

A Study on the Experiential Learning Process Design of the Exploration Box of Traditional Chinese Medicinal Herbs for Augmented Reality

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Abstract

In 2015, the United Nations adopted 17 Sustainable Development Goals, or SDGs, the fourth of which is "Ensure inclusive and equitable quality education and promote lifelong learning opportunities," a goal that aims to ensure that everyone has access to an equitable, diverse, and high-quality education. Lifelong learning is closely related to self-directed learning, and learners must use the tools for self-directed learning in order to truly realize lifelong learning. In the Information Age, where cell phones and tablets are becoming more and more popular, the age at which children are exposed to smart products is decreasing year by year. However, most of the time children spend using smart products is mostly for entertainment, and rarely for learning. Traditional Chinese herbs have been used for thousands of years and are often used for therapeutic purposes in many regions, so this study aims to increase children's understanding of traditional Chinese herbal medicine. This study aims to introduce Chinese herbal medicine to children through augmented reality presentations on tablet PCs, in order to expand children's knowledge of tablet devices beyond entertainment. The learning process design of the traditional Chinese herbal medicine exploration box for augmented reality independent learning was carried out by using the Focus Group Interviewing method to understand the needs of the augmented reality Chinese herbal medicine independent learning exploration box, and the learning process diagram was completed by the participatory design method.

Keywords: Self Directed Learning, Learning Portfolio, Augmented Reality

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Introduction

In 2015, the United Nations proposed the Sustainable Development Goals, with the fourth goal emphasizing the need to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. This goal calls for the creation of an environment where everyone, at different stages of life, can obtain high-quality education through various means. In this vision, self-directed learning plays a critical role, and learners need to leverage various tools and resources to truly achieve the goal of lifelong learning.

In recent years, with the rapid development of technology, smartphones and tablets have become indispensable parts of people's lives, and the age at which children are exposed to these smart products has been decreasing year by year. However, current observations show that children mostly use these devices for entertainment rather than learning. To reverse this trend and in response to the Taiwanese government's policy of "Internet in every classroom, tablets for every student," this research aims to explore how tablets can become effective tools for promoting self-directed learning.

Traditional Chinese medicine (TCM), as a cultural treasure, has a history spanning thousands of years and is widely used in healthcare and dietary therapy in many regions. However, modern children have relatively limited knowledge about TCM. Therefore, this study aims to develop a self-directed learning exploration box for TCM using augmented reality (AR) technology on tablets. This will allow children to learn about the types, properties, and uses of TCM through interactive games, thereby expanding their understanding of tablet devices beyond mere entertainment functions.

Technology-Enhanced Learning

Technology Enhanced Learning Environments (TELEs) refer to any settings that use technological tools or applications to facilitate learning, whether they are physical classrooms, virtual spaces, or hybrid models combining both. These environments aim to enhance learning engagement, provide personalized experiences, promote collaborative interaction, offer real-time feedback, and expand learning opportunities (Persico & Steffens, 2017). The "Internet in every classroom, tablets for every student" policy is an educational initiative launched by the government of the Republic of China (Taiwan) in 2021, aimed at bridging the digital education gap between urban and rural areas and enhancing students' digital technology application skills. This policy plans to fully subsidize the installation of wireless networks in elementary and secondary schools nationwide within four years and provide one tablet per student in remote areas. Information technology, especially computers, the internet, and various human-computer interfaces, has become an indispensable part of human life, learning, and interaction. It not only provides channels for information acquisition and communication but also drives innovative transformations in education, work, and recreational activities (Vicente & Lopez, 2010).

Self-Directed Learning

With the advancement of technology and the rapid dissemination of information on the internet, learners have access to a vast source of knowledge. Therefore, learners need to develop self-directed and self-regulated learning abilities to responsibly manage their own learning processes. When learners can effectively take charge of their own learning, it

enhances their motivation and engagement, while also fostering critical thinking and problem-solving skills (Swollet, 2023). According to an article by the University of the People (2023), self-directed learning offers numerous benefits, including promoting student autonomy, systematic skill enhancement, supporting interests, and strengthening collaboration. These advantages help students build a personalized learning foundation through various learning methods.

