

Designing Game-Based Asthma Rehabilitation Services for Children

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ABSTRACT

This study addresses issues such as low treatment adherence and strong psychological resistance during the rehabilitation process for children with asthma. It proposes a service design framework based on gamification thinking that integrates hardware devices and software systems. The framework aims to enhance children's participation in rehabilitation through entertaining interactive experiences.

Using the service design double diamond model combined with literature analysis, user journey maps, and NPS assessment methods, the study identifies core pain points in traditional rehabilitation products, such as a lack of interactive feedback, single training modes, and insufficient intelligence. The design incorporates a gourd flute-shaped hardware device that integrates breathing detection and nebulization treatment functions. Dynamic sensors convert breathing mechanics parameters into game commands, enabling children to complete lung function training through blowing-style interaction. The accompanying software system establishes a gamified reward mechanism combined with respiratory data visualization, forming a "detection-training-feedback" closed-loop system. User evaluations indicate significant recognition of the solution's functionality and product design, validating the effectiveness of gamified design in alleviating medical anxiety and strengthening treatment motivation.

This study provides an innovative, cross-disciplinary paradigm for designing rehabilitation services for children with chronic diseases. Future research should optimize ergonomic details further and deepen the dynamic adaptation mechanism between medical data and game content.

Keywords: Children's asthma rehabilitation products, service design, interaction design, gamified experience.

INTRODUCTION

Asthma is a common chronic inflammatory disease of the airways in children, and its exact causes remain unclear. However, research suggests that genetic, environmental, immune dysfunction, and airway inflammation factors may contribute to its development. The incidence of asthma in children has steadily increased and has become one of the most significant global health issues affecting children (Serebrisky & Wiznia, 2019).

In China, the prevalence of childhood asthma is also increasing, which imposes a significant burden on children's health and their families (Fan, 2015). Therefore, investigating the pathogenesis and preventive measures of childhood asthma is significant for improving children's health and preventing asthma attacks (Jin et al., 2017). Asthma treatment typically requires long-term medication and daily rehabilitation exercises to control the condition and alleviate symptoms; however, prolonged medication and rehabilitation training often lack fun and appeal for children, leading to a lack of initiative and enthusiasm for participation.

There is increasing evidence that negative psychological factors can trigger and exacerbate asthma symptoms. Recurrent asthma symptoms can also impact children's physical and mental health, so research on psychological interventions must consider the interaction between asthma's physiological and psychosocial factors. One study showed that anxiety levels (especially state anxiety) were significantly lower in the experimental group than in the control group (Chiang et al., 2009). The results indicated that combining self-management with relaxation breathing exercises reduces anxiety in children with asthma and improves health outcomes. This provides further support for using breathing exercises to manage asthma in children.

Gamified design applies game elements and mechanisms to non-game domains (He, 2025). By introducing the fun and challenges of games, gamified design can stimulate children's enthusiasm and initiative, enhancing their willingness and motivation to participate in rehabilitation training (Zhang et al., 2024). Therefore, designing gamified asthma rehabilitation products and services for children has become a valuable research topic.

This study aims to explore how gamified design principles and service methods can be used to create fun, interactive asthma rehabilitation products and services for children. To achieve this goal, an in-depth study of the characteristics and needs of pediatric asthma rehabilitation will be conducted. With this approach, children will no longer fear or dislike rehabilitation training. This will improve the participation rate and treatment outcomes of pediatric asthma patients, enhancing their quality of life and overall health.

RESEARCH REVIEW

Current Status and Limitations of Children's Asthma Rehabilitation Products

Asthma is a chronic respiratory disease requiring long-term, continuous, standardized, and individualized treatment. Several related products and services have emerged in the field of pediatric asthma rehabilitation. The most common products on the market that assist in the treatment of pediatric asthma fall into two main categories: exhalation testing and inhalation therapy (Chen,2023).

Peak flow meters are convenient, quick, comfortable, and accurate devices for measuring lung function. They are suitable for patients with asthma or chronic bronchial diseases and can be used to measure peak expiratory flow rate (PEF) for daily monitoring of their condition. Peak flow meters can be used to assess asthma severity and control levels, promptly detect declines in lung function, and encourage patients to seek timely medical attention. Peak expiratory flow is the maximum airflow velocity produced when a person exhales forcefully. It is an important indicator of lung function. Monitoring changes in PEF using a peak flow meter helps assess asthma control in children.

In the inhalation therapy category, commonly used devices for pediatric asthma include pressurized metered-dose inhalers, dry powder inhalers, and soft mist inhalers (Wang,2022). Pressurized metered-dose inhalers and soft mist inhalers are active devices, while dry powder inhalers are passive devices (He *et al.*,2023). Different inhalation devices are suitable for different age groups. Currently, drug therapy is the primary means of asthma rehabilitation services for children, including the use of inhaled and oral medications. These medications can effectively control asthma symptoms, but they cannot cure the disease. Breathing exercises are an important component of asthma rehabilitation services for children because they help patients improve lung function and respiratory control.

Although current asthma rehabilitation products for children form a complete ecosystem covering detection, prevention, and treatment, they still have the following limitations:

- (1) First, the interactive feedback mechanism needs to be upgraded. Existing products rely too heavily on one-way output forms, such as numerical charts, for training data visualization. They lack dynamic, interactive feedback, especially for children with short attention spans. These products fail to convert parameters, such as breathing frequency and airflow intensity, into gamified, instant reward mechanisms, which affects long-term training compliance.
- (2) Lack of intelligent guidance systems. Home products generally lack real-time error correction functions and cannot monitor training posture correctly. Compared to specialized hospital products, home devices have technical gaps in key areas, such as breathing rhythm guidance and error warnings. These gaps can lead to ineffective training over time.
- (3) There is insufficient innovation in training modes. The current market offers limited breathing training products that focus on breathing itself and neglect the user experience. Training methods are monotonous and lacking in fun.
- (4) Lack of communication. Effective individual and group rehabilitation training outcomes are positively correlated. However, most breathing training products are designed for single-user use and do not allow users to communicate with each other, which leads to a lack of psychological belonging.

