

Research on Digital Content Development for AR-Based Traditional Craft Education and Training -Focusing on Lacquer Thread Sculpture-

HaiBiao-Huang, LingJing-Zheng, Seuc-HO Ryu*

Ph.D, Dept of Game Design, Kongju National University

**Professor, Dept. of Game Design, Kongju National University*

*E-mail : haibiaohuang35@gmail.com, z15159219755@gmail.com, *seanryu@kongju.ac.kr*

Abstract

This study focuses on combining traditional craft lacquer thread sculpture and augmented reality (AR) technology to develop digital educational content. In this way, we not only make it easier and easier for children to learn and understand the traditional craftsmanship of lacquer thread sculpture, but also finds a new direction for traditional craft education. First, through literature research, the production process of traditional craft lacquer thread sculpture is summarized. Through an in-depth understanding of traditional craft lacquer thread sculpture, it provides a theoretical basis for subsequent AR digital content development to achieve educational goals. Next, we used AR technology to design and produce the digital content of the traditional craft lacquer thread sculpture. This study proposes the application of AR technology and the design and production methods of digital content. It is hoped that the methods and experiences we have proposed will not only provide reference for the development of similar digital content in the future, but also provide new educational methods for the inheritance of traditional crafts.

Keywords: *Augmented Reality (AR), Traditional Crafts, Digital Content, Lacquer Thread Sculpture*

1. Introduction

Traditional crafts preserve and symbolize our society, and have an influence on various fields such as art and fashion [1]. The reality is that traditional crafts in modern society are considered old and outdated and are gradually being marginalized from the mainstream cultural circles of society [2]. Recently, the value and importance of traditional crafts have been recognized again, and above all, various measures for their continued preservation and development are being explored. In particular, from an educational perspective, it can be seen as having great significance if education that provides more efficient field experience effects is proposed instead of the existing authoritative learning method. In other words, with the emergence of a AR technology, AR technology has shown the potential to be widely used in various fields, including digital educational content [3].

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Corresponding Author: seanryu@kongju.ac.kr (Seuc-HO Ryu)

Tel: +82-41-850-0350, Fax: +82-41-850-0358

Professor, Dept. of Game Design, Kongju National University, Korea

Combining traditional crafts with AR technology enables learning independent of time and space, and providing an opportunity to learn traditional crafts inexpensively and safely has positive implications for the preservation and development of traditional crafts. The research purpose of this paper is to suggest a new method for future traditional craft education. It is very meaningful to use cutting-edge technologies such as artificial intelligence, big data, and VR technologies in education, and this study seeks to provide a new educational method using AR technology. We hope that through case development focusing on lacquer carving, we will summarize the method of combining traditional craft digital content and AR technology and serve as a meaningful reference for the development of future educational digital content.

2. Traditional Craft Lacquer Thread Sculpture and AR Technology

2.1 The Concept of Traditional Craft Lacquer Thread Sculpture

Lacquer thread sculpture originated from Quanzhou City, Fujian Province, China. It is one of the artistic treasures of China's lacquer cultural treasure and is a unique traditional craft of the Minnan region of Fujian Province. The history of lacquer wire carving is a traditional folk craft with a history of more than 1,400 years [4, 5]. As shown in Figure 1, lacquer thread sculpture is made from aged brick powder, lacquer, cooked tung oil and other raw materials. It is pounded repeatedly into a soft and tough mud ball, commonly known as "lacquer thread", which is then rubbed into "lacquer thread" by hand. Then, "lacquer thread" is used to coil, knot, wind, and pile up the primed body to carve out various exquisite and embossed patterns and graphics [6].



Figure 1. Photos of lacquer thread sculpture work

2.2 AR Concept and Application Areas

Augmented reality (AR) technology is a technology that subtly fuses virtual information and the real world. It utilizes a variety of technological means to apply virtual information, such as computer-generated text, images, 3D models, music, and video, to the real world to create two pieces of information. It is a technology that complements each other to augment the real world [7]. These technologies utilize a variety of technological means, including multimedia, 3D modeling, real-time tracking and registration, intelligent interaction, and sensing. Major application areas of AR include education, medicine, advertising shopping, exhibition guidance, information retrieval, and industrial design interaction [8]. This paper studies the application of AR in the field of traditional craft education.