Everyone can potentially benefit from the ability to learn autonomously, but social and individual factors may influence the feasibility of implementing self-directed learning. In today's rapidly changing world, self-directed learning has become one of the important goals of education. Self-directed learners can think independently, critically evaluate information, and solve problems. They take responsibility for their own learning and set their own learning goals (Zimmerman, 2000). Self-directed learning is an approach to education and learning where learners themselves establish and implement their personal education plans. Compared to other educational theories, self-directed learners believe that self-directed learning involves making choices for themselves and being accountable for those choices (Holec, 1996).

Experiential Learning Process

Experiential learning is a learning theory that emphasizes the importance of personal experience and reflection. Self-directed learning occurs through active participation and reflection on experiences. Experiential learning differs from traditional teaching methods, which typically involve teacher-led instruction and passive knowledge reception by students (Kolb, 1984). Experiential learning can be implemented in various ways, such as role-playing, field trips, case studies, and simulations. In role-playing, students are required to assume specific roles and interact within hypothetical scenarios (Smith, 2001). Experiential learning has been proven effective for students of all ages and learning backgrounds. It can enhance student engagement, motivation, and retention (Kolb, 1984). Additionally, it helps students develop critical thinking, problem-solving, and communication skills (Smith, 2001).

Method

The main objective of this study is to develop an experiential learning process using an augmented reality exploration box for Traditional Chinese Medicine (TCM). Therefore, the research process is divided into three stages. The first stage involves a literature review to thoroughly investigate related studies on Technology Enhanced Learning (TEL), self-directed learning, and experiential learning concepts, providing a solid theoretical foundation for subsequent empirical research.

The second stage focuses on analyzing the needs and principles for the augmented reality TCM exploration box. This involves conducting focus group discussions with teachers, experts, and managers of the sites where the exploration boxes will be placed. The purpose is to collect the needs and suggestions of educators regarding the design and implementation of the self-directed learning exploration box. Following this, a needs analysis will be conducted, and a participatory design approach will be used to complete the learning process map.

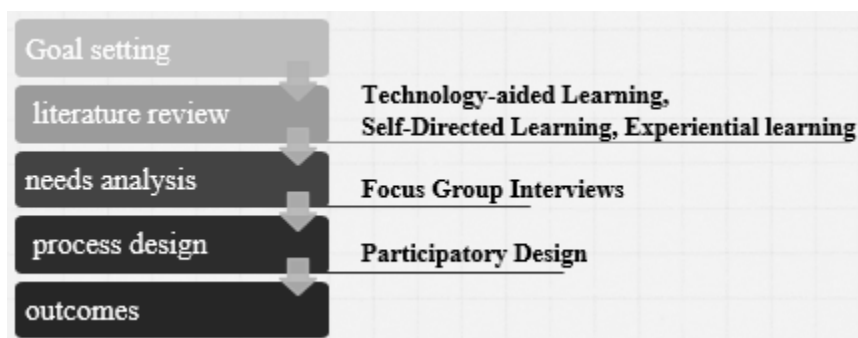


Figure 1: Conceptual Framework

Method 1: Focus Group Method

The focus group method is a qualitative research approach where a moderator guides a group of participants with common characteristics to discuss a specific topic in-depth, gathering their views, opinions, and attitudes. This method was first introduced by sociologist Robert K. Merton in the 1940s and is now widely used in market research, product development, educational research, social sciences, and other fields.

In this study, the focus group method is used to revise and adjust the "Exploration Box Self-Directed Learning AR Script Process and Content Diagram" and to further explore the future production guidelines for the exploration box. The research team will invite experts and educators from the fields of botany, science education, traditional Chinese medicine (TCM) education, and curation for interviews. These interviews will delve into the experience process, experiential objects, construction suggestions, and AR setup opinions for the exploration box, aiming to effectively enhance its application value. Through in-depth interviews with experts, the research team expects to gather valuable feedback to refine and optimize the design and content of the exploration box, ensuring it meets actual teaching needs and effectively promotes student learning outcomes.