Game Design Theory

Game-based design is a multidisciplinary field integrating creativity, psychology, user experience, and interaction design to create engaging, challenging, and appealing game-based experiences (Zhang *et al.*,2019). In pediatric asthma rehabilitation programs that incorporate game design, this design plays a crucial role in stimulating children's interest and engagement. This enhances their motivation to participate in rehabilitation and improves treatment outcomes. For example:

- (1) Fluent Experience: Designing fun yet moderately challenging activities and tasks in children's asthma rehabilitation can help them enter a state of flow, thereby increasing their participation in rehabilitation and improving treatment outcomes.
- (2) Reward Mechanisms: Various reward mechanisms can be designed for children's asthma rehabilitation, such as unlocking new game levels, earning virtual rewards, or character upgrades, to increase motivation and participation.
- (3) Competition and Cooperation: Designing multiplayer game modes that allow children to compete or collaborate with other patients increases interaction and socialization, thereby enhancing motivation and treatment outcomes.

In summary, game design theories and principles provide guidance for developing gamified asthma rehabilitation products and services for children. Applying principles such as flow experiences, reward mechanisms, and competition and cooperation makes it possible to design engaging, challenging, and attractive asthma rehabilitation games for children. This enhances their motivation and treatment outcomes.

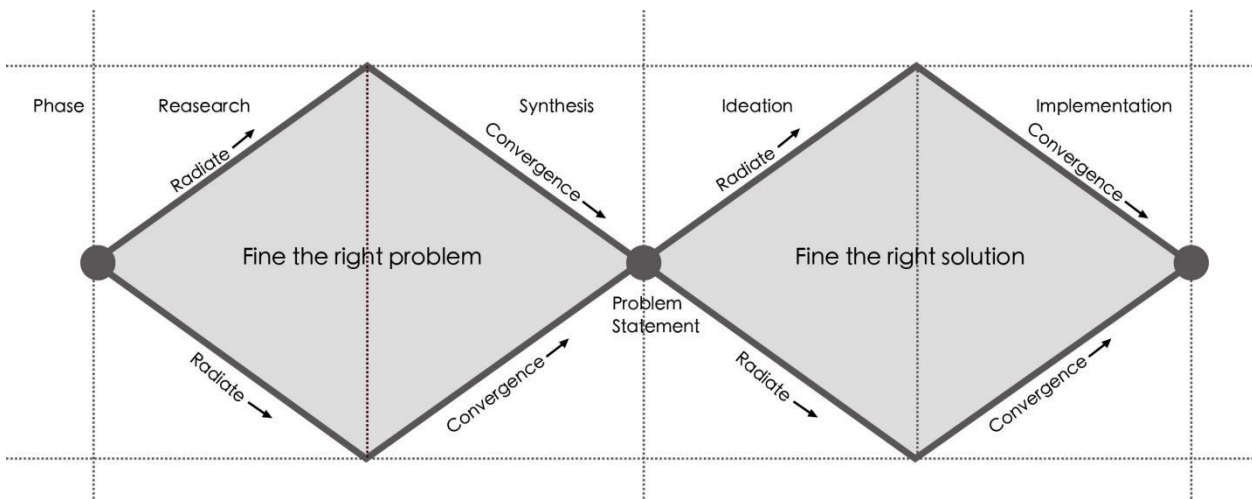
Service Design

Service design focuses on system-level construction, with its core lying in creating and optimizing service experiences (Xin & Cao,2018). Key elements include stakeholders (participants), touchpoints (interfaces between users and services), the service itself (core value provided), and the service process (steps for delivering the service). These elements interact to define the structure of service design with the aim of improving efficiency, usability, and satisfaction. Through a systematic approach, service design ensures consistency and coherence across stages, providing users with a high-quality experience.

The Double Diamond Model is a structured service design method that helps address four major challenges in the design process effectively (as shown in Figure 1):

- (1) Discovery phase/user needs research: In this phase, we gain deep insights into the problem by collecting information through extensive discussion and brainstorming. We clarify the research objectives and the scope of the problem. For example, we might design a rehabilitation product for children with asthma. Through interviews, observation, and research, we gain an in-depth understanding of the needs, expectations, and pain points of children and their parents. We collect user feedback and suggestions to better understand their needs.
- (2) Definition phase/summary stage: We focus on the problem, clarify its core, and lay a solid foundation for subsequent design. We organize and analyze the collected user data to identify common needs and problems. Create user journey maps based on user data to better understand user behavior and experience.
- (3) Development phase/concept design stage: Begin thinking divergently and exploring various possible solutions to generate ideas for the design. Based on user needs and problem analysis, generate ideas and propose a variety of solutions. Then, we select the most promising solutions and further refine the design.
- (4) Delivery phase/implementation stage: We determine the final solution and transform it into a product or service that meets user needs. We create a visual prototype of the conceptual design for validation and feedback from users and stakeholders. Through user testing, we allow users to experience the prototype firsthand and collect their feedback and suggestions.

In summary, the core of service design lies in creating and delivering services that closely align with user needs. This study will use the Service Design Double Diamond Model to efficiently deliver services and continuously optimize the user experience.



