

Original Article

Designing Online Public Education Contents in Korean Medicine Using the Rapid-Prototyping Instructional Systems Design Model

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Objectives: The purpose of this study is to design Korean-themed online public education content in Korean medicine using rapid prototyping instructional systems design (RPISD). This study presents cases of developing and converting face-to-face general education programs designed to increase the interest in and understanding of Korean medicine for the public into online programs within a short timeframe.

Methods: This qualitative study is design and development research, which used the RPISD model to analyze the available resources utilized in the rapid development of public educational content and propose systematization and optimization measures by analyzing the needs of clients, learners, and the environment. The <Treasured Mirror of Eastern Medicine(DUBG)Open Course> was developed according to the model procedure, which involved needs analysis, development of course materials and manuscript, and storyboard creation and its filming and editing. Usability tests were conducted at all stages, and the opinions of clients, instructors, experts, and instructional designers were accommodated and reflected at each stage.

Results: Using the rapid prototyping model, <Treasured Mirror of Eastern Medicine(DUBG)Open Course> was organized into five classes of 20 minutes each. Each class was developed in Korean and included English, Chinese, and Japanese subtitles in addition to Korean under the cooperative instructional design among clients, subject-matter experts, instructional designer and learners.

Conclusion: The cooperative instructional design of stakeholders is significant in developing Korean medicine public education content online through extensive interaction and feedback from stakeholders in the early stage of educational content development.

Key Words : Rapid Prototyping Instructional Systems Design (RPISD) model, General Public Education in Korean Medicine, Design & Development Research

Introduction

Online education for adult learners has been widespread since the establishment of online universities in the early 2000s. The introduction of the Korean Massive Online Open Course

(K-MOOC) in 2015 proportionately increased online courses in the field of lifelong education of various learners. In particular, general courses, which had been held in person, have also been converted to online in response to COVID-19. This sweeping expansion of online education has

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raised questions regarding lecture quality and educational effectiveness. The growth of online content open to the general population heightened concerns over factors that affect various educational effects, such as the lecture material production fidelity, appropriate difficulty of the educational lectures, and attracting learners' interests.

To improve the effectiveness of online educational programs, the field of educational technology aimed at designing an instructional system based on the systems theory. This approach guides the systematic application of learning principles that affect the instructional design *ab initio*.¹⁻³⁾ The Instructional Systems Development Model (ISD Model) is a procedural model that schematizes the development process and procedures around the key elements involved and the relationship between them to develop an efficient and effective teaching system.⁴⁻⁵⁾ In this study, educational content was developed according to the ISD Model, which presents a series of procedural models necessary to devise educational content and programs and provides detailed specifications of the tasks essential for analysis, design, development, implementation, and evaluation. This study presents cases of developing and converting face-to-face general education programs designed to increase the interest in and understanding of Korean medicine for the general public into online programs within a short timeframe, utilizing Rapid Prototyping Instructional Systems Design (RPISD), a systematic instructional design methodology.^{6-7,9)} Although various online education is being developed for the domestic and international public and expert groups in the field

of Korean medicine, efforts to design and develop online education by introducing the ideas of system approach are insufficient. Korean medicine physicians and researchers can understand the specialized medical terms written in many Chinese characters; however, the general public has difficulty understanding several parts while reading. Therefore, an easy interpretation of Korean medicine terms to a level that the general public can understand and avail the knowledge is crucial.⁸⁾ It is likely that instructional designers and content developers have difficulties in the e-learning content development process due to their unfamiliarity with the use of terminology and knowledge in Korean medicine. Mostly, the role of instructional designers is to absorb the educational content from subject-matter experts and develop the e-learning content through instructional design interventions and prescriptions. However, subject-matter experts efficiently develop curriculums through collaboration with instructional designers having instructional design perspectives in cases when the teaching content expertise deepens, when the content development and operation proceed rapidly, or when several instructors must conduct a single training together (i.e., team teaching).

