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Design of Internet Rehabilitation Service System with Individual Assessment Data for Autistic Children

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Abstract. As a subtype of pervasive development disorder, autism has unknown cause of disease and no completely rehabilitated cases to date. However, in the golden intervention period from 2 to 6 years old, scientific rehabilitation training may significantly improve the condition of the children patients. Therefore, in professional and timely initial assessment, diagnosis and continuous treatment, data continuity is of great importance to the rehabilitation service of autistic children. But, a lot of reasons such as shortage of professionals, irregular industry and limited coverage of rehabilitation institutions make professional and timely assessment and rehabilitation services not available to autistic children. In combination with the approach of designing an interactive service system, the application practice of the rehabilitation service system with individual assessment data of autistic children being the core in the internet environment was introduced in this article.

Keywords: Autism · Verbal behavior assessment · Rehabilitation training · Interactive design · Service design

1 Introduction

1.1 Background

Autistic disorder, also known as autism, is a subtype of pervasive development disorder. It is difficult for autistic patients inherently to establish normal emotional association with people in the surrounding environment, mainly featured by different levels of linguistic development disorder, interpersonal communication disorder, narrow interest and stark behavior mode. According to the Centers for Disease Control and Prevention, the incidence is 1/68. Based on our estimation, in China, there are more than autistic patients, including about 3 million children aged between 0–14 years old [1]. In view of great socioeconomic burden caused by autism has become a significant public health issue of common concern. Autism has unknown cause of disease and no completely rehabilitated cases to date. However, in the golden intervention period from 2 to 6 years old, scientific rehabilitation training may significantly improve the condition of the
children patients. Therefore, in professional and timely initial assessment, diagnosis and continuous treatment, data continuity is of great importance to the rehabilitation service of autistic children. But, a lot of reasons such as great base of children patients, shortage of professionals, irregular industry and limited coverage of rehabilitation institutions make professional and timely assessment and rehabilitation services not available to autistic children.

New generation of internet has provided new development motives to social services, bringing about innovation in service mode. Unlike previous typical public benefit activity or charity donation, social innovation in the new era emphasizes the solution of social issues by utilizing new technological methods, innovative business mode, rigorous organizational behavior and people-centered service philosophy while realizing sustainable development of both the industry and all institutions.

1.2 Objectives

IngCare Project is just a social innovative project targeting initial assessment screening and rehabilitation data service under the guide of new technologies and concepts. By utilizing the internet platform, IngCare Project tries to establish a standardized, easy-to-use, far-reaching expert assessment and individual training data system which offers professional and efficient screening and treatment recommendations to all autistic children patients, including suspected people, in a timely manner, establish related Internet education and information service platforms on such basis, face with the pain points of the industry and reshape the industrial ecology through multi-discipline integrated innovation, thus rapidly improving the overall level of Chinese rehabilitation industry of autistic children and bringing health and happiness to autistic children and their families.

2 Status Quo and Related Studies

2.1 Related Domestic and International Studies About Autism

In 1943, Dr. Leo Kanner from US pioneered in offering the first autism case study in the world through clinical observation of 11 children [2]. After decades’ in-depth research, a relatively mature rehabilitation theory system and approach in international community, such as TEACCH (Treatment and Education for Autistic and related Communication Handicapped Children), which was structured education carried out by Eric Schople from North Carolina, US in 1972, mainly for linguistic communication disorder among autistic children; ABA (Applied Behavior Analysis) is a branch system of psychology proposed and proofed through scientific experiment by Professor, B. F. Skinner, from psychology department, Harvard University at the earliest. It mainly discusses the function of environment in behaviors, with an aim to facilitate behaviors beneficial to society by changing surrounding environment. It has been extensively applied to areas such as special education (treatment of autism included) as a practical science; Floor-time, which was a game therapy created by Stanley Greenspan, an American psychiatrist and encouraged parents to sit on the floor and strengthen
communication and exchange through games with children being the center and adults being the guide and assistant; and PECS (Picture Exchange Communication System), which was a linguistic communication system specifically designed for patients with language retardation (including autism patients). The biggest feature of the system was to allow language retardation children to express their inner minds through pictures and strengthen their communication with other persons.

2.2 New Research Trend with Support of Information Technology

The development of new generation of information technology is also supporting the innovation in the rehabilitation approach of autistic patients. Aids such as smart robot, interactive media game, APP, VR technology have been tried in China and internationally, resulting in certain rehabilitation effect. For instance, Acumen remote video autism therapy [3] (see Fig. 1) aims to assess and manage neurological disorder, introduce video observation, diagnosis and treatment concept through remote guidance such as video and website, and establish an information digital platform among children patients, families and doctors.