Source: Author created

Figure 1: The Double Diamond Model

RESEARCH DESIGN AND DESIGN PRACTICE

Discovery Phase/User Needs Research

To determine the current state of user needs for children with asthma, this study employed a systematic literature review of the PubMed, Web of Science, and CNKI databases using the keyword search terms "children's asthma" and "user needs." Three core needs were identified: product care standardization, physiological treatment needs, and psychological support needs. Additionally, in-depth interviews were conducted with four groups of asthma patients and their parents to gather user feedback. The primary objectives were to understand the usage of rehabilitation products and to uncover the latent needs of indirect users. Based on the results of the literature review and interviews, the study identified key issues related to services and parental needs (as shown in Table 1).

Table 1: User requirements table

User group	Physiological requirements	Psychological requirements
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Children with asthma	<p>(1) Rehabilitation needs Children with asthma require pulmonary function rehabilitation exercises from the time of diagnosis until recovery. Studies show that proper breathing exercises can improve pulmonary function and reduce the discomfort of asthma attacks in children.</p>	<p>(1) Confidence in Recovery Due to the long duration of asthma and the difficulty of achieving a full recovery, children with asthma often lose confidence in their ability to recover. The pain experienced during asthma attacks can also evoke negative emotions, causing patients to resist treatment.</p>
Parents of children with asthma	<p>(2) Product Usage Experience Requirements: Due to their incomplete physical and mental development, children's comprehension and practical skills are limited compared to adults'. Therefore, when using products, it is very important for children to have clear feedback, simple and smooth operating processes, and easy-to-understand user interfaces.</p> <p>Child Rehabilitation Care Because they are young, pediatric patients often struggle to manage and control their conditions. During this period, their parents usually coordinate their care. Therefore, it is crucial for parents to have a clear understanding of their child's rehabilitation progress and the measures being implemented to facilitate cooperation with the medical team in diagnosis and management.</p>	<p>(2) Self-actualization needs In the field of rehabilitation training, users hope to gradually achieve their goals and surpass their own expectations.</p> <p>Boosting Confidence in Recovery Asthma is a unique condition that requires a long course of treatment. During this time, parents and children often lose confidence in their ability to recover. Since children's emotions are easily influenced by their parents, it is important to boost parents' confidence during treatment. This will positively impact children and increase their confidence in recovery.</p>

Source: Author created

Definition/Summary Phase

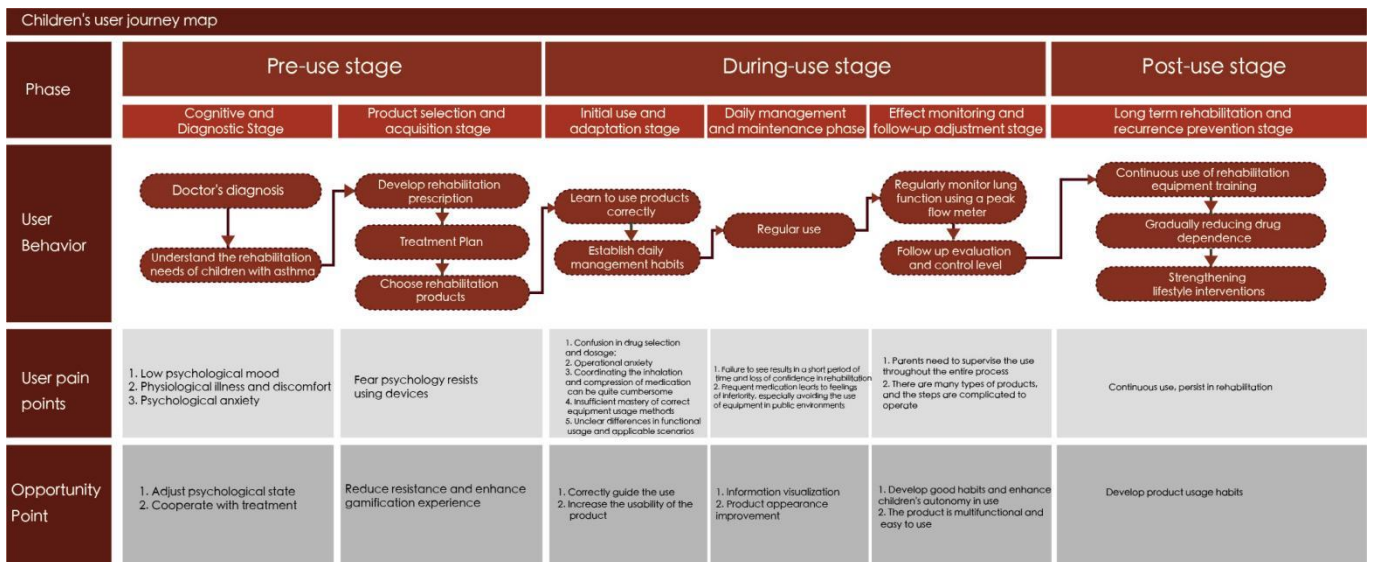
User journey map analysis

A user experience map is a visual tool that illustrates a series of users' key behaviors, emotions, needs, and pain points during their use of a product or service. It clearly shows the "pain points" users experience throughout the service process and suggests ways to improve the service (Howard, 2014). This study uses user experience mapping to understand the real-world experiences of children and parents using asthma products. It identifies potential issues and areas for improvement and optimizes product design and functionality to enhance user experience and satisfaction.

Children's user journey map

This study uses the user journey map methodology, based on prior literature and field research, to analyze the path of children's asthma rehabilitation product use in the following sequence: pre-use, during use, and post-use. Pre-use stage: Focuses on triggers and decision-making processes related to children's needs; During-use stage: Focuses on product interaction and maintenance of adherence.