In this study, subject-matter experts were continuously provided with instructional design ideas and feedback. In addition, the seamless interactions between subject-matter experts, instructional designers, content developers, and clients were facilitated to ensure efficient instructional design. The educational content on Korean medicine that best reflects the client's needs and conveys specialized knowledge to the

public was expeditiously developed, and detailed procedures and step-by-step development tasks and outputs were arranged based on the RPISD model. The RPISD model has been developed and improved by researchers in the field of educational technology since 2006 in Korea that designs a prototype early in the development stage and quickly reflects the feedback of stakeholders, including clients, subject-matter experts, and learners.^{6-7,10-13)} Unlike the linearity of the existing instructional systems design in the development of curriculums or teaching and learning manuals, advantages of RPISD, like superposed analyses, design development, and test processes, efficiently reflect the opinions of clients, learners, and subject-matter experts rapidly, thereby improving education. After meticulous analysis of the learners' needs, all lesson components are placed, and the intended learning outcomes are pursued. In particular, the RPISD model quickly derives prototypes early in the instructional design process and conducts several usability tests with stakeholders so that clients and learners can view the results at the final stages to supplement the shortcomings of the existing instructional system design that are difficult to modify.¹⁷⁾ Through this study, the effectiveness of using the RPIDS Model is confirmed in developing online public education content in the field of Korean medicine and in designing educational programs.

Methods

1. Study design

This study is a design and development

research for online educational content for public education on Korean medicine. Design and development research is the systematic study of the design, development, and evaluation processes aimed at establishing an empirical foundation for creating instructional and non-instructional outputs and tools, as well as improved developmental models.¹⁴⁻¹⁵⁾ This qualitative case study develops and improves the educational program model; it analyzes all environmental resources related to educational content development for guiding teaching and learning activities in this context and generates tools necessary for the process. Therefore, the RPISD model was used in the present study to analyze the available resources utilized in the rapid development of public educational content and propose systematization and optimization measures by analyzing the needs of clients, learners, and the environment.

In this study, the RPISD model was applied for effective course development, and the <Treasured Mirror of Eastern Medicine(DUBG)Open Course> was developed according to the model procedure. Unlike the existing linear instructional systems design model in curriculum development, the RPISD performs simultaneous and super-positional analysis, design, and evaluation. Additionally, the quick designing of the prototype in the early stages and then confirming the stakeholders' opinions are critical. The RPISD model can be modified and supplemented to reflect the client's needs immediately. Ensuring that the client's needs are reflected in the curriculum development, designing the curriculum by considering the educational environment and context that the instructional designer may miss as well as the

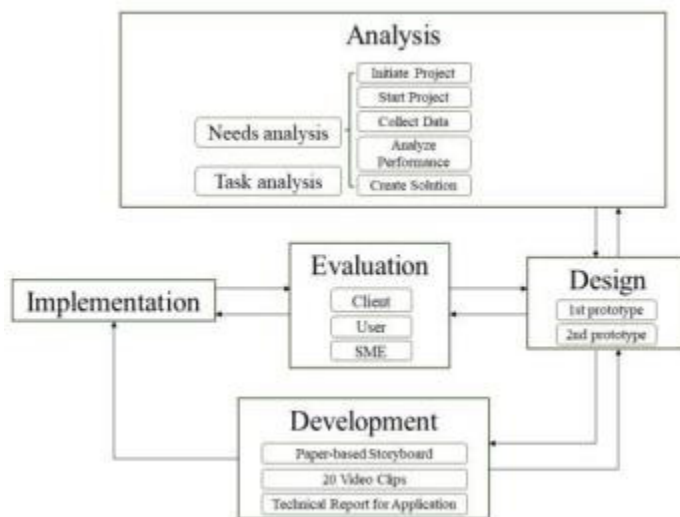


Fig. 1. Main Process with Rapid Prototype Model in This Study

Each stage of instructional systems design, such as analysis, design, development, implementation, and evaluation, was conducted simultaneously rather than sequentially. The analysis stage of asking the opinions of the client, subject matter expert, and the user, was mainly performed. (Modified this figure from the works of Lim C.I, Yeon E. K.11 & Cho E.B., Kim J.H., Hong J.S.¹⁶⁾)

characteristics and levels of the learners are possible. The RPISD model presents stages of educational program development and allows instructional designers to design educational programs by accommodating the opinions of clients, learners, instructors, and subject-matter experts at each stage. As such, the RPISD model, which allows for rapid modification and supplementation by reflecting the field circumstances, learners' levels, and clients' needs, can play a significant role in effectively developing the curriculum. The RPISD model used in the current study is shown below in Figure 1.

