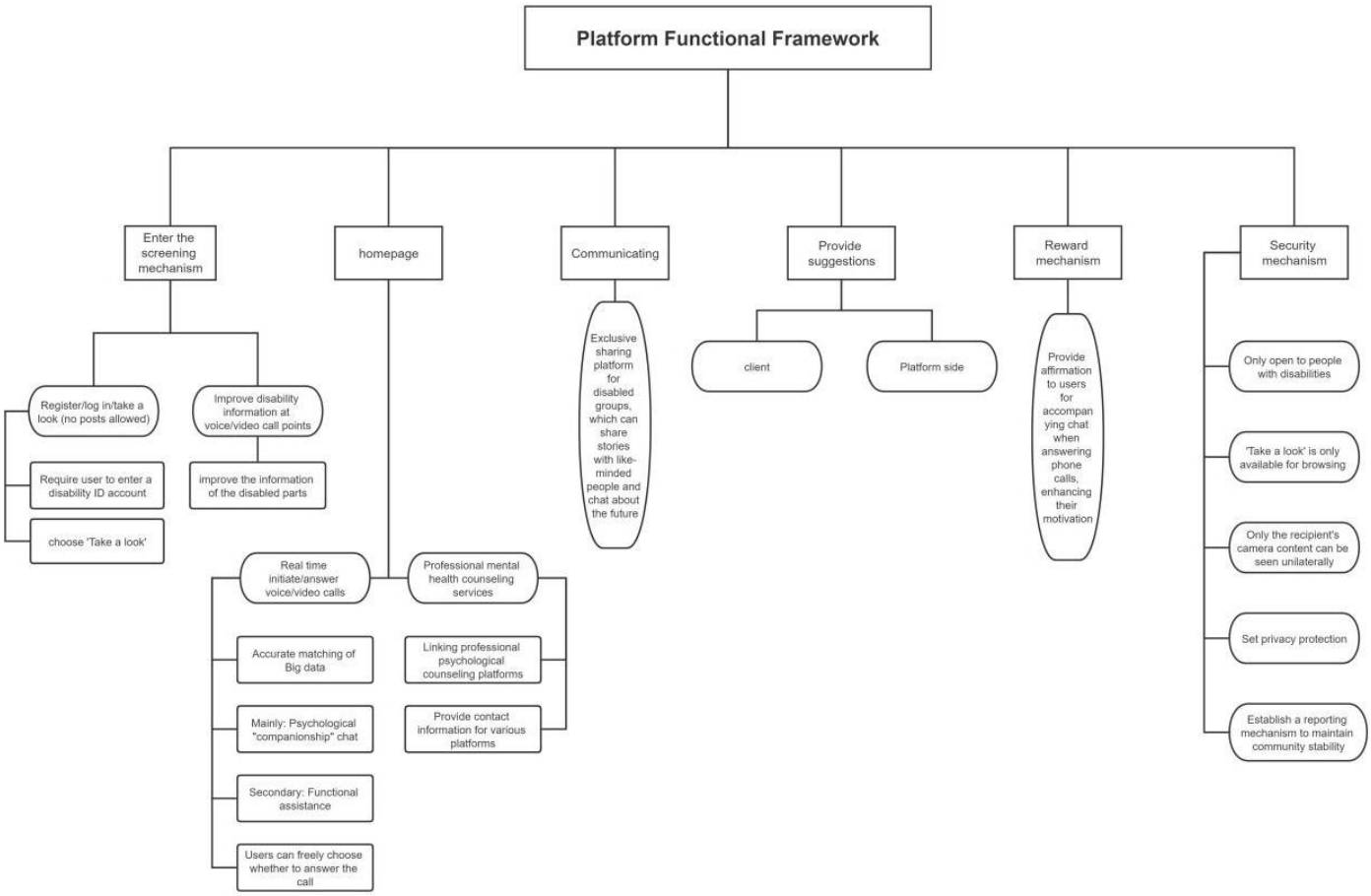

Figure 11. Overall framework of the platform.