2.3 Augmented Reality Education Content Type

The types of augmented reality educational content are composed of four parts: observation-manipulation type, experimental activity type, learning guide type, and field problem-solving type are shown in Table 1 [9].

Table 1. Types of augmented reality educational content

| Types | Concept |
|----------------------------|---|
| Observation-Manipulation | The most widely used learning type in augmented reality. It provides specific objects or physical objects on the screen and presents the names, functions, or operating methods of each part [10]. |
| Experimental Activity Type | A form in which learners can perform various manipulation activities after creating a virtual space using augmented reality technology [11]. |
| Learning Guide Type | A method that provides learning content while the learner moves through the learning space [12]. |
| Field Problem-Solving Type | Refers to augmented reality implemented to provide information necessary for the process of performing actual tasks. The purpose is to improve learning performance by providing additional information about the actual situation the learner is facing based on location-based information and to develop the ability to interact with the actual situation [13]. |

3. Development of Traditional Craft Lacquer Thread Sculpture AR Digital Content

3.1 AR Digital Content Development Overview

This is an AR digital content developed to help children understand and learn about the traditional craft of lacquer thread sculpture. The development process first selects traditional craft lacquer thread sculpture as the design subject, and through literature research to understand in detail the main production processes of traditional craft lacquer thread sculpture, including embryo selection, hammer the soil, start a draft, twist the thread, coiled wire, coloring, and gold leaf attachment [14]. This production process is used to create picture books, and the picture book screen is used to develop AR digital content for augmented reality effects. Through this AR digital content, children can learn the process of making traditional lacquer thread sculpture from digital content, helping them achieve supplementary educational effects and help them understand the traditional craft lacquer thread sculpture in a more fun way.

3.2 Traditional Craft Lacquer Thread Sculpture AR Digital Content Development Process

As shown in Figure 2, AR digital content development process for traditional craft lacquer thread sculpture can be mainly divided into four stages. First, the first step is the analysis stage, which includes investigation of lacquer thread sculpture, investigation of teaching methods, analysis of educational trends, analysis of learner environment, analysis of educational content, and analysis of educators' experiences. The second stage is the design stage, which includes detailed curriculum design, educational design, implementation design for each element, and content structure design. At this stage, the educational content and curriculum of AR digital content are planned and the educational effectiveness of the content and achievement of educational goals are guaranteed. The third stage is the development stage, which includes designing craft-making process images, implementing learning elements, implementing AR technology, and creating animations. At this stage, the design and content are converted into actual AR digital content to realize interactivity and visual effects. The final stage is the upgrade stage, and the main content is testing for users and upgrading content. At this stage, digital content is provided to users and necessary improvements are made according to their feedback and requests to improve the quality of digital content and user experience.

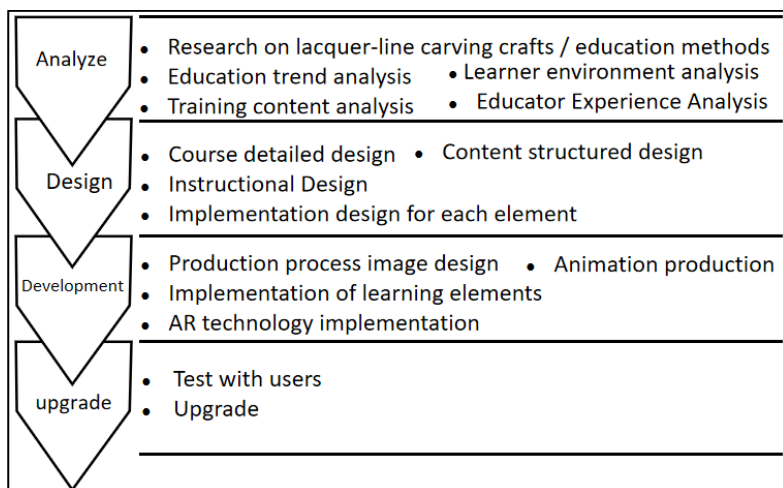


Figure 2. AR digital content development process

3.3 Content Development Technology Application

Adobe Photoshop is raster graphics editing software developed by Adobe Systems in the United States. It is a bitmap-based tool that uses pixels as the basic unit. This paper uses Adobe Photoshop to perform graphic design of AR digital content. The design inspiration for the screen refers to the actual production scenes and craft production stages of the traditional craft Lacquer thread sculpture production originating from CAI CHAORONG (蔡超荣), the 13th generation successor to the CAI's lacquer thread sculpture is shown in Figure 3.