2. Procedure

This study was conducted specifically through the procedure shown in Table 1. The <Treasured Mirror of Eastern Medicine(DUBG)Open Course>

was developed through the key stages of curriculum development initiation, analysis, design, development, usability test, implementation, and general evaluation according to the RPISD model.

During the curriculum development initiation stage, the overall scope of the study was determined, and the roles of the clients, as well as participating instructors, designers, and developers, were established.

A needs analysis was conducted to understand the needs of the stakeholders at this stage. In particular, to actively reflect the needs and trends of the institutions, in-depth interviews with the Cultural Heritage Administration, Gyeongsangnam Province, and the local government of municipality A were conducted. Simultaneously, to construct online content as part of the initial task analysis, an expert advisory group of Korean medicine experts was formed, and in-depth

interviews were conducted with professors and doctors of Korean medicine and other medicine-related personnel. Based on the above, a literature review on Korean medicine-related publications and the main contents of the “Treasured Mirror of Eastern Medicine(DUBG) Online Course” were conducted.

In the design stage, the composition of the classes and the subject and main contents of each class were formulated based on the needs identified in the analysis stage. Course materials and manuscripts were developed based on refined content and collaboration with subject-matter experts in the development stage. Based on the manuscripts and materials, storyboards for each class were created, and filming and editing were

performed accordingly. Usability tests were conducted at all stages, and the opinions of clients, instructors, experts, and instructional designers were accommodated and reflected at each stage(Figure 2).

Results

1. Curriculum development initiation

An operation organization system consisting of a project management team (client), a instructional development team, and an advisory panel, was established for the actual operation of the present study to enable cooperatively efficient instructional design and development within a short time. The instructional development team included a

Table 1. Process Using RPISD

Key Stages	Detailed Steps
Curriculum Development Initiation	<ul style="list-style-type: none"> • Setting the scope of project execution • Clarification of client role
Analysis	<ul style="list-style-type: none"> • Review of “Treasured Mirror of Eastern Medicine(DUBG)”-related literature • In-depth interviews with the Cultural Heritage Administration, Gyeongsangnam Province, and Sancheong County • Analysis of contents that can promote the value of “Treasured Mirror of Eastern Medicine(DUBG)” • In-depth interviews with experts in Korean medicine (e.g., professors, doctors of Korean medicine, and Korean medicine-related personnel) • Derivation of three key topics and selection of the core educational content based on the results of the content analysis of Treasured Mirror of Eastern Medicine(DUBG)and Korean medicine
Design	<ul style="list-style-type: none"> • Educational program design • Storyboard design
Development	<ul style="list-style-type: none"> • Prototype development • Selection of topics, training hours, and educational materials for each class • Manuscript analysis, manuscript-based foundation design, structuring/illustrating/media selection, storyboard creation • Filming and editing • English, Chinese, and Japanese subtitling
Implementation	<ul style="list-style-type: none"> • Run prototype development
Usability Test	<ul style="list-style-type: none"> • Usability test of instructors, learners, and designers • Final program development based on the usability test results
Evaluation	<ul style="list-style-type: none"> • Conducting the general evaluation • Quality check on the video lecture material • Utilization and evaluation based on the proposed utilization plan