![Fig. 1. Acumen remote video autism therapy.](image)

However, in the meanwhile, the development of related products is still encountered with a lot of difficulties due to its own complexity of autism and unknown cause of disease. Like the foregoing mobile terminal APP as a new healthcare rehabilitation education means, there are up to 500 types available in app store. Few proved to be effective for rehabilitation scientifically, Acumen is one of a very few effective cases. In addition, existing digital products that support the rehabilitation of autistic children mostly are standalone ones and specific to local problems. To date, there is no systematic authoritative rehabilitation service product system available.
2.3 Status Quo of Domestic Use in China

Currently, more than 1000 special education institutions have been open that offers autism rehabilitation training throughout China. However, these institutions of different scales distributed in different regions are of varying quality. Many of them lack in systematic service mode and scientific regular assessment and rehabilitation service system, frequently causing inaccurate and incomplete assessment of autistic children, delayed optimal rehabilitation training period and consequently limited rehabilitation effect. Whereas rehabilitation teachers play a very important role in the entire rehabilitation education process, industrial faculty is greatly short relative to large demand, and high-level professional rehabilitation teachers who receive systematic education and have abundant experience are of critical shortage. It can be seen that in addition to rehabilitation technology and medical difficulty, the industrial ecology not effectively organized and regulated is also an important factor that restricts industrial development and the improvement of overall rehabilitation level.

3 Design of Internet Rehabilitation Service System Based on Special Assessment Products

3.1 Difficulties and Breakpoints for Autism Rehabilitation

Though we have had relatively deep understanding of the autism, the rehabilitation of autistic children internationally remains a difficulty, which is dependent upon the complexity of autism and individual difference of autistic children.

Firstly, many studies tried to find out the cause and mechanism of the autism, the cause of disease remains unclear and it’s hard to launch a rehabilitation product that is specific to autism and has single effect. Secondly, a series of assessment and rehabilitation therapies specifically developed for autism in the international community have achieved certain effect, single product cannot adapt to most children patients due to wide individual deviation among children patients, and the rehabilitation treatment requires face-to-face specific training with experienced rehabilitation teachers, resulting in limited efficiency and popularity. Thirdly, verbal behavior capability of children has a lot of complex dimensions. In the book The Verbal Behavior Milestones Assessment and Placement Program, Dr. Mark Sundberg identified 170 milestones and 900 skills. Therefore, it is a great challenge for every rehabilitation teacher on how to familiarize and master the assessment of children’s capability and take appropriate rehabilitation training methods specifically.

Rehabilitation courses or products that show significant effect for every autistic patient are not available in the market, and we have difficulty in developing and popularizing them with our current understanding and technology level. Rehabilitation treatment of the autism seriously depends upon experienced rehabilitation teachers and its core essentially is a kind of service. During our in-depth understanding and research, we have gradually found that in such an industrial ecology, data regarding professional children assessment and diagnosis and children’s capability description remains the foundation and core of subsequent rehabilitation service. The acquisition of such data
was seriously relied upon few highly-competent experts in the past, and such data could not be circulated and conveyed among experts, rehabilitation teachers, parents, schools, institutions and communities, resulting in reduced value. Therefore, an expert assessment data platform based on internet connectivity may definitely offer important support to the entire industry. In view of such background, we proposed the design of internet rehabilitation service system with assessment data of autistic individuals being the core and we would like to drive the integrated innovation in the autism rehabilitation industry through the service system idea and approach.

3.2 Structure of Internet Rehabilitation Service System for Autistic Children

Through analysis of each link of autism rehabilitation service and in combination with features and pain points of the autism industry as well as current technological system features, we built an internet rehabilitation service system with assessment data of autistic individuals being the foundation and core (See Fig. 2).

The foundation and core of the system is the assessment product of autistic individuals “VB-MAPP Assessment Helper”. It is an internet-based online assessment aid developed by us through our cooperation with and authorization from Mr. MARK L. SUNDBERG, the author of VB-MAPP, an internationally authoritative verbal behavior assessment system, and our introduction of the assessment system into China. Through learning, rehabilitation teachers may use online service to complete the assessment of
autistic children and the system will automatically generate IEP (individual education program) to guide subsequent rehabilitation training.

In the meanwhile, we also launched an online cloud classroom about VB-MAPP system usage and autism rehabilitation training and engaged domestic famous authoritative autism experts to shoot online video courses for the purpose of popularizing autism rehabilitation education and training course system. Together with the cloud classroom, “VB-MAPP Assessment Helper” formed the data and education training support platform for the internet rehabilitation service system, which would provide data, education training and assistant product support service to healthcare institutions, families and virtual community, thereby forming the ecological system of rehabilitation service primarily.

For hospitals and other professional rehabilitation institutions, the system may provide training and professional qualification certification to professional rehabilitation teachers, and online “VB-MAPP Assessment Helper” service to various types of rehabilitation institutions, and based on above, offer smart classroom management, regulate training course systems, develop or improve courseware props and rehabilitation training assistant devices; for families, the system may provide training and assessment services to the parents of children patients and develop courseware and APPs suitable for family training; for virtual communities, the system may launch online forums, gather intelligence and enthusiasm from experts, teachers, parents and volunteers, make social publicity, facilitate integrated education, and offer rehabilitation training reservation management, and etc.