Figure 3. Actual production scene of lacquer thread sculpture



Figure 4. Draft of picture book for lacquer thread sculpture

The design draft fully considers the production environment of the lacquer thread sculpture, including workbench, tables and chairs, tools used and related books. The line drawing uses a close-up view for line drawing and composition, so that the line drawing can accurately show the production process of traditional lacquer line carving in the picture. As shown in Figure 4, it is an album screen drawn based on the content of the reference image. Once the draft is complete, use Adobe Photoshop to color it. As shown in Figure 5, the reason why the warm orange color was chosen on the album screen is because it is a color unique to the buildings in southern Fujian and can better highlight the regional characteristics of the traditional craft lacquer thread sculpture. This warm color allows users to easily relate to the cultural traditions that the area symbolizes.

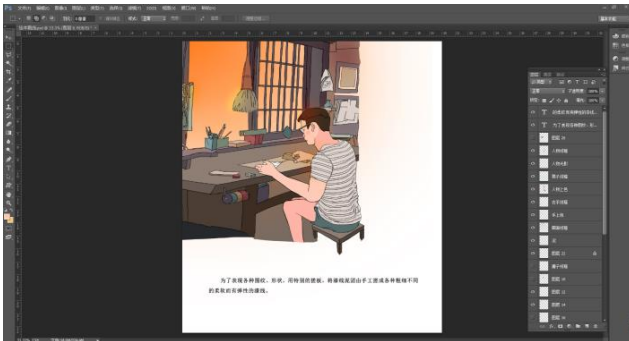


Figure 5. Picture book design using Photoshop



Figure 6. Using tool legends

During the production phase of traditional craft Lacquer thread sculpture, a specific series of tools are used. These tools include knives, hammers, twist boards, pens, paint trays, etc are shown in Figure 6. These tools are cleverly integrated into digital content development to provide a more intuitive user experience, and therefore will play an important role in the subsequent development of digital content. Users can intuitively understand the production steps of how to use these tools to make traditional craft Lacquer thread sculpture.

Adobe After Effect is a digital motion graphics and synthesis software developed by Adobe Systems. Used for non-linear image editing of movies or production of advertising, TV, games, animation, Internet and other content. As shown in Figure 7, this study used Adobe After Effects to animate the origin and main production process of the lacquer thread sculpture. The animation production includes the main process steps of lacquer thread sculpture, such as including embryo selection, hammer the soil, start a draft, twist the thread, coiled wire, coloring, and gold leaf attachment. In this way, the users can vividly understand the production process of traditional craft lacquer thread sculpture, providing an intuitive learning experience.



Figure 7. Animation production using AE



Figure 8. Animated voice editing using PR

Adobe Premiere Pro is a real-time, timeline-based image editing application software. It belongs to Adobe Creative Cloud, a product group of graphic design, image editing, and web development applications produced by Adobe Systems. At this stage, use Adobe Premiere Pro to perform video editing on the above-mentioned animation generated by Adobe After Effects is shown in Figure 8. The editing process includes a series of key steps such as adjusting the video volume, adding background music, inserting sound effects, and optimizing the animation rhythm, aiming to improve the fluency of animated images, improve viewing effects, and improve the quality of animated images.

Kivicube is an AR online production platform launched by Chengdu Meizhi Technology Co., Ltd. in China.

Through visual online editing, users can easily create their own AR/3D scenes and publish them to mini programs and web pages. The Kivicube platform has the characteristics of simple and efficient development, multiple development methods, and powerful AR recognition capabilities. Therefore, the Kivicube platform was selected for the development of traditional craft digital content in this study. As shown in Figure 9, this study uses the Kivicube platform to edit identification photos and create animated. After the editing is completed, the system will generate a QR code and network link. Players can open the mobile phone camera to scan the QR code or click on the network link to experience traditional craft Lacquer thread sculpture AR digital content. Users do not need to download an application on their mobile phones. They can experience digital content by simply scanning the QR code on the album.