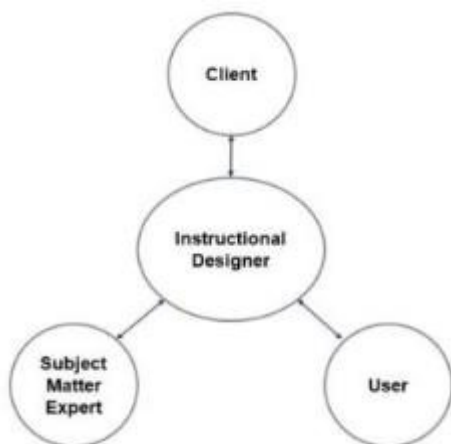


Fig. 2. Stakeholders in Systematic Instructional Design
 The instructional designer constructively reflected the opinions of the client, subject matter expert(SME), and user in the design process. (Modified this figure from the works of Cho E.B., Kim J.H., Hong J.S.¹⁶⁾)

management team from University B, video recording and editing developers, and a researcher who is also a professor and designer from the Center for Innovation and Future Education of University A.

2. Analysis

The analysis stage comprised the needs and initial task analysis phases. Needs analysis actively reflected the needs and trends of Korean medicine-related institutions by conducting in-depth interviews with clients. The results of the needs analysis were as follows: First, various learning elements and interfaces to enhance the learners' interest and increase the general public's access to Treasured Mirror of Eastern Medicine (DUBG) and Korean medicine are necessary. Second, the classes should be developed into small units to reflect the characteristics of the public admiring short-form content in recent

years. Third, the course quality must be improved by constructing a content review system and establishing an accurate developmental direction and evaluation. Fourth, suggestions for post-project utilization and various promotional measures are required. Adding subtitles in three languages, English, Chinese, and Japanese, was requested to develop products for foreigners visiting municipality A. For the initial task analysis, a group of Korean medicine experts constructed online content by gathering input from the experts through interviews with professors, physicians of Korean medicine, and other Korean medicine-related experts. Lastly, five core topics were derived, and the main contents were selected to promote the value of 「Treasured Mirror of Eastern Medicine (DUBG)」 to the general public.

Municipality A requested educational content development that promotes the region and the subject matter, as well as concrete alternatives to the content utilization plan. In particular, educational content consumers have gained clarity of their requirements through the needs analysis process. Moreover, the municipality wanted educational content development that could be used not only for the general public but also for foreigners visiting region A. Accordingly, additional content with subtitles for tourists and overseas Koreans was produced. Due to the limitations relating to development cost and period, Korean, English, Chinese, and Japanese versions were produced by applying SRT subtitle files, while the screen composition was in Korean. All scripts were presented as subtitles because playing the video without sound in a large, open space visited by tourists was imperative.

Additional suggestions included using a local policy expert as an instructor and timely addressing the COVID-19-related topics or topics that highlight the region's characteristics because Korean medicine is a specialized field, and its understanding and access may be challenging for the general public.

Consequently, the topics were organized into content that inform about the value of Korean medicine and Treasured Mirror of Eastern Medicine(DUBG) to the public to increase access. An interface was planned to construct by applying various learning elements, Chroma Key recordings, and computer-generated effects to enhance learners' interest. The course was organized around the Treasured Mirror of Eastern Medicine(DUBG) table of contents and divided into short classes of around 20 minutes each to reflect the profound familiarity of the modern population with short videos.

A precise direction of development by constructing a course content review system and improving the course quality through a usability test of video quality was established. Furthermore, a post-project utilization plan and various promotion measures in the form of a report were

proposed and delivered with the product. Concurrently, storyboards and videos were created for each class by reflecting the needs of five instructors.

3. Design

Based on the analysis results, the "Treasured Mirror of Eastern Medicine(DUBG)Open Course" was organized into five classes, and the core topics of each class were determined, as shown in Table 6. All five classes of the "Treasured Mirror of Eastern Medicine(DUBG)Open Course" were of 20 minutes each. Each class was developed in Korean and included English, Chinese, and Japanese subtitles in addition to Korean.

