

# The Design and Implementation of Digital Picture Books for Preschoolers Based on iPad

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**Abstract.** It is of life-long importance for children to accept rudimentary knowledge about science in their early childhood. Nowadays, the Internet and mobile devices have been widely popular, and Internet-based early education products for preschoolers have also come out thick and fast. From the perspective of design thinking on Internet products, this paper elaborated a method for designing digital picture books based on iPad for preschoolers in terms of demand analysis, content design, functional design, interactive design and system implementation, in combination with the physiological and psychological characteristics of child audience.

## Introduction

As its name implies, a picture book is “a painted book”. For a long time, picture books for children mostly have depended on the form of traditional paper books, to convey storylines by fusing visual and verbal narratives, which can be read in the linear reading mode of manually leafing through the pages [1].

With the popularization of the Internet and mobile terminals, the medium of picture books for children gradually shifted from traditional paper books to multimedia equipment such as iPad. The younger generation of parents wants to nurture their children with high-quality education and culture in their early childhood by virtue of new media, and the functions of digital interactive picture books such as dubbing reading and aided learning also relieve many parents of such burdens as reading and accompanying their children during their reading. The diversified ways of reading also increase interaction between parents and their children through interesting games on mobile equipment. Though it is still controversial for children to use multimedia products like iPad, the emerging interactive multimedia technology undoubtedly can be helpful to the popularization of science education among young children if designed properly and used correctly [2].

As preschoolers are a special user group, this project follows the user experience design principle of Internet products in the process of research, starting from user demand and taking the psychological and cognitive characteristics of children into consideration, so as to design a digital picture book meeting the aesthetic needs and interactive habits of children.

## Demand Analysis

Before designing and developing an app in practice, it is rather necessary to research sufficiently at the preliminary stage, thus digging up the required functions and value of the product through an analysis of its core target user group.

**An analysis of user demand.** It is helpful to the exploration of real user demand to segment target users into typical groups and learn about the psychology, values and lifestyle of users. The target group of this project is preschoolers aged 3 to 6. Children at this stage are highly curious about surroundings and fond of reading picture books, but their weak cognitive capacity decides that they have a poor understanding of complex problems but great interest in games and stories [3]. In the process of preliminary scientific popularization, it is hard to give a clear explanation with static images in paper books. Therefore, digital picture books aiming at children in this age range can meet their needs in the artistic expression form of interactive games.

**The functional requirements of the product.** Only through user demand analysis can we find the pain points and the functional requirements of the product and finally fuse the requirements into its design.

(1) Scientific and healthy content. A digital picture book aimed at preschoolers should be scientific and healthy in content, and this project publicizes knowledge on forest ecology to children, based on the popular science of nature.

(2) Learning while playing. On the basis of scientific popularization, the product needs to achieve the effect of learning while playing, fusing scientific popularization into stories, combining games with teaching, and thus letting children acquire knowledge unconsciously by playing and learning through practice.

(3) Simple operation. In the process of reading, children feel no pressure to operate the product, which can lead them into the world of stories in the picture book by means of simple and instructive interaction.

**The selection of a platform.** iPad is featured by a big touch screen, portability, easy operation, an independent and stable operation system etc [4]. Its build-in sensing equipment such as a gravity sensor, a gyroscope and a microphone, as well as multi-touch technology, can be used to design and develop more interesting modes of interaction. Thus, children can participate in different interactive scenarios by simply clicking, sliding and shaking the screen, to gain more experience from visual, touch and auditory feedback effect, so iPad is selected as the hardware environment of development.

## Content Design

After the user demand and the goal of products, developers should determine the positioning of product content.

The project conveys the theme of caring and protecting animals and plants in forests to children, by telling stories for scientific popularization with the technique of personification. According to their physical features, different characters are endowed with the personality of humans. The structure of three paragraphs is adopted for the creation. Moreover, the typical path of role development in Disney films, which is the self-redemption of a nobody, is used in designing the personalities of characters. Chipmunk Zhizhi was dishonest and liked taking petty advantage, but it could correct timely when making mistakes, saving the forest with its own dedication and bringing new hope to the forest. The change of its personality and behavior not only increases the depth of the whole story, but also makes readers touched and inspired by the character.