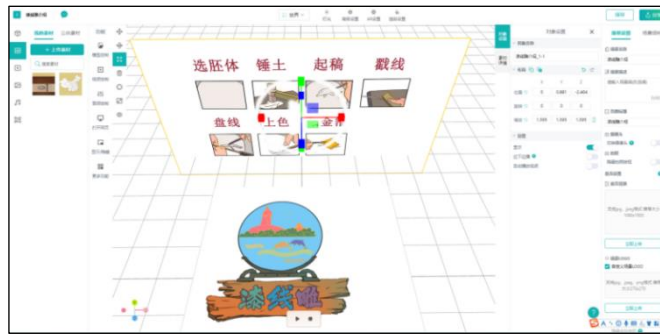



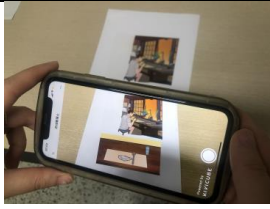
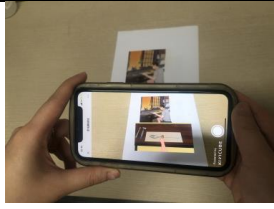




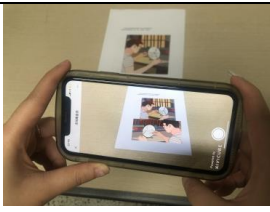
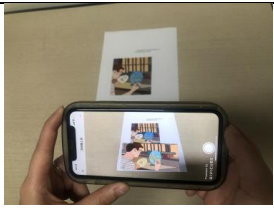
Figure 9. AR-Based digital content development screen using Kivicube

3.4 Prompt Content Development Results

As shown in Table 2, the experience results of the digital content of the experimental AR-based lacquer thread sculpture education training initially developed in this study are presented. Pictures A-F in the Table 2 are pictures of the main production steps of traditional craft lacquer thread sculpture. These pictures are used as identification pictures in the AR scene. Pictures a-f are pictures showing the effects of traditional craft lacquer thread sculpture AR digital content. The operation method of AR digital content is to use the mobile phone camera to scan the QR code provided to the user, and then scan the album. After the scanning is completed, a traditional craft production animation related to the book content will appear on the phone screen. Traditional craft AR digital content includes including embryo selection, hammer the soil, start a draft, twist the thread, Coiled wire, coloring, and gold foil production stages. Users can intuitively see all these steps and fully understand the production process of traditional craft lacquer thread sculptures and achieve the educational goals of traditional crafts.

Table 2. Presenting AR digital content development results

| Production Process | Introduction | Hammer the Soil | Twist Thread |
|---------------------|---|--|---|
| Picture Book Screen |  <p>A.</p> |  <p>B.</p> |  <p>C.</p> |

| | | | |
|---------------------|--|---|--|
| AR Display Screen | a.  | b.  | c.  |
| Production Process | Create a Draft | Coiled Wire | Coloring |
| Picture Book Screen | D.  | E.  | F.  |
| AR Display Screen | d.  | e.  | f.  |

4. Conclusion

In this study, we combine traditional craftsmanship and AR technology to develop AR digital educational content that helps children intuitively learn and understand traditional craftsmanship. The traditional craft of lacquer thread sculpture, one of China's cultural heritage, is selected as the main body of the digital content development case in the study, and the main production process of the traditional craft of lacquer thread sculpture is summarized through a literature survey. In the AR digital content development of the traditional craft of lacquer thread sculpture, the main production process of lacquer thread sculpture is reflected in the form of visual images, animations, and simulations of actual operation. After scanning the QR code or clicking on the URL link, users can understand the production process of traditional craft lacquer thread sculpture through video, animation and actual operation. Finally, we summarize the traditional technology combined with AR technology, which provides a reference for the development of similar AR digital content in the future.

In the future research, it is planned to experiment AR digital content of traditional craft lacquer thread sculpture with children subjects and verify the effect.

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