The name of each lesson is as follows. Lecture 1 is "Treasured Mirror of Eastern Medicine(DUBG), Being Listed on UNESCO's Memory of the World Register," lecture 2 is "Treasured Mirror of Eastern Medicine(DUBG), Soaring Through the 2013 World Traditional Medicine Expo in Municipality A," lecture 3 is "Treasured Mirror of Eastern Medicine(DUBG)Internal Bodily Elements, Soothing the Mind with Mind-healing Methods," lecture 4 is "Treasured Mirror of Eastern Medicine(DUBG)External bodily elements,

Table 2. The Name of Each Lesson

Lesson	Title
1	『Treasured Mirror of Eastern Medicine(DUBG)』 Being Listed on UNESCO's Memory of the World Register
2	『Treasured Mirror of Eastern Medicine(DUBG)』 Soaring Through the 2013 World Traditional Medicine Expo in Municipality A
3	『Treasured Mirror of Eastern Medicine(DUBG)』 Internal Bodily Elements, Soothing the Mind with Mind-Healing Methods
4	『Treasured Mirror of Eastern Medicine(DUBG)』 External Bodily Elements, Looking at Digestive Disorders from Outside the Body
5	『Treasured Mirror of Eastern Medicine(DUBG)』 Miscellaneous Disorders, a Convergent Approach to Strokes

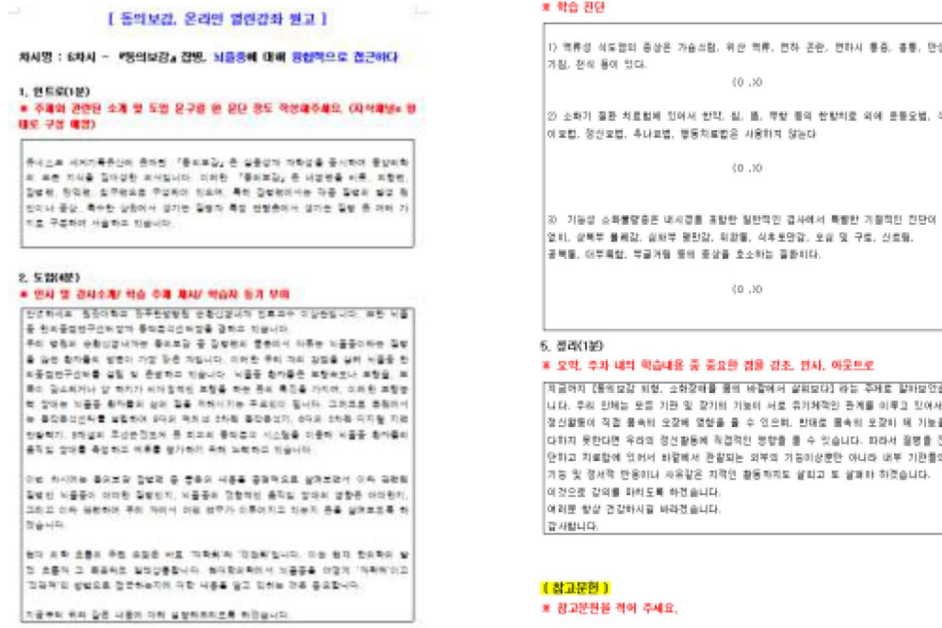


Fig. 3. Initial Version of lecturers' manuscripts

Looking at Digestive Disorders from Outside the Body,” and lecture 5 is “Miscellaneous Disorders, a Convergent Approach to Strokes.” (Table 2)

Each class started with 1) the introduction of the “Treasured Mirror of Eastern Medicine (DUBG)Online Open Course,” then 2) greetings, the introduction of instructors and the topic, learner motivation, and delivered 3) the educational contents related to the core topic of the class. Further, there were 4) quizzes on learned materials as a learning assessment and finished with 5) a summary of the lecture contents and an outro video.

4. Development

Five instructors wrote the manuscript based on the above procedures, and the instructional design team developed the storyboards based on the

manuscript. Figures 3 and Table 3 below show the manuscript and screenshots of storyboards.



Filming and editing took place according to the designed storyboards. Filming was completed over two sessions, and Chroma Key techniques were used.