Meanwhile, data acquired by every product will be uploaded to a public cloud database, thus gradually forming the “Rehabilitation education database for autistic children”. Once the database has accumulated sufficient samples, we will be able to further conduct big data based analysis and research and summarize the rules, which in turn facilitate the research of the medicine itself and the overall integrated innovation and development of the industry.

3.3 Development of Core Products of Internet Rehabilitation Service System for Autistic Children

The core of the system is “VB-MAPP Assessment Helper” online assessment. It is a Chinese digital version of assessment system developed based on The Verbal Behavior Milestones Assessment and Placement Program. Its launch has changed the situation where only few professional assessment staff is available in the industry, thereby rapidly popularizing professional assessment.

Designed with high complexity, the product system involves 170 milestones and nearly 800 skill milestone assessment standards in 14 areas, as well as 24 types of disorder assessment and 18 transition assessment links. The design also used 1596 assessment pictures totally and assistant methods such as various types of real props and counting and timing, through which a comprehensive assessment was conducted on children’s verbal and behavior capability (see Fig. 3). Through careful analysis on function and usage flow, we mainly adopted linear interaction with diversified assistant tools to simplify the operation flow. Through iteration of multiple test versions, the product
preliminarily converts a very professional and complex assessment system into a simplified, personalized, semi-automated operation flow. Through labeling and graphic means and a series of digital assistant tools such as quick recording and timers, we have significantly improved the efficiency of individual assessment with specialty and scientific nature guaranteed (see Figs. 4, 5 and 6). As a result, the professional assessment that cost two or three days in the past only takes three or four hours now, thus greatly reducing the burden on teachers and children patients.

Fig. 3. VB-MAPP assessment system integrated with assessment table and assessment tools.

Fig. 4. Main screen of assessment menu: horizontal menu bar to realize autonomous switching among all links including milestone assessment, disorder assessment and transition assessment; longitudinal tab bar to realize quick recording function of assessment feedback; multi-tab display under Assessment closely associated with assessment tools. Click each table to realize the recording of assessment contents.
Fig. 5. Automatic scoring may be completed by the assessment staff through sliding correct assessment results from the left to the right assessment column.

Fig. 6. Use of assistant tools such smart timer.

Through online registration and cloud management, the product offers such services as online data storage, management and reservation, facilitating the connection among parents, assessment staff, experts and rehabilitation teachers (see Fig. 7). Upon completion of the assessment, the system will automatically generate VB-MAPP assessment result score form, assessment report and individual education program (IEP), facilitating the filing by users (see Figs. 8 and 9). Multiple assessment results may facilitate the comparison for the purpose of understanding the progress of the children.
Fig. 7. Online customer management system.

Fig. 8. Upon completion of the assessment, the system will automatically generate scoring scales such as milestone assessment, disorder assessment and transition assessment.
The system will automatically generate IEP “Individual education program” target push.

The product also reduces the learning difficulty and entry threshold for assessment staff, which allows more professional rehabilitation teachers to quickly master the use of the product and improve the assessment skills and efficiency, thus reducing social education cost of professional assessment and rehabilitation training teachers and quickly increasing the quantity and quality of teachers.

Through improved scientific nature, professionalism and efficiency, the product significantly improves the social coverage of autistic children assessment and rehabilitation service generally and offer important support to the improved overall rehabilitation service capability.

3.4 Research Results of Internet Rehabilitation Service System for Autistic Children

By the end of 2016, the system has offered training services to more than 6000 front-line rehabilitation teachers, accounting for about 30% among all Chinese front-line rehabilitation teachers. “Cloud classroom” has been viewed for 2.9 million times totally, thus reducing a lot of education and training cost and improving training efficiency for the society; once the WeChat public account was launched one year ago, specialized knowledge about autism published in the system has been viewed for 3.41 million times totally; online public benefit Q&A has solved 1712 problems for 1004 parents; “Virtual community” has released 71064 posts and 35,000 topics, has 13,100 registered members consisting of teachers, parents and institutions, and 10.21 million page views, making it one of the most important virtual knowledge communities about autism in China [4].
4 Conclusion

The internet rehabilitation service system with individual assessment data of autistic children being the core seems build a “value chain” system. What exist in the value chain is not independent individuals, but a system consisting of a series of activities which are connected with various bonds and mutually dependent, thereby maximizing the overall efficacy.

In the internet rehabilitation service system, every online, in-line or offline link shows mutually penetrated and associated trend. Finally, it gathers all indispensable links and penetrates and integrates base critical data service, thus forming a complete B2B2C internet service system incorporating such functions as customer management, teacher management, institution management, course management and database management. The system has changed the management and service mode of conventional autism rehabilitation and education, and built the ecology of brand-new rehabilitation service industry. It realizes simple and efficient information exchange among children patients, parents, teachers, families, schools and the society, allows more people to understand autism, develops more qualified rehabilitation teachers, makes the demands of more families with autistic patients be satisfied, allows big data resources to play a bigger role through data storage, mining and analysis, and facilitates the development of scientific research of rehabilitation medicine, thereby generally improving the system service level of the entire industry, and offering practical help to autistic children patients, families with autistic patients, and even the society.

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