7.1.1. Login page for two groups

On the login page, we set up two versions—"Get Help" and "Provide Help", for users to choose their identity, i.e., people with disabilities or the general public. The pages and functions after entering the app will be different for people with disabilities and the general public (see **Figure 12**).

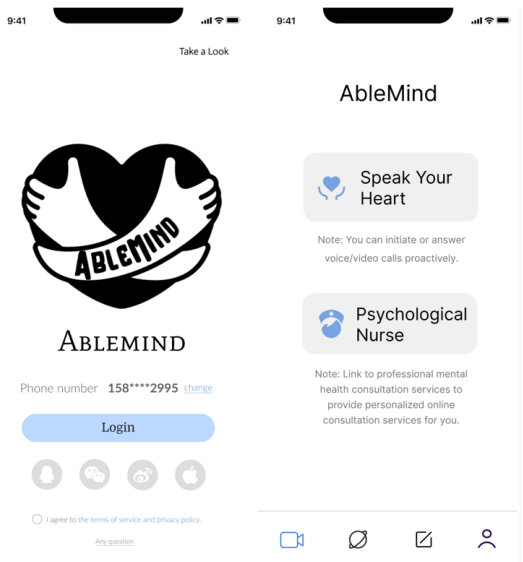

Figure 12. Login interface of the App.

After selecting identity, users with disabilities need to enter their disability account for identity authentication; of course, the "Take a Look" function can also be chosen. They can supplement relevant information about their disability area through voice input in the App.

7.1.2. Homepage and community

After entering the app, the user sees the homepage. Users with disabilities can have real-time chats with strangers in the general public through precise big data matching, to discuss difficulties or troubles in life, and express their feelings. The public can provide support, encouragement to users with disabilities, and offer possible assistance or suggestions. Users with disabilities can also proactively ask for help from the public, e.g., care in daily life, support when going out, etc. The chat interface supports communication through voice, text, images and more (see **Figure 13**).

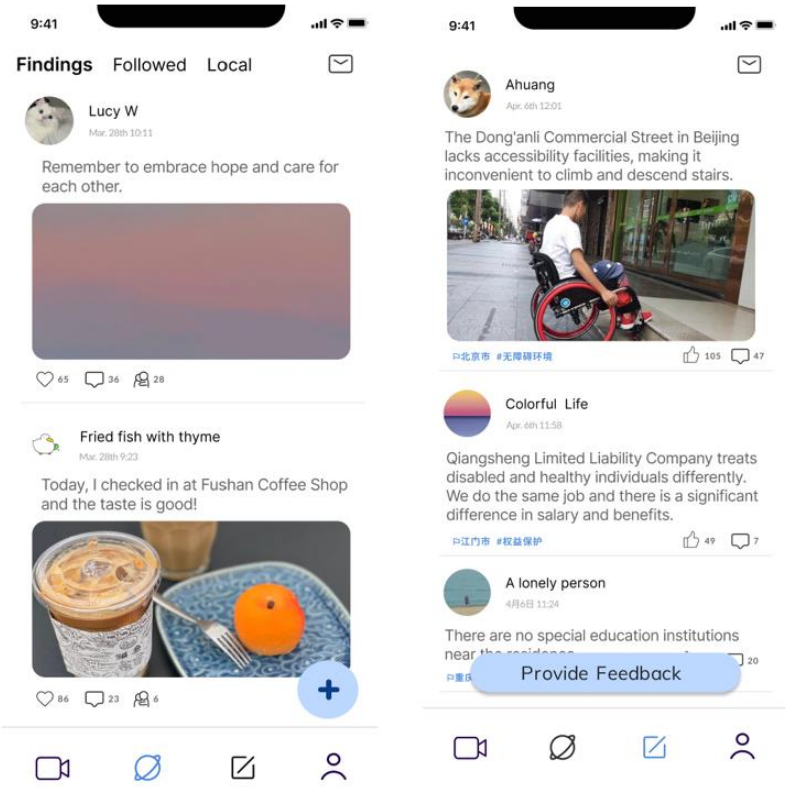

Figure 13. Homepage and community interface.