The main content was derived for developing storyboards, and the instruction topic was selected through meetings with experts in each field. Additional meetings were held to determine the editorial direction. After conducting the initial meeting for the curriculum composition, the overall lecture arrangement and related materials were obtained from the instructors. The instructional design team analyzed the instructors' data to provide feedback on the course structure, based on which the instructors wrote the lecture manuscripts. Storyboards suitable for online

Table 3. Paper-based Prototypes of Each of 5 Lessons

Class Title	Example Storyboard
<p>Class 1 『Treasured Mirror of Eastern Medicine(DUBG)』 Being Listed on UNESCO's Memory of the World Register</p>	
<p>Class 2 『Treasured Mirror of Eastern Medicine(DUBG)』 Soaring Through the 2013 World Traditional Medicine Expo in Municipality A</p>	
<p>Class 3 『Treasured Mirror of Eastern Medicine(DUBG)』 Internal Bodily Elements, Soothing the Mind with Mind-Healing Methods</p>	

Table 3. Paper-based Prototypes of Each of 5 Lessons

Class Title	Example Storyboard
<p data-bbox="297 501 358 525">Class 4</p> <p data-bbox="182 527 472 629">『Treasured Mirror of Eastern Medicine(DUBG)』External Bodily Elements, Looking at Digestive Disorders from Outside the Body</p>	 <p>The storyboard for Class 4 features a central silhouette of a person. To the right, a diagram shows a box labeled '복문단(口) 1' containing the text '『복문대사(口)』, 『복문대사(口)』'. Below this, another box labeled '복문' shows a person's hands holding a small object, with the text '상복부' and '해복부'.</p>
<p data-bbox="297 942 358 966">Class 5</p> <p data-bbox="182 968 472 1070">『Treasured Mirror of Eastern Medicine(DUBG)』 Miscellaneous Disorders, a Convergent Approach to Strokes</p>	 <p>The storyboard for Class 5 features a central silhouette of a person. To the right, a diagram shows a central circle labeled '신경계 질환' (Neurological Disorders) with arrows pointing to '신경계 질환', '신경계 질환', and '신경계 질환'. Below this, a box labeled '신경계 질환' contains the text '신경계 질환, 뇌졸중 / 뇌혈류 질환' and '신경계 질환, 뇌졸중 / 뇌혈류 질환'.</p>

courses were constructed based on the lecture manuscripts and final lecture materials (PowerPoint slides).

Five storyboards were created using Microsoft PowerPoint for a lecture each. After producing the first version of the storyboards, the instructors' opinions on the developed storyboards were sought, and the second version of the storyboards was produced, reflecting their opinions. The instructors provided final feedback on the revised second version of the storyboards, and five final

versions were developed that reflected their feedback.

The storyboards were organized in the order of intro, motivation, instructor introduction, main lecture, quiz, and wrap-up. For the intro, the photographic materials centered on Korean Medicine, Treasured Mirror of Eastern Medicine (DUBG), and municipality A were obtained, the intro video was determined through the advisory committee consultation, and the final storyboard approval of the general management team was

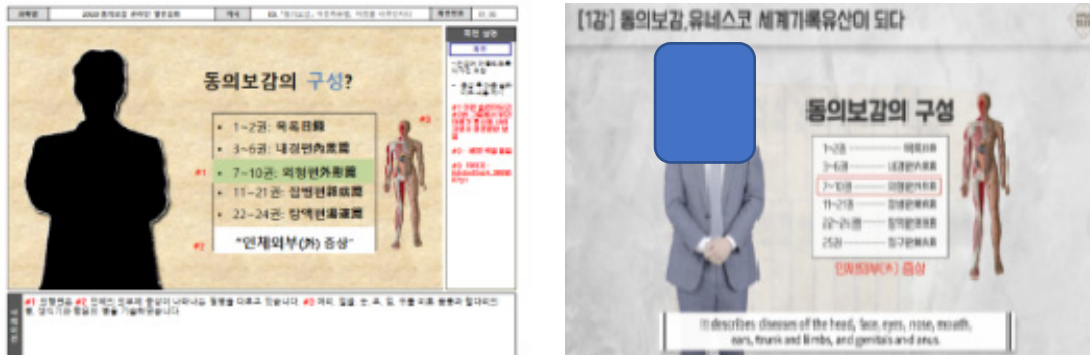


Fig. 5. A paper-based storyboard and a production output Comparison

confirmed.