## Functional Design

In the functional design of the digital picture book for children, we should take its applicability for scientific popularization, as well as creatively design its functions by fusing their interested functions according to the cognitive features of preschoolers.

(1) Learning function. The interactive picture book should break through the learning pattern of traditional paper picture books, to make the product more applicable to learning.

(2) Story-telling function. The interactive picture book can accompany children in reading to some extent, so the story-telling function is necessary whether in the mode of learning or reading, to help children read the text at any time.

(3) Guiding function. Children should know how to use the product on getting it, and learn to operate it in a short period of time, so the function of guiding children to interact should always be available in the product.

(4) Game function. It is the nature of children to play games. With game time added to the reading of stories in the picture book, children will be more interested in the product while participating in the stories in the picture book through playing games.

(5) Awarding function. Preschoolers are happy to be recognized and encouraged by their parents or people around them, so the introduction of an awarding mechanism can make them feel

contented in the process of using the product, improving their enthusiasm for the product.

## Interactive Design

The interactive design of the digital picture book for children can be divided into interactive logic design, interactive sketch design and interactive interface design, which are in a bottom-up sequence, showing a process from abstract design to concrete design, and from concepts to specific content.

**Interactive logic.** Preschoolers are hardly capable of logical thinking, so the interactive logic should be simple and easy to understand, to let children quickly join in the interactive process and gain a sense of achievement [5]. As shown in Figure 1, children have to go through the two steps of learning and reading before fulfilling the interactive process. Moreover, only when they finish all the learning tasks in the step of learning can they enter the step of reading. In the step of reading, they can go back to the previous step of learning at any time, to review the knowledge points. The setting of such simple circles can align the two processes of “preview” and “review”, so that children can better retain the knowledge points learned and have a deeper impression.

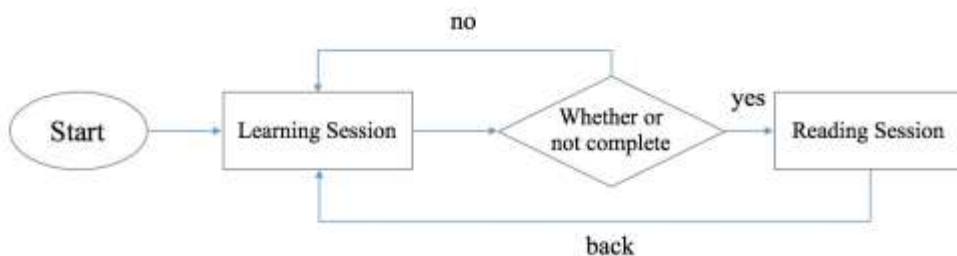


Figure1. Product interaction logic diagram

**Interactive sketch.** After the interactive logic of the product is determined, the design of its interactive sketch should be started. In this step, we should consider the position and layout of functional points, as well as the switching of dynamic effects and interfaces and the interconnection among functional points. The process of drawing a conceptual sketch also determines interactive events and the interactive mode. The animation events that can be added to an interactive logic are recorded by drawing sketches, and the most reasonable animation effect is selected through deliberation. In the conceptual sketch in Figure 2, the position of each button icon is marked in the interface, and the functional points and information elements contained in the interface are presented in the forms of pictures, text and symbols and so on.

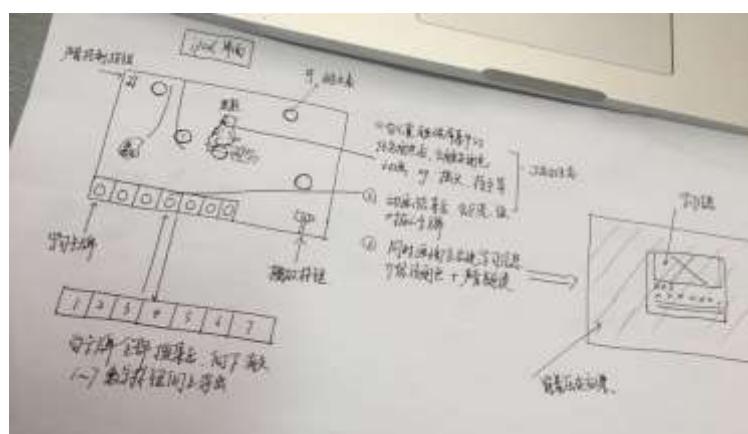


Figure2. Interface sketch design

**Interactive interface.** The interface for information communication has the most direct relation with users. The interface design of digital picture books for children should follow the principles of user-friendliness, aesthetic design, and attraction to children, to make children highly curious about