During the focus group interviews for drafting the AR self-directed learning experience process script, the study focuses on the experiential process of the self-directed learning exploration box. Experts from botany, science education, TCM education, and curation are invited to use the TCM self-directed learning exploration box AR self-directed learning experience process script for focus group discussions, collecting AR setup opinions to effectively enhance the exploration box's application value.

Based on preliminary analysis data, the exploration box content is analyzed in three tiers. The first tier includes a self-exploration passport and user manual placed in a binder pocket. The first tier contains medicinal materials such as hawthorn, dried papaya, almonds, lotus seeds, ginger, longan, and TCM AR cards. The third tier covers acupuncture and massage, including a meridian model, magnifying glass, AR acupoint answer cards, display needles, meridian vest, meridian gloves, and AR acupoint answer cards. Through the exploration box, learners will gain rich knowledge of TCM and develop an interest in traditional culture. Based on the aforementioned analysis, an AR self-directed learning script process is created and used as the focus of the focus group interviews.

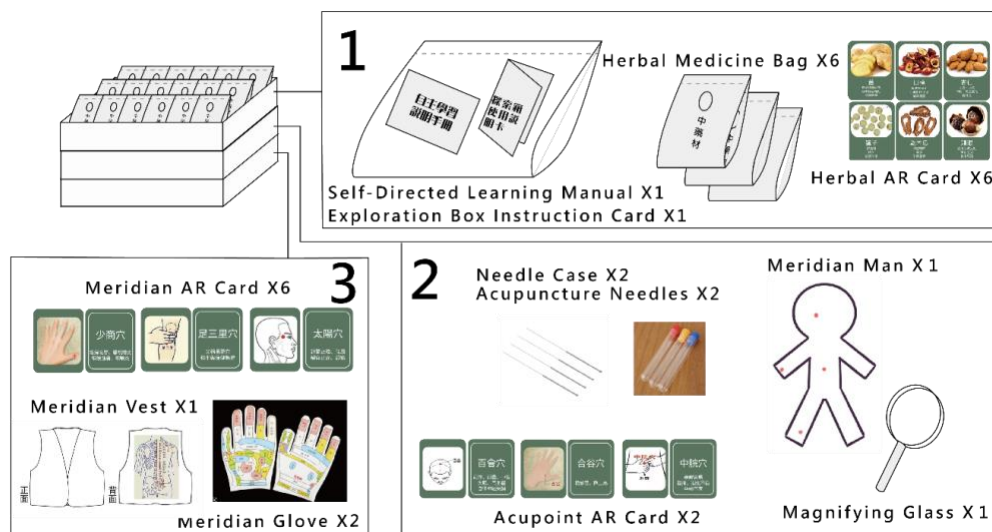


Figure 2: Inventory of Contents Before Revision of the Exploration Box

The focus group interview comprised 5 participants, including 4 males and 1 female, all meeting criteria such as having engaged in service-learning, botanical studies, and self-directed learning for over a year. Prior to the interview, this study consulted the participants regarding their relevant experiences and backgrounds to ensure they could provide valuable insights.

The experience was divided into three stages: pre-experience, mid-experience, and post-experience. The pre-experience stage involved the process of renting the exploration box and scanning to activate the exploration; the mid-experience stage focused on exploring the distribution and appearance of medicinal materials; and the post-experience stage included completing learning worksheets, guided tidying up, and returning the box. During this phase, we emphasized the smoothness of the process, the user-friendliness of the interface, and the content design of the learning units to ensure that the entire experience closely met the needs of the learners.

Table 1: List of Focus Group Participants

Member	Interviewee's Field	Experience Description
Mr. Xu	Digital archiving, smart learning	More than 10 years of work in education related to digital archiving and smart learning.
Ms. Yeung	Anthropology, design and culture	More than 10 years of research on cross-cultural performances in anthropology, design and culture.
Mr. Lee	Science education	More than 2 years of work on education projects and educational experience design.
Mr. Liao	Plant and animal research	More than 2 years of work in plant garden plant cultivation, and has published three popular science books.
Mr. Kwok	Chinese medicine base identification and Chinese medicinal materials	More than 10 years of education in Chinese medicine base identification and Chinese medicinal materials.