The quiz comprised five yes or no questions for each lecture. Questions were presented, and three to four seconds were provided for the viewer to think. Subsequently, a correct answer and feedback were shown.

For lecture 1, data was collected to effectively publicize Treasured Mirror of Eastern Medicine (DUBG) as the world's documentary heritage and select its core contents. Quiz-like content was embedded at the beginning of the lecture to attract viewers' interest and motivation. Lecture 2 contained abundant visual appeals using rich photographic materials. For lecture 3, the storyboard was created around guiding a detailed "sample meditation" that the viewers could actually follow and adding elements of entertainment. It also provided additional explanations and data regarding the portion of the main text of Treasured Mirror of Eastern Medicine (DUBG) to be visible on the screen. Lectures 4 and 5 provided sufficient photographic data for the learners to familiarize themselves with the external appearance of the body and various

diseases presented in Treasured Mirror of Eastern Medicine (DUBG). Specialized medical terms were emphasized, and textual form with added explanations was used to enhance understanding.

The <Treasured Mirror of Eastern Medicine (DUBG) Open Course> was developed into five video classes based on paper-based storyboards. In addition to five classes with Korean subtitles, 20 videos were made, including English, Chinese, and Japanese subtitles, to promote the value of Treasured Mirror of Eastern Medicine (DUBG) and Korean medicine both domestically and internationally. After developing a prototype according to the RPISD model, the final video course was developed upon several revisions and supplements based on feedback from instructional designers, instructors, cinematographers, and editors. An example of the development output of the <Treasured Mirror of Eastern Medicine (DUBG) Open Course> is given below. (Figure 5)

5. Usability Test

The present study emphasizes the usability test of clients, instructors (subject matter experts;

SMEs), and online education experts based on the RPISD model. What is important in the RPISD model is that the design is not completed in a single process, but iterative modifications can be made through usability evaluation. Usability test is a process of exploring the practical effects and applicability of educational programs for clients, subject matter experts (SMEs), and learners for the initial prototype. It is generally conducted 2-3 times when developing online educational contents. In particular, this is evaluated as the most suitable method to fully reflect the needs of the client in a short period of time. When developing educational content according to the RPISD model, a paper-based prototype is rapidly developed at an early stage and confirmed by stakeholders. Although this is slightly different from the term used in the field of system development, it is common to call it usability test in the design & development research area. The first usability test was conducted on the first draft of the storyboards, the second test was on the revised storyboards, and the third test was on the videos developed based on the storyboards.

The details of each usability test are shown in Table 4.

Usability tests aimed to improve the course quality through iterative development and

modification of prototypes and to develop the course as quickly as possible.

6. Final Product

Based on the analysis results, the “Treasured Mirror of Eastern Medicine(DUBG)Open Course” was organized into five classes, and the core topics of each class were determined. All five classes of the “Treasured Mirror of Eastern Medicine(DUBG)Open Course” were of 20 minutes each. Each class was developed in Korean and included English, Chinese, and Japanese subtitles in addition to Korean. The name of each lesson is as follows. Lecture 1 is “Treasured Mirror of Eastern Medicine(DUBG), Being Listed on UNESCO’s Memory of the World Register,” lecture 2 is “Treasured Mirror of Eastern Medicine(DUBG), Soaring Through the 2013 World Traditional Medicine Expo in Municipality A,” lecture 3 is “Treasured Mirror of Eastern Medicine(DUBG)Internal Bodily Elements, Soothing the Mind with Mind-healing Methods,” lecture 4 is “Treasured Mirror of Eastern Medicine(DUBG)External bodily elements, Looking at Digestive Disorders from Outside the Body,” and lecture 5 is “Miscellaneous Disorders, a Convergent Approach to Strokes.”