For general public users, the main interface after entering the app showcases information of disabled people in need of help. The general public can choose who they want to help based on their capacity, and connect with them directly in the app. The app provides real-time matching—when a disabled user posts a request, suitable members of the public will receive real-time notifications.

For users with disabilities, after entering the app, they can choose to communicate one-on-one with psychological nurses through online chat or video. The psychological nurses all have professional psychological consulting certifications, and receive specialized training on counseling for the disabled. The app provides regular online appointment functions for the disabled to choose and schedule sessions with

psychological nurses based on their needs.

7.1.3. My tree hole

There is an anonymous "Tree Hole" feature in the app. In the tree hole, users with disabilities can express thoughts, share stories, discuss problems anonymously; other disabled users can also interact, provide support and advice in the tree hole, resonating with each other (see **Figure 14**).

The app utilizes voice recognition and synthesis technology, supporting both voice and text to access the tree hole which lowers the barrier for use.

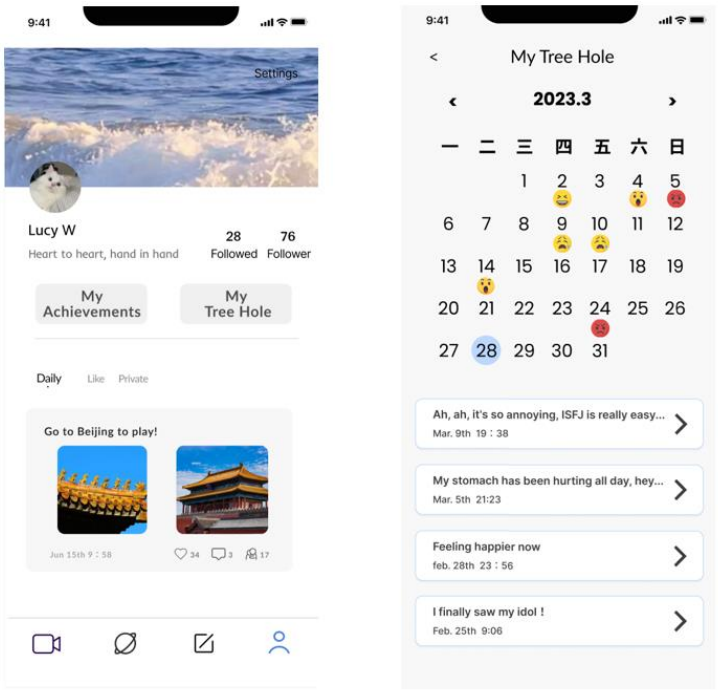

Figure 14. Interface of the My Tree Hole.

7.1.4. Suggestions feature

In the "Suggestions" section of the app, users with disabilities can propose improving opinions and optimization suggestions regarding inconveniences and barriers encountered in daily life, going out for medical treatment, using public facilities, etc. Other users can discuss and optimize these opinions. The app team will regularly aggregate these online opinions into reports and maintain close communication with relevant government departments, as well as regularly organizing offline forums.

Through this combination of collecting suggestions online and submitting reports offline, the "Suggestions" function of the app allows the voices of the disabled to be better heard by government departments and all sectors of society.

7.1.5. Incentive and security mechanisms

The app has a points and medals system to encourage mutual assistance. The general public and people with disabilities can earn points by interacting in the app, which can be exchanged for medals in the app: members of the public who help more will earn medals like "Enthusiastic Volunteer", disabled users who share more stories

will earn medals like “Storyteller”, etc. (see **Figure 15**). These points and medals system aims to increase interactivity of the app and motivate more communication between both sides.

