Mobile app for breast cancer patients: Development process using the ADDIE models (Step 1)

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Method Article

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Abstract

The mobile app is becoming an indispensable product of our lives with its different features as well as communication services that make our lives easier. In addition to communication, it is used in areas such as monitoring health checks, tracking steps, and data transfer. In addition to these features, the mobile app is an effective tool to contribute to the disease process. To take advantage of this feature of the mobile app, health professionals develop app for different types of diseases. "ADDIE model", which is one of the education models, can contribute to the design process of mobile app content. These design steps involve a systematic approach process that includes analysis, design, development, implementation and evaluation. This research deals with the steps related to the development process of the mobile app prepared according to this design model in detail. This research focuses on the technical aspect of the app, explains the installation of a mobile app system that can be used by the patient who has undergone breast surgery, and can guide post-surgical symptom management. This research, which details the steps of the mobile app product design process, contains information that can guide researchers who are at the stage of producing similar products.

Introduction

Technological development continues rapidly in health care services as in other areas (1). These developments offer health care providers many options in the diagnosis, treatment and follow-up of individuals (2). Smart phones make it possible to easily integrate technology into our daily life and besides being a communication tool, they include a portable multifunctional computer, camera, video / voice recorder, music player, radio and navigation features. Due to the development of technology many medical mobile applications (apps) that contain information about health are easily installed on phones (3). These apps are used for different purposes for many individuals. Some of them provide nutritional and exercise advice in daily life, some count our daily steps, some remind us to drink water. In addition, the Turkey Ministry of Health contributes to the support of healthcare services with technological tools by offering the physician appointment system to the use of patients through the mobile app. Reported in the study that easy access to mobile apps by everyone will contribute positively to maintaining healthcare (4). In another study stated that the use of mobile apps by the public in health has increased at an acceptable level (5). Based on this information; it is thought that the mobile app can be useful for the patients to manage the problems that may occur outside the hospital, to ensure their participation in their care, to conduct and receive consultancy.

Mobile apps are used in different disease groups to control health problems. In a mobile app developed to be used for skin cancer controls, patients can upload their own stories and images of the change in the skin to the mobile app for the evaluation of the physician. In this way, it is possible to diagnose cancer earlier and to prevent possible negative effects during the treatment process (6). In the mobile app designed to monitor blood glucose levels of