Research on Designing Plant Science Popularization Application based on Cognitive Psychology

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Abstract. This paper aims to explore how to optimize the design of plant popular science applications for specific locations based on cognitive psychology theories. Current plant popular science applications suffer from issues such as single dissemination methods and excessive specialization of content. Cognitive psychology suggests that perception, information processing, and meaning attribution are key processes in learning plant knowledge, with specific learning environments playing a crucial role. Therefore, guided by cognitive psychology theories, this study analyzes the existing problems and causes of plant popular science applications and constructs a design framework for plant popular science applications, designing a campus plant popular science mini program. While ensuring the accuracy and professionalism of plant information, the study integrates external environments and improves cognitive processes to promote the effective dissemination of plant knowledge and enhance public scientific literacy.

Keywords: Plant popular science, plant knowledge, cognitive psychology, information processing.

1 Introduction

Plants are one of the crucial life forms in nature. Despite this, botanical science knowledge remains relatively unfamiliar and easily overlooked by most people. As proposed by American botanists James Wandersee and Elizabeth Schussler, compared to animals, plants are more likely to be overlooked, a phenomenon termed "plant blindness"[1]. The act of learning about plant knowledge requires cognition as a bridge, bringing value to this behavior and indicating how to act upon it[2].

2 Existing Problems and Causes Analysis of Plant Popular Science Applications

Plant popular science, as part of science popularization, has not developed as richly and diversely as other disciplines. From an external perspective, insufficient investment and attention have been given to this field. Internally, the following problems persist.

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2.1 Lack of Integration of Design and Technology

In the past, the learning of botanical scientific knowledge relied mainly on systematic study of botany and morphology, requiring a lengthy learning process. In recent years, revolutionary changes have been brought about in plant recognition by machine learning-based deep learning technology, shifting plant recognition from human learning to the era of machine learning. Plant enthusiasts can now simply upload photos of plants and obtain basic information about them, completing the learning process by some applications, such as Xingse and iPlant[3]. In the transition from traditional media to digital mobile smart devices, there has always been a pursuit of encyclopedic "encyclopedia" type pure utility applications, leading to the current situation of few types of plant science education applications and low survival rates.

2.2 Ignoring the Specificity of Locations for Plants

Sun Yat-sen University has incorporated campus plant resources into the school's fixed asset management system, achieving significant results[4]. In practice, many plant science education activities often overlook the specificity of locations. Plants themselves are part of nature. Conducting plant science education in specific locations that are closer to people's daily lives can stimulate interest and attention towards plants. Compared to delivering specialized knowledge in classrooms and textbooks, plant science education leveraging site-specific conditions and resources is more engaging and participatory.

3 Plant Cognition Process Reconstruction

Cognition refers to the process in which the human brain receives external input information, undergoes processing, and transforms into mental activities internally, ultimately influencing and guiding human behavior[5]. The processing of information is a key link to ensure effective learning and understanding. The external environment also has an important impact on the process of plant cognition.

3.1 Internal Information Processing

The information processing theory views the human brain as an information processing system composed of four parts: the sensor, processor, storage, and effector.

Taking Forsythia suspensa as an example, the sensor will first receive the external characteristics of Forsythia suspensa. Upon receiving the plant information, the processor may notice that the flowers of Forsythia suspensa are pale yellow, usually with 4 petals, and the branches are hollow and yellow-brown, and then associate and compare them with existing plant knowledge. For example, the external characteristics of Forsythia suspensa and Jasminum nudiflorum are very similar but different. After analyzing the above information, the storage is responsible for storing these feature information about Forsythia suspensa and distinguishing it from Jasminum nudiflorum.

When Forsythia suspensa is seen again, due to familiarity, observes the flowers and branches to identify it as Forsythia suspensa, and a sense of satisfaction is obtained emotionally, which is the response made by the effector. Fig. 1 provides a detailed explanation.

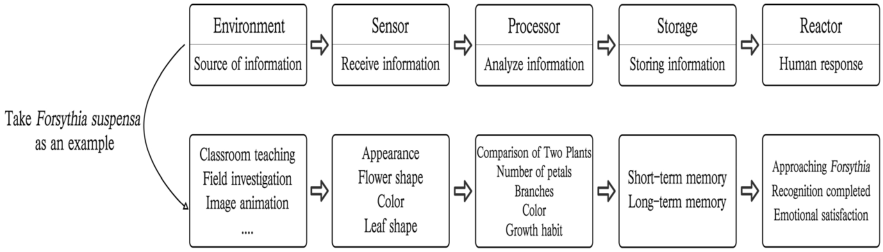

Fig. 1. The information processing process using Forsythia Suspensa as an example

3.2 External Environment Facilitation

The plant cognition process abstracts plants into data information, and the external environment is the primary means of obtaining plant information. For plants and the process of plant cognition, the term "environment" has a dual meaning. On the one hand, it refers to the natural ecological environment of nature, including the ecosystem composed of natural elements such as air, water, and soil. On the other hand, "environment" can also broadly refer to external spaces, including the specific locations where plants are located, the surrounding climatic conditions, and vegetation composition.