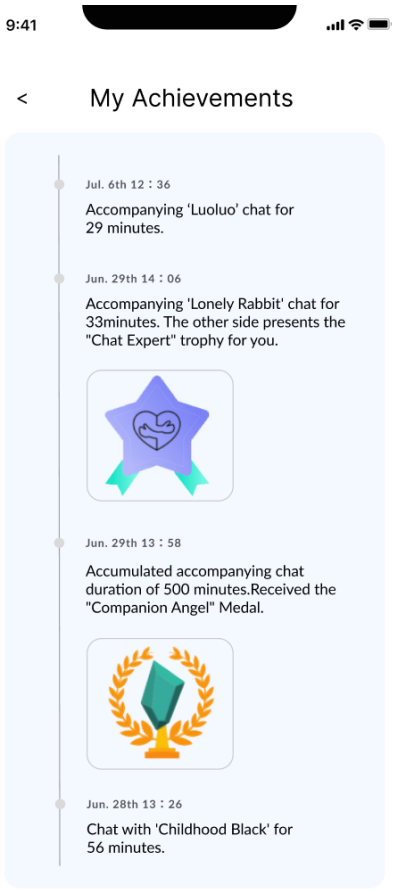

Figure 15. Interface of incentive points and medals.

7.2. Evaluation

The app “AbleMind” has three main functional highlights: Firstly, users can conduct personalized matching with the same/different disability types through real-time voice or video calls, to find more empathetic listeners, or be empowered helpers; Secondly, the platform also provides a link to professional psychological therapists, who can facilitate communication as a third-party, or be invited to join, to better improve mental health of the disabled; Thirdly, the “Suggestions” feature of the platform builds a bridge for communication between the disabled community and the general public, so users can anonymously raise issues and demands, which helps enhance sense of security and well-being for the disabled. Building this innovative “Disabled + Mutual Assistance + Mental Health” model contributes to differentiated competition and higher user retention.

7.3. Discussion and next steps

As an app helping the disabled achieve communication and socializing, “AbleMind” has the following main functions: First, the expression function. Users can post personal needs and thoughts through text and voice, which facilitates the

disabled to express their true hearts and achieve their speech intentions. Second, the needs matching function. It allows users of the app to obtain others' help or provide help, through matching between needs and capabilities, enabling effective interaction. This provides a channel for the disabled community to obtain social support. Third, the interaction function. In the "community" module, users can interact with each other. Disabled users can obtain understanding and support, while ordinary users can also share insights and experiences, promoting communication. Fourth, the personal sharing function. "My Tree Hole" enables private sharing. Disabled users can confide emotions, while ordinary users can obtain first-hand information to understand the disabled experience. Fifth, the achievement accumulation function. The "my achievements" module records personal progress, motivating users to keep taking action. This helps enhance self-efficacy and social confidence for disabled users.

In summary, "AbleMind" app effectively promotes social integration for the disabled community through enabling expression, needs matching, sharing and interaction, transmitting achievements etc. User feedback also shows its functional design meets the needs of the disabled. In addition, our app also plans to establish a long-term partnership with online platforms launched by Chinese disabled organizations, which will enable more people with disabilities to benefit. In the future, "AbleMind" will be combined with China Disabled Persons' Federation and launched on major platforms. Overall, the specialized function design of the "AbleMind" app tailored for the disabled effectively facilitates their social integration. But as functions continue expanding, user experience should be further improved with a focus on simplicity and ease of use, in order to benefit more people with disabilities.

8. Conclusion

This research has identified significant gaps in the social integration of persons with disabilities in developing countries, particularly through the lens of the accessibility challenges and social perceptions that limit their participation in community life. The findings revealed a vicious cycle where the lack of humane design in accessibility infrastructure and the unintentional overlooking of assistance by non-disabled individuals perpetuate barriers that hinder the mobility and social engagement of persons with disabilities.