Table 2: Focus Group Interview Outline

Phase	Step	Interview Questions
Pre-Experience	Start scanning to explore	Were there any problems or questions you encountered when you started scanning to enter learning?
Mid-Experience	Scan and answer questions	What problems or improvements do you have for the scanning and answering process?
Post-Experience	Answer questions	Did you encounter any difficulties or problems during the learning process in the third unit?
Post-Experience Overall		Did you encounter any difficulties after learning?

Approach 2: Participatory Design

Participatory Design (PD) is a design methodology aimed at actively involving users in the design process to ensure that the design outcomes meet their needs and are usable. Participatory Design is an approach focused on the design process and procedures rather than a design style. Based on the feedback collected through focus group discussions, this study conducts research on the design of the experiential learning process for the Traditional Chinese Medicine (TCM) exploration box for self-directed learning with augmented reality.

In this phase, Participatory Design methodology is employed to design the experiential learning process for the "Augmented Reality TCM Exploration Box." Building upon the integrated needs analysis and functional planning from the preliminary stage, the Participatory Design method is utilized to create the "Experiential Learning Process."

Results

Based on the analysis of focus group interview scripts, a new script process was derived after revision, and a customer journey map was created using the process to be further refined through participatory design. Through discussions, three layers of items were determined. The expected contents of the first layer include maps and signage necessary for exploration, aimed at guiding learners to understand the sources and distribution of medicinal materials while presenting relevant basic knowledge of Traditional Chinese Medicine, enabling them to gain deeper learning experiences during the exploration. The second layer presupposes three types of herbal packs, namely foot bath herbal packs, mosquito repellent incense packs, and sour plum soup packs, containing uncombined medicinal materials. The design intention is for learners to perceive the unique characteristics and effects of each herb through actual touch, thereby expanding their understanding of herbs. The third layer presupposes the tools required for combining the herbal packs, including a Chinese medicine scale, magnifying glass, and others.

Table 3: Summary of Focus Group Interview Results

Phase	Expert Feedback
Pre-experience	<ol style="list-style-type: none"> 1. The content of the case is too long, it is recommended to reduce it, the learner's attention will not be enough. 2. The process of getting sick needs to be added, such as suggesting to see a Chinese medicine doctor when sick. 3. The medicinal properties of traditional Chinese medicine have multiple therapeutic effects and side effects, etc., and precautions should be added to the process.
Mid-experience	<ol style="list-style-type: none"> 1. Experts pointed out that professional actions such as acupuncture require a Chinese medicine practitioner's license to perform, so the process direction needs to be modified. 2. It is necessary to understand the Medical Practitioners Act and the Medical Practitioners License, and put it forward in the AR screen, so that learners can understand the importance of laws and regulations. 3. The meridians need to be discussed with the Chinese medicine doctor, and the meridians may be asked whether they can be purchased. If they cannot be purchased, they need to be removed from the process.
Late experience	<ol style="list-style-type: none"> 1. Since the learners are in the upper grades of elementary school, needles are easily used for fun, so it is recommended to put the needles in the needle tube seal. If the script is not modified, it is easier to understand by taking pictures. 2. It is suggested that the temples can be introduced, which are used to protect the eyes, etc. It is necessary to think about the traditional Chinese medicine that learners are exposed to in daily life and modify the process. 3. It is suggested that the script process start with diet, diet therapy, and traditional Chinese medicine, which is more in line with life.
After the experience	<ol style="list-style-type: none"> 1. It is suggested to add a cleaning step in the process to help learners understand the principle of returning objects, and also to help the rental personnel do not need to clean up again.