Post-use stage: Extends to evaluating the effects and subsequent behaviors. As shown in the figure 2, the emotional state of children with asthma fluctuates from treatment preparation to completion.

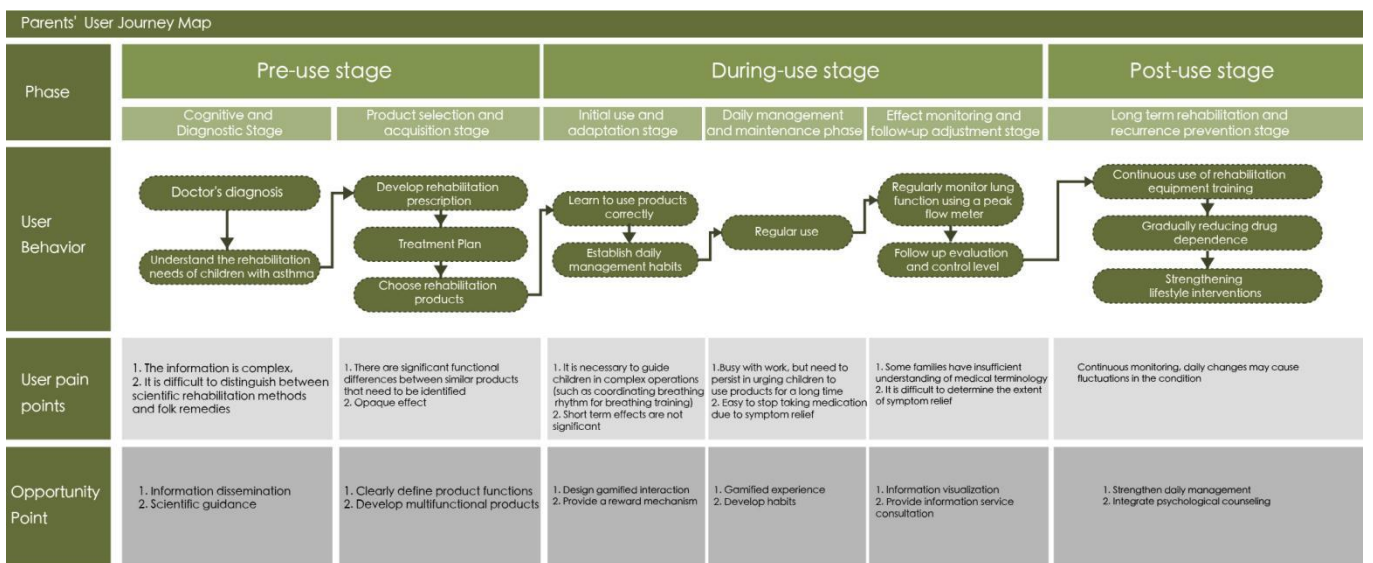


Source: Author created

Figure 2: Children's user journey map

Parent user journey map

In the treatment and health management process for children with asthma, parents' emotional responses and behavioral patterns are diverse and complex. This study, based on literature reviews and field research with families affected by asthma, analyzed the sequence of "pre-use, during use, and post-use of asthma rehabilitation products" to understand their behavioral responses and emotional changes. This approach allowed the study to comprehensively identify touchpoints between users and services, pinpoint potential opportunities for service improvement and optimization, and provide targeted recommendations for healthcare providers and managers (as shown in Figure 3).



Source: Author created

Figure 3: Parent user journey map

Summary of service pain points

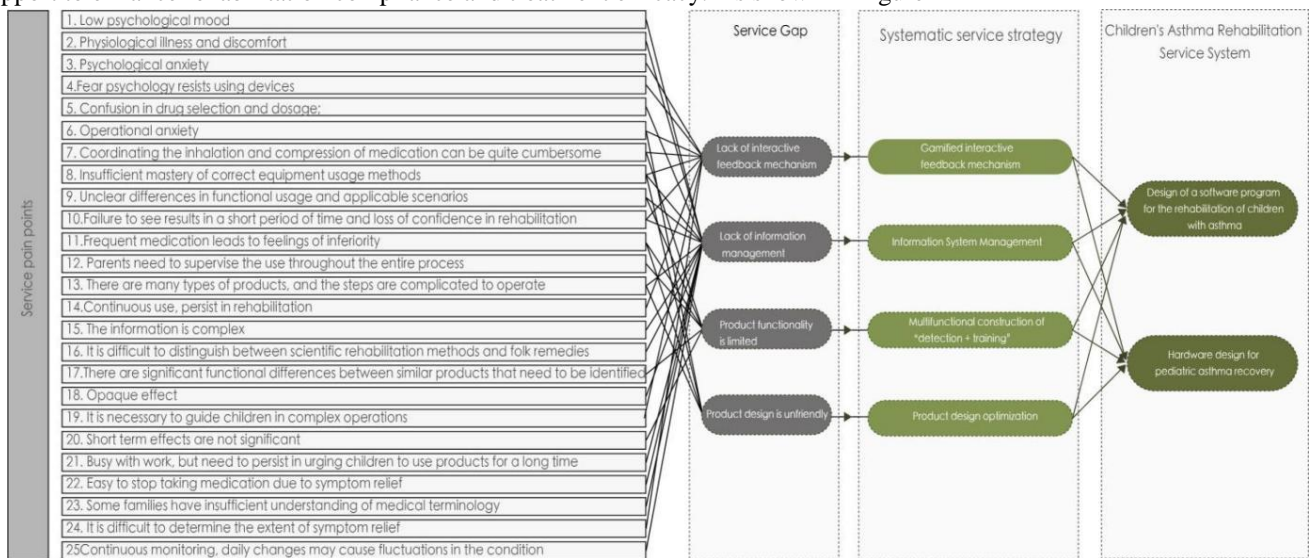
User pain point analysis includes two elements: first, whether users experience “pain” and, second, the degree to which they experience it. First, it is necessary to correctly identify user pain points. First, pain points should have a user demand base with the potential to be converted into "demands." On the other hand, pain points are problems to be solved that change with factors such as user demands and time. A summary of user pain points is shown in Table 2.