This research adopted questionnaires and in-depth interviews to conduct a pre-study for the "AbleMind" app development, soliciting public opinion and examining feasibility. Our research subjects covered people of all ages and occupations in society; at the same time, we focused on the disabled themselves to discuss feasibility of developing the "AbleMind" app. Research shows the general public holds an open attitude towards the "AbleMind" app, recognizing its potential role in improving lives of the disabled. People with disabilities also have a positive attitude towards the app, and look forward even more to it practically resolving actual needs of the disabled. The research predicts that after official launch, the "AbleMind" app can promote deeper public understanding of the disabled, and willingness to participate in assisting the disabled will also increase. The "AbleMind" app will improve quality of life for the disabled, allowing them to obtain more care and assistance, and will also become an important platform for the disabled to communicate and share experiences with

each other. Overall, the "AbleMind" app will drive societal attention to the disabled, and facilitate better integration of the disabled into society. "AbleMind" has the potential to foster greater societal inclusion by enabling persons with disabilities to navigate their environments more independently and express their needs and thoughts more effectively. This tool not only addresses the physical barriers faced but also encourages a more empathetic understanding between disabled and non-disabled communities, thereby contributing to bridging the cognitive gaps identified.

Of course, this research also has some limitations. While the interviews provide qualitative insights, the questions might have been limited in scope or depth, potentially missing critical aspects of the users' experiences and needs. Our interviews might have involved participants who are more accessible or willing to engage, which may not fully represent the diverse experiences and opinions of the broader disabled community. Future studies could enhance the interview protocol by incorporating feedback from initial rounds and consulting with disability experts to cover broader themes and deeper issues. The research has a limited trial scope, which may not adequately represent the global diversity of the disabled community, especially those in rural or underdeveloped areas who might face unique challenges. Expanding the trial to include a wider geographical and cultural spectrum could provide more generalizable data and insights, helping to tailor the software more precisely to meet diverse needs. Our questionnaire might not have reached a sufficiently diverse audience, especially considering the varying degrees of accessibility challenges among different disabled groups. Question clarity and relevance: Questions in the survey may not accurately reflect the nuances of the daily experiences of all types of disabilities. Future research should aim for a more stratified sampling strategy to ensure representation from all relevant subgroups within the disabled community.

Technically, the functional design of the app still needs further optimization, differentiated design based on characteristics of different disabled groups, expanded trial scope, and continuous improvements. In addition, willingness of the disabled to use the "AbleMind" app remains to be observed, necessitating further research. Looking ahead to the future, this research is just a first attempt at paying attention to the needs of the disabled and promoting their social integration. Follow-up studies can build on this research to continue exploring how to better leverage new technologies to meet the needs of the disabled and improve their quality of life.

To sum up, the research contributes to the academic discourse on disability and social integration by highlighting the necessity for comprehensive and empathetic approaches to infrastructure and community programs that consider both the physical and social inclusion of persons with disabilities. It is hoped that the insights gained from this research will prompt further investigation into effective strategies for enhancing the lives of persons with disabilities, promoting not only their mobility but also their rightful place as equal participants in society.

Author contributions: Conceptualization, XM and MG; methodology, XM, MG and JT; software, MG and JT; formal analysis, XM, MG and JT; investigation, MG, JT, YZ and YY; data curation, MG and JT; writing—original draft preparation, MG and JT; writing—review and editing, XM; visualization, MG and JT; supervision, XM; project administration, XM; funding acquisition, XM. All authors have read and

agreed to the published version of the manuscript.

Funding: This research work was financially supported by the Fundamental Research Funds for the Central Universities, grant number CUC230B004.

Acknowledgments: This research was incubated by the University Student Innovation and Entrepreneurship Training Program, so thanks to the University Student Innovation and Entrepreneurship Training Program, and the authors acknowledge all participants of this study and thank them for their voluntary participation. Deepest thanks to the China Disabled Persons' Federation (CDPF).

Conflict of interest: The authors declare no conflict of interest.

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