Based on feedback from focus group interviews and experts, this study has identified several areas that require modification. In order to ensure the accuracy of medicinal herbs and prevent misleading learners, it is essential to verify the accuracy of the provided herbal images and information. This information will be used in Augmented Reality (AR) technology, with safety precautions embedded into the AR system to enhance the safety and effectiveness of learning. Secondly, concerning acupuncture, it must be clarified that acupuncture is a professional practice requiring a license to perform. Therefore, equipment that cannot be used or requires a license to operate should be excluded from the process design. This not only streamlines the learning process but also ensures that learners operate within legal and safe boundaries. Regarding the selection of medicinal herbs, emphasis should be placed on choosing common and safe herbs, with attention to their safety issues in application to protect learners' health. Finally, for props that are difficult to use, instructional videos can be created to help learners better understand and master their usage through visualization. In summary, these modifications aim to enhance learning effectiveness and safety, ensuring that the educational content provided is both accurate and practical, thereby promoting the popularization and development of the study of Traditional Chinese Medicine herbs and acupuncture.

- (1) Ensure the accuracy of provided herbal image information, which can prevent misleading learners in AR, and embed herbal safety precautions in AR.
- (2) Modify the process to shorten it, removing equipment that cannot be used or requires a license.
- (3) For props that are difficult to use, we can create videos to introduce them.

After revising the content according to the focus group method, the three layers of contents in the exploration box are as follows: the first layer is the exploration layer, including "Chinese Medicinal Herb Book" and "Chinese Medicinal Herb Exploration Map." The second layer is the scent layer, containing containers of Chinese medicinal herb scents. The third layer is the measurement layer, including traditional herb scales, herb bags, and storage trays.

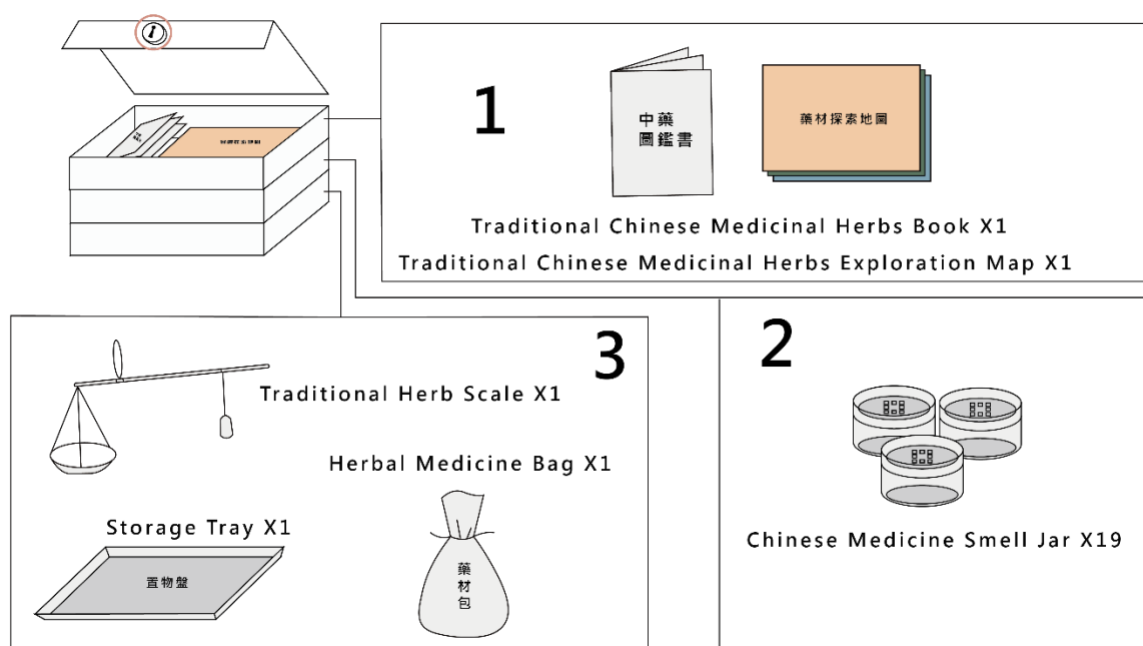


Figure 3: Three-layer Content List of the Revised Exploration Box

Users follow AR instructions on a tablet. They first select an herbal combination pack and then open the first layer. In the first layer, users need to consult the Herbal Encyclopedia to identify the herbs required for the unit and observe the distribution of these herbs on the map.