Table 2: Summary of user pain points

	Stage	Children with asthma	Parents of children with asthma
Summary of service pain points	Pre-use stage	1. Low psychological mood 2. Physiological illness and discomfort 3. Psychological anxiety 4. Fear psychology resists using devices	1. The information is complex 2. It is difficult to distinguish between scientific rehabilitation methods and folk remedies 3. There are significant functional differences between similar products that need to be identified 4. Opaque effect
	During-use stage	1. Confusion in drug selection and dosage; 2. Operational anxiety 3. Coordinating the inhalation and compression of medication can be quite cumbersome 4. Insufficient mastery of correct equipment usage methods 5. Unclear differences in functional usage and applicable scenarios 6. Failure to see results in a short period of time and loss of confidence in rehabilitation 7. Frequent medication leads to feelings of inferiority, especially avoiding the use of equipment in public environments 8. Parents need to supervise the use throughout the entire process 9. There are many types of products, and the steps are complicated to operate	1. It is necessary to guide children in complex operations (such as coordinating breathing rhythm for breathing training) 2. Short term effects are not significant 3. Busy with work, but need to persist in urging children to use products for a long time 4. Easy to stop taking medication due to symptom relief 5. Some families have insufficient understanding of medical terminology 6. It is difficult to determine the extent of symptom relief
	Post-use stage	Continuous use, persist in rehabilitation	Continuous monitoring, daily changes may cause fluctuations in the condition

Summary of service gaps and strategy proposals

Based on a systematic analysis of the demand for asthma rehabilitation services for children combined with user journey maps and an in-depth analysis using the KJ method (Scupin, 1997), this study identified four core service gaps from 25 specific pain points. 1) lack of an interactive feedback mechanism involving eight pain points, such as psychological and emotional support and operational guidance; 2) absence of an information management system involving seven pain points, such as data monitoring and medical terminology recognition; 3) product functionality being too limited involving six pain points, such as device differentiation and rehabilitation method validation; and 4) the design not being user-friendly involving four pain points, such as resistance to use and parental supervision. Targeted, systematic solutions have been developed to address these gaps, including strengthening emotional incentives through gamified interaction mechanisms (software design), building an intelligent information management system to enable data tracking (information system management), innovating a "detection + training" composite functional module (hardware functional restructuring), and optimizing human-machine design (product form upgrade). These solutions form an integrated "software-hardware" children's asthma rehabilitation service system that provides systematic support to enhance rehabilitation compliance and treatment efficacy. As shown in Figure 4.



Source: Author created

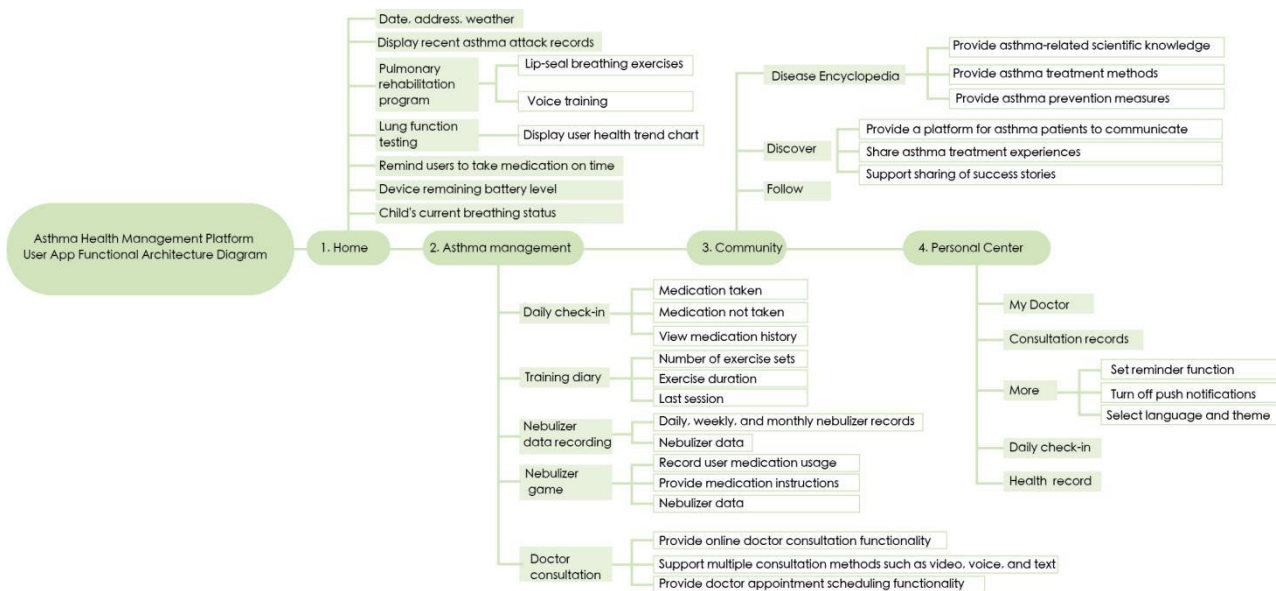
Figure 4: Summary of service gaps and proposed strategies

In-Depth

Design of asthma recovery software for children

Design of software functional architecture diagram

User research shows that users of asthma recovery products and services for children have a high demand for asthma diary design, remote consultations, and medication reminders. At the same time, parents also demand asthma knowledge and community circle design. Therefore, the children's asthma rehabilitation service system should center on core functional modules, including asthma warning, asthma diary design, remote consultations, medication reminders, gamified testing, and training. It should also incorporate knowledge education and community circle design (as shown in Figure 5).