Learners can gain rich practical experience through outdoor observation and learning, which is summarized as environmental education. The goals of environmental education include in, about, or for the environment[6]. Learning in the real natural environment helps learners integrate theoretical thinking with practical experience. Hands-on experience can stimulate learners' interest and learning motivation while fostering their environmental awareness. Places such as schools, communities, and parks abound in plant species. Plant science popularization conducted in these places is more closely aligned with people's daily lives, enhancing audience attention and participation.

3.3 Framework for Plant Science Popularization Application

Based on the above analysis, a new design framework can be established, as shown in Fig. 2. Starting from the theory of information processing, this design framework improves the way information is processed at each stage. With the enhancement of the external environment, users' perception and learning of plant science popularization content will be strengthened. The specific design practices will be elaborated in the following sections in conjunction with the design framework.

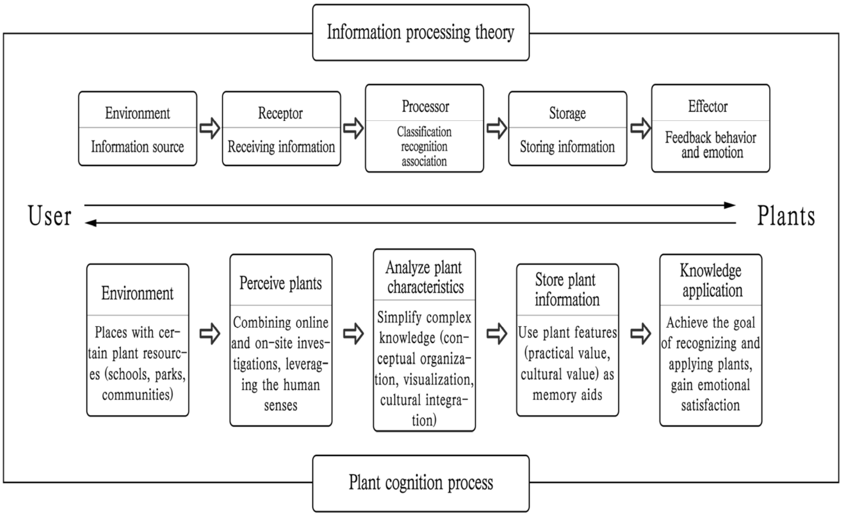

Fig. 2. Design Framework for Plant Science Popularization Applications

4 Design Case Analysis

Based on the cognitive process, a plant popular science application design framework was independently developed, focusing on creating the "Beilin Plant Guide" mini program designed for campus use.

4.1 Application Carrier

Considering the convenience of offline use of the application, the Beilin Plant Guide uses a mini program as its carrier, developed based on official WeChat documentation, fully leveraging the functions of the WeChat platform. In addition, it utilizes WeChat's built-in components and interfaces, as well as Tencent Cloud development for data storage, management, and retrieval, improving development efficiency and facilitating subsequent updates and iterations.

4.2 Data Collection

After tracking and collecting image information, there are a total of 115 species of trees, totaling over 3320 individual trees in Beijing Forestry University. Basic information was organized, selecting the most relevant content for users' daily lives. Specifically, this includes the following information:

- Plant Basic Information Description: Provide basic descriptions for each plant, including its family, genus, Latin name, quantity, as well as descriptions of its appearance.

- Image Collection and Location Annotation: Collect plant images, and the location information of each plant should be annotated.
- Historical and Cultural Value of Plants: Record the historical and cultural value of each plant, including its portrayal in folklore, literary works.

4.3 Mini Program Design

We classify and filter the collected plant data to determine which data is the most representative and important, prioritizing what should be displayed to users. This ultimately forms the content system focusing on plant basic information, flowering period, and plant morphology. Then, we proceed with information visualization, transforming plant data into graphical representations, including map markers, plant images, and plant icons, to enhance user experience and information delivery effectiveness. Through the processes of conceptual refinement and information visualization, we complete the stage of parsing plant characteristics, reducing the burden on users' processors, and designing a user-friendly, fully functional plant guide mini program, providing users with a more convenient and enriched plant science experience.

In terms of functionality, the main focus is on query display. Upon entering the Beilin Plant Guide, users are first provided with a campus map and area division. Clicking on the zone button allows access to the plant distribution map of that area. After selecting a specific plant, users enter the plant details page. This page includes three parts: plant photos, plant knowledge, and campus plant conditions, meeting users' needs for information on plants within Beijing Forestry University and basic plant information, providing more insight into plant knowledge. The plant spectrum categorizes plants based on their flowering period. The plant recognition interface starts with plant morphology, organizing plant morphological knowledge into six categories. Through visualization, users are shown the characteristics of different types of plants.

5 Conclusion

Based on the information processing theory in cognitive psychology, this article reconstructs the process of plant cognition, establishes a design framework for botanical popularization applications based on cognitive processes, and designs a campus botanical popularization application called the Beilin Plant Guide Mini Program. While ensuring the accuracy and professionalism of botanical information, and considering the external environment, improvements in cognitive processes are made to provide a pathway and method for the design of botanical popularization applications.

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