Moving to the second layer, users scan the herbal jars based on the Herbal Encyclopedia. After scanning, the tablet will play a video introducing the herbs. Users can watch the video and answer questions. After completing the second layer, users must return the used props to their original positions before entering the third layer.

The third layer plays a tutorial video on using the scale. AR guides users on how to use the scale correctly and answer questions. This completes the exploration box experience. Users can choose different herbal combination packages for the experience.

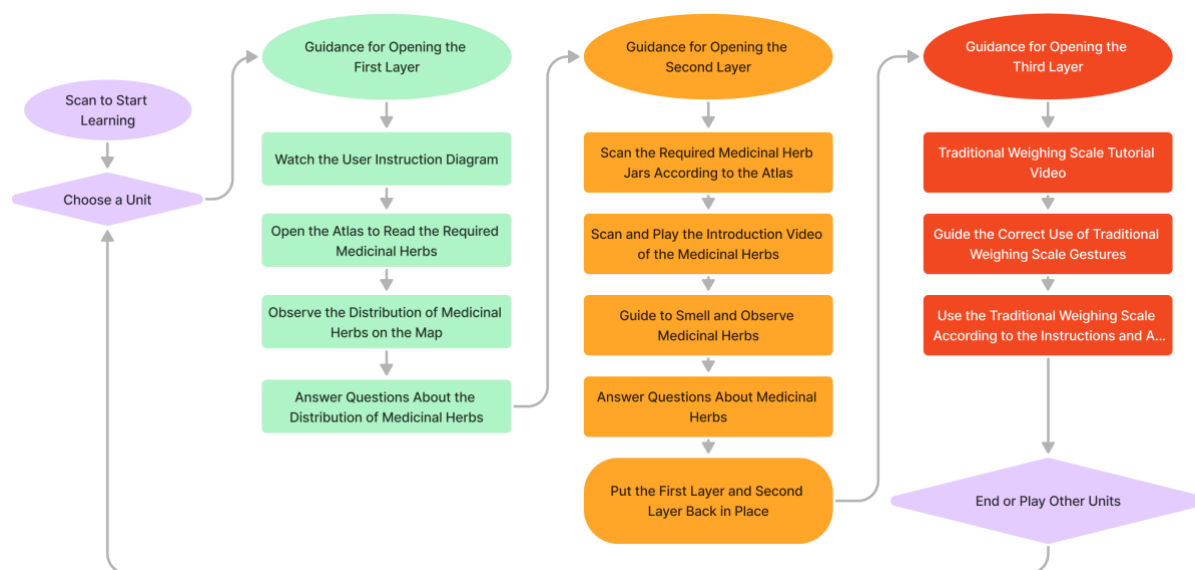


Figure 4: Flowchart of Experiential Learning Process in Augmented Reality Chinese Medicine Exploration Box

Conclusion

This study explores the application of augmented reality (AR) assisted teaching in the Traditional Chinese Medicine exploration box and designs an augmented reality self-directed learning process. The results indicate that AR-assisted teaching effectively facilitates the learning process, enhances students' motivation, learning outcomes, and satisfaction. An augmented reality self-directed learning process tailored for the Traditional Chinese Medicine exploration box was developed and integrated into the exploration box. The findings demonstrate that the augmented reality self-directed learning process significantly enhances students' motivation, learning outcomes, and satisfaction.

Future research directions should focus on continuous improvement and optimization of the augmented reality self-directed learning process. Additionally, providing richer and more effective self-learning experiences through augmented reality is an important direction for future research. This not only enhances learners' experiences but also provides examples and evidence for further exploration, leading to significant advancements in the fields of education and training. Furthermore, this study can further evaluate long-term effects and improve the design of AR Traditional Chinese Medicine self-directed learning exploration boxes.

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