The original educational videos developed were

Table 4. Usability Test Sessions

Session	Target	Participants	Output
Usability Test 1	Version 1 storyboards	Instructors, instructional technology experts	Version 2 storyboards
Usability Test 2	Version 2 storyboards	Instructors, subject-matter experts	Final storyboards
Usability Test 3	Version 1 videos	Instructional designers, subject-matter experts, clients, instructors	Final videos

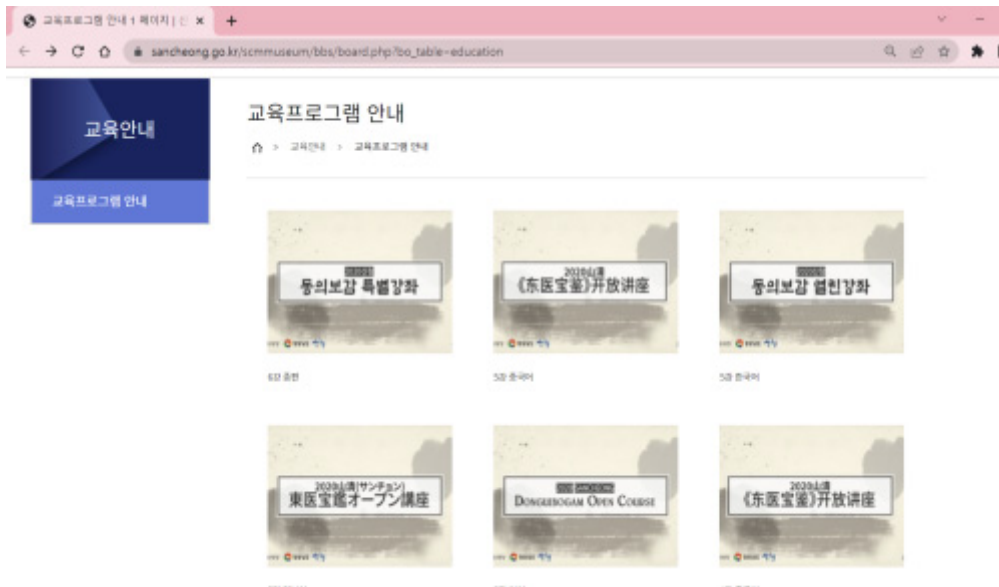


Fig. 6. Final output loaded on the website of clients

provided at the request of the clients, and they were installed on the website of cultural facilities to show to domestic and foreign tourists visiting the area(<http://donguibogam-village.sancheong.go.kr>).

Conclusions

This study presents a series of procedures necessary for developing educational content as a model. Educational content was developed according to the RPISD model, which specifically prescribes tasks necessary for analysis, design, development, implementation, and evaluation. A case of efficient development of a face-to-face general education program designed to enhance the interest and understanding of Korean medicine for the general public into online programs in a short period of time was reported.

The instructional systems development model that has been prevalent since the mid-1960s plans

and manages projects for developing real-world educational programs and organizing educational content and activities in collaboration with subject matter experts and related groups. The systematic instructional design thus shows a series of logical and rational processes of analyzing problems based on clients' requests to run educational programs, setting goals for problem-solving, and selecting, executing, evaluating, and modifying alternative solutions and strategies. In other words, this systematic method reviews the relationships of all the elements of the educational environment, deconstructs the goals, performs tasks, and finally assesses whether they align with the goals initially set and corrects any insufficient elements. The systemic approach highly values holistic and organic relationships and establishes an efficient educational environment by analyzing the relationships between the elements.

The present design and development study confirmed the necessity of developing a program that meets the client's needs by applying design and development methodologies based on the systems theory, the RPISD model. Further, the efficiency of applying the RPISD methodology to online educational content development was confirmed due to an increase in the satisfaction of subject-matter experts, instructional designers, and clients who teach specialized Korean medicine knowledge in a short period of time. For instructional designers to promote the spread of educational content by proposing utilization methods is also important. A resource statement investigation revealed that utilization could be increased by actively guiding the education and utilization methods.

The produced content on Korean medicine is online open educational content that can be posted on open video platforms such as YouTube and Naver TV to enable people to acquire knowledge and information about Treasured Mirror of Eastern Medicine(DUBG). In addition, it can be used as lifelong education content for various institutions, as it was developed as a course suitable for the needs of the era of lifelong education in topic, scope, and level.

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