Source: Author created

Figure 5: Functional architecture diagram

Low-fidelity prototype design

After clarifying the functional architecture of the asthma health management platform for users, this study proceeded with designing a low-fidelity prototype. Figure 6 shows this prototype.



Source: Author created

Figure 6: Low-fidelity prototype

Interface Interaction Design

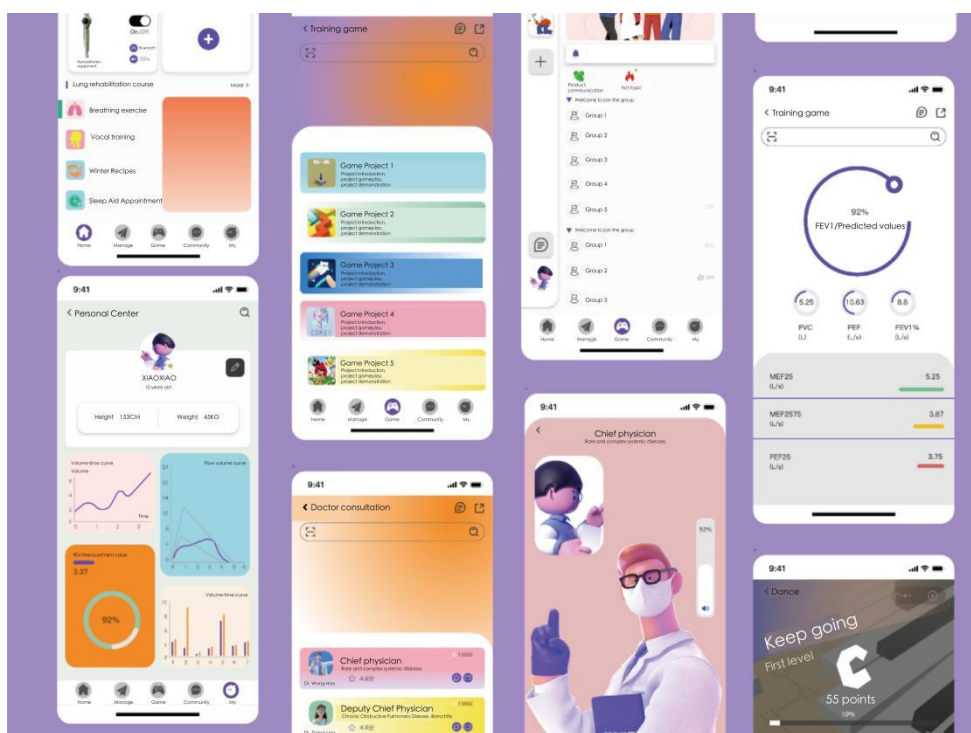
Due to their incomplete physical and mental development, children have a more limited understanding and set of practical skills than adults. Their cognitive abilities are also far inferior to adults', and overly complex operations may confuse them. Therefore, when using the app, it is crucial for children to have clear feedback, simple and smooth operational processes, and an intuitive interface (as shown in Figure 7).

First, the functional modules are clearly defined. The home page primarily displays weather information and data related to asthma attacks in the surrounding area. This enables asthma warning alerts for patients and allows users to clearly perceive the risk of an asthma attack. In other words, it is an asthma warning mechanism. Additionally, users can freely connect to other devices. The lung rehabilitation course includes breathing and vocal exercises designed to be used with rehabilitation products for daily lung function training. Furthermore, there are recipe courses and sleep-aid music modules tailored for asthma treatment that can help treat asthma in children.

This study also includes a module for assessing and predicting health data. Specifically, it provides real-time updates of children's forced expiratory volume in one second values after game-based training and a comprehensive assessment of their health data to determine if it is within the normal range.

Second is information visualization design. In this study, the children's training data page was designed with information visualization to provide an intuitive, information-rich user interface. Users can access detailed physical data records by clicking the "My" tab in the application interface. This includes visualization of lung volume test results, peak expiratory flow test values, and volume-time curve graphs. This chart records numerical changes during lung function testing as well as flow-volume curves, which illustrate relevant lung function testing data. Health trend charts track and display changes in children's health status over time.

Finally, there is gamified interactive feedback design. Children complete game tasks by blowing into the rehabilitation product while undergoing asthma testing. The blowing actions in the game can be used to assess respiratory status, determine asthma severity based on breathing flow rate and volume, and provide medication recommendations. Children are rewarded with virtual currency, items, or achievement badges based on their performance in the game and progress in completing tasks. These rewards can be used to unlock new levels, characters, or items, which motivates children to continue participating in the game and complete asthma monitoring and medication tasks.



Source: Author created

Figure 7: Interface design diagram

Design of hardware for rehabilitation of childhood asthma

Appearance design

The hulusi (葫芦丝), also known as the "gourd flute," is a traditional wind instrument widely played by ethnic minorities in China. Playing it requires active control of breathing strength and rhythm (e.g., Sustained, steady exhalation is used for long notes, while short, forceful exhalation is used for staccato notes). This aligns closely with diaphragmatic breathing exercises, which emphasize deep, slow breathing, and respiratory muscle endurance training in asthma rehabilitation. This study transforms children's medical rehabilitation behaviors into artistic expression. Children naturally complete breathing exercises during the "performance" process, which reduces their resistance to treatment. As a traditional musical instrument of China's southwestern ethnic minorities, the hulusi has a distinctive cultural identity. Children can associate it with a "musical toy that heals" rather than a cold medical device. Parents have also reported that the Hulusi's design conveys trust in the combination of traditional wisdom and modern technology, which lowers the cognitive barrier to new treatment devices.