the product and eager to know more about it when they first hold the product in hands [6]. The interface design of this project adopts the forest style theme. As shown in Figure 3, children can immediately feel the surrounding atmosphere on entering the interface. The animals in the scenes are designed in cute cartoon models, with simple structure and smooth lines. The design of icons employs the elements of plant vines and wood grain, echoing the forest theme and meeting the curiosity of children to explore forests. Moreover, the buttons in the interface are in bright and dim colors, the combination of which improves the effect of the shiny yellowish background, attracting the attention of children with the highly contrastive visual impact. The task cards in the interface are designed with concave wooden texture, corresponding to the scenes of stories. When the light is on, the cards will become color role icons. The yellowish contouring effect distinguishes bright cards from dim cards effectively to better help children fulfill tasks.



Figure3. Interface design

**The design of sound effect.** The design of sound effect for the interactive digital picture book includes the design of interactive sound effect, verbal sound effect, and background music.

(1) Interactive sound effect: In the modules unlocked, children will trigger the effect sound like “ticktack” when touching interactive buttons, and the auditory feedback can help them understand the interactive behavior of “clicking the button”. Children can voluntarily touch interactive buttons under the visual guidance, as well as find the difference between interactive buttons and other interactive elements through the feedback, to grasp the interactive operation of the picture book more quickly.

(2) Verbal sound effect: Verbal sound effect can be divided into dialogues between different roles and the voiceover of each page. According to its character and current emotion of speaking, each animal is matched with dialogues of different intonations, tones and frequencies. The voiceover of stories is also sometimes soothing and cheerful, and sometimes nervous and downcast with the development of the storyline.

(3) Background music. Along with the progress of the storyline, the background music also changes, becoming gentle and cheerful in peaceful and joyful scenes, and downcast in stressful and depressive scenes, and sad in quiet and barren scenes. Different background music creates different atmospheres for the scenes.

## System Realization

During technological realization, many measures were taken at earlier stage to test the effects. Also, the test also used development kits like the three-dimensional game engine Unity. After several tests, Xcode, the official iOS App development kit was finally adopted.

As a 2D animation and game engine of Apple, Sprite Kit support Sprite display, animation, audio player, particle effects, physical simulation and other features. Besides, Apple’s official development kit Xcode has a built-in scene editor for Sprite Kit. Sprite Kit will greatly save development time and make for rapid iteration. For instance, the code for a series of actions is set for the scene’s background as below:

```
background?.runAction(SKAction.sequence([
```

```
SKAction.moveBy(CGVectorMake(50,70), duration:4.5),
SKAction.moveBy(CGVectorMake(40, 0), duration: 3.5),
SKAction.scaleBy(0.8, duration: 3.5),
SKAction.moveBy(CGVectorMake(0, -100), duration: 6.0)
]))
```

With Sprite Kit, an animation sequence such as move upper right, move right, scale down and move upward can be added to the story scenes in this way. It can be seen that the programming code of Sprite Kit is visualized, simple, flexible and convenient.

## Conclusions

Today, when mobile multimedia equipment is widely popularized, the emergence of digital picture books for children provides a brand new pattern of reading and learning. Meanwhile, relying on the independent and high-performance operation system of iPad, designers have a good design environment, which vigorously facilitates the creation of digital picture books for children. Through the design of the digital picture book for preschoolers based on iPad, this paper was aimed to combine the scientific popularization for children with the design mode of Internet products, elaborating the design method and implementation of such products and providing a new idea for the design of such products.

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