This study's hardware design adopts the shape of a gourd flute with a smooth, rounded, ergonomic design that ensures safety for pediatric patients during use. The product's color scheme uses primarily gray and white, consistent with the clean, simple characteristics of medical rehabilitation products. Warm, bright orange accents stimulate children's positive emotions (as shown in Figure 8).

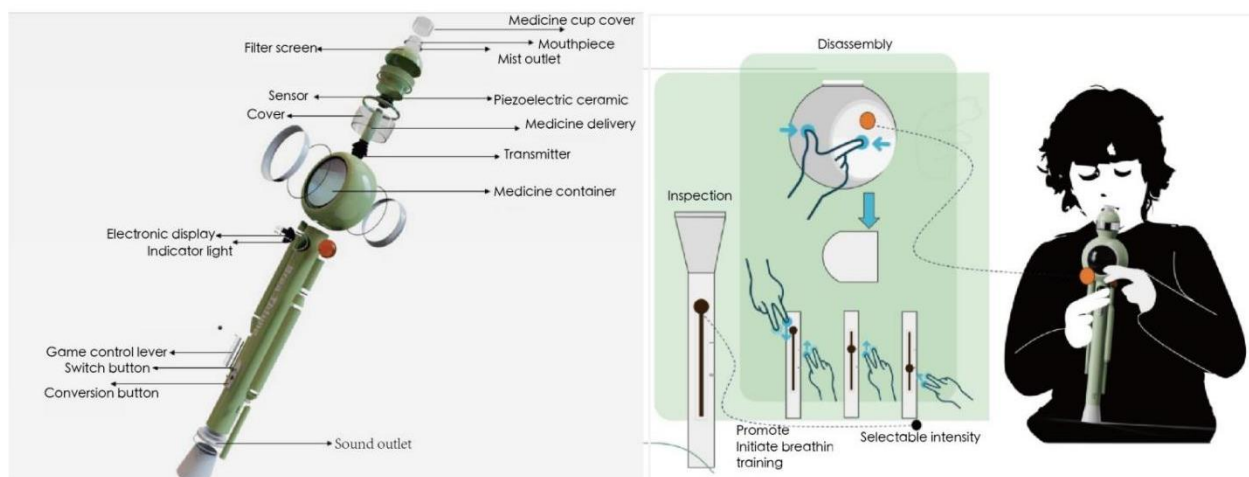


Source: Author created

Figure 8: Product design scheme

"Monitoring and Training" Multi-Functional Design

To address pain points in pediatric asthma treatment, such as the disconnect between condition monitoring and drug intervention and low treatment adherence, hardware products should incorporate multifunctional modules for respiratory monitoring and nebulization therapy (as shown in Figure 9). These products use high-precision sensors to detect children's respiratory status, including parameters such as respiratory rate and flow. Combined with a micro-drug delivery system, the devices administer asthma medication automatically or manually based on the detection results. Children must activate the device for nebulization when taking medication. During nebulization, the mesh design of the nebulization screen does not involve dynamic vibration mechanisms. The connection between the piezoelectric ceramic and the amplitude modulator is a critical component in the nebulizer's construction. The main control system regulates the output current and voltage to generate an electrical signal of a specific frequency. When this frequency matches that of the nebulizer components, including the piezoelectric ceramic and amplitude-modulating rod, the rod vibrates. This vibration, combined with the medication, propels the medication through the mesh pores, ultimately achieving nebulization and the spray of the medication.



Source: Author created

Figure 9: Product explosion diagram and usage diagram

Gamified interactive features

The children's asthma hardware product features a gamified interaction module. It enhances children's engagement by using breathing data to drive game content. To address the challenge of low treatment adherence among children, the product converts respiratory mechanics parameters into game operation instructions. For instance, exhalation intensity corresponds to a game character's jumping height, and breathing rhythm aligns with music beats. The hardware is equipped with dynamic RGB breathing lights that change color based on lung function performance. Vibration feedback enhances immersion.

The hardware works with the software to support real-time gaming experiences driven by breathing data. The system automatically records game duration and generates training reports. To increase long-term appeal, the product features an achievement system and a virtual nurturing mechanism. Children can accumulate points by completing daily breathing exercises. These points can be used to unlock game skins or feed digital pets, creating positive behavioral incentives.

Intelligent data management features

The children's asthma hardware product has an intelligent data management module that uses Wi-Fi/4G dual-mode communication to upload breathing parameters and medication records to the cloud in real time. It records the duration of each nebulization session, the type of medication used, and the dosage. It supports setting smart reminders. The parent app provides a multidimensional visual dashboard connected to an asthma health app. It automatically records and uploads detection and training data to provide doctors with professional, comprehensive reference data for more reasonable treatment recommendations and adjustments.

Delivery Period/Implementation Phase

User evaluation of design

Design evaluation is critical for testing service systems and provides data to support service system upgrades. A comprehensive evaluation of the service system, based on evaluation dimensions, intuitively determines whether the system meets user needs and refines elements affecting user experience.

The Net Promoter Score (NPS) survey is commonly used to validate service simulation solutions and assess the importance of functional service points in project-based teaching processes. The higher the NPS score for a service or product, the greater the likelihood of acquiring new users and the higher the user recommendation rate.

This study created a two-minute simulation video based on the design scheme and conducted an NPS survey from January 10 to January 20, 2025, to validate acceptance of the service simulation scheme and assess its importance.

The study employed a sampling method to recruit 100 survey participants, including pediatric patients, parents, and professional designers. First, participants are shown an animated video introducing the concept of the pediatric asthma gamified service product. Then, participants are asked to evaluate the service functions in the video using a 10-point scale to complete the Net Promoter Score questionnaire. This allows for a more accurate evaluation of the design scheme's content, serves as a reference for future service optimization, and establishes a foundation for setting priorities.

Table 3: NPS Questionnaire

In terms of software	Question 1: How likely are you to recommend the software's functional services to friends or colleagues?
	Question 2: To what extent would you recommend the software's information visualization design features?
	Question 3: To what extent would you recommend the software's gamified, interactive feedback design features to your friends or colleagues?
In terms of hardware	Question 4: How willing are you to recommend the product's hardware design to your friends or colleagues?
	Question 5: To what extent would you recommend the "detection + training" multifunction design of the product hardware to your friends or colleagues?
	Question 6: To what extent would you recommend the product hardware's gamified interaction features to your friends or colleagues?
	Question 7: To what extent would you recommend the intelligent data management features of the product to your friends or colleagues?

Source: Author created

Descriptive statistics

As shown in Table 4, in terms of population distribution, children account for 32% of patients, parents for 37%, and professional designers for 31%. In terms of gender, males account for a relatively higher proportion (56%), while females account for 44%. Regarding educational attainment, the highest proportion is "associate degree or below" at 53%, due to the presence of child patients. In terms of asthma treatment duration distribution among pediatric patients, the majority of samples fall into the '9–12 months' category, accounting for 31%.

Table 4: Frequency analysis results

Name	Options	Frequency	Percentage (%)	Cumulative percentage (%)
Population	Pediatric patients	32	32	32
	Parents	37	37	69
	Professional designers	31	31	100
Gender	Male	56	56	56
	Female	44	44	100
Education	College degree or below	53	53	53
	Bachelor's degree	34	34	87
	Master's degree or above	13	13	100
Treatment time	6 months or less	27	27	27
	6-9 months	26	26	53
	9-12 months	31	31	84
	12 months or more	16	16	100
Total		100	100	100

Source: Author created

User evaluation results

The statistical results of the NPS questionnaire survey indicate that all service functions have been recognized(as shown in Table 5), thereby validating the effectiveness of the gamified pediatric asthma rehabilitation service design.

Table 5: NPS Questionnaire Survey Statistics

Type	Critical users						Passive users		Recommended users		Net Promoter Score
	1	2	3	4	5	6	7	8	9	10	
Question 1	0	0	0	1	2	3	4	6	9	75	78
Question 2	0	0	0	0	3	2	6	8	10	71	76
Question 3	0	0	0	1	1	5	3	3	11	76	80
Question4	0	0	0	0	1	2	5	8	9	75	81
Question 5	0	0	0	0	1	3	2	4	11	79	86
Question 6	0	0	0	1	2	3	3	3	12	76	82
Question 7	0	0	0	1	2	2	5	7	9	74	78

Source: Author created

DISCUSSION

According to the NPS results, Question 5 had the highest Net Promoter Score, indicating that users generally believe integrating asthma detection and medication training functions into a single design is necessary. Integrating the "detection + training" dual modules effectively addresses the separation of monitoring and intervention in traditional treatments, creating a closed-loop management system of "assessment-treatment-reassessment."

Question 4, regarding the product's appearance design, received an NPS score of 81, which validates the positive role of good aesthetics and traditional cultural symbols in medical rehabilitation products. Most respondents believed that the shape resembling a Chinese flute helps reduce children's fear of medical devices, thereby increasing their willingness to use the device. However, some respondents suggested that this shape may hinder children's grip and operation, recommending a simpler, more practical design.

In the game design module, both Question 3 and Question 6 received positive feedback. Respondents believed that the game content effectively educates children about asthma-related knowledge and provides reward mechanisms that enhance children's adherence to medication therapy. The game design should aim to improve children's mastery of rehabilitation knowledge and enhance their ability to independently engage in rehabilitation activities and achieve rehabilitation goals.

Questions 2 and 7 regarding information visualization and intelligent management systems were also well-received. For pediatric patients, a user-friendly design with vibrant colors, intuitive icons, and a well-designed user interface can enhance interaction with the management software and facilitate asthma symptom tracking and management.

CONCLUSIONS

This paper explores the application of game design principles to children's asthma rehabilitation products, proposing an innovative, gamified design concept. Through this analysis, we clearly defined the objectives and requirements of rehabilitation game design and successfully designed a fun, educational, and effective asthma rehabilitation game for children. The gamified asthma rehabilitation design scheme received positive feedback in a questionnaire survey, providing new design ideas and solutions for asthma rehabilitation.

While this study has produced results regarding the design of asthma rehabilitation games for children, further research is needed to address shortcomings and challenges. Further research on the physiological and psychological characteristics of children with asthma and their rehabilitation needs is necessary to better meet their personalized requirements during the rehabilitation process. Additionally, we should explore innovative game mechanics and interactive modes to enhance the fun and playability of rehabilitation games. We should also incorporate intelligent technologies and Internet of Things (IoT) devices to integrate rehabilitation games with real-life scenarios, improve rehabilitation outcomes, and strengthen interdisciplinary research by integrating medicine, psychology, and education. This will provide comprehensive support for children's asthma rehabilitation game design.

In summary, this study provides valuable insights into asthma rehabilitation for children. In the future, we hope more researchers and designers will pay attention to this field and collaborate to provide children with asthma with higher-quality, more enjoyable rehabilitation experiences to help them overcome their illness and grow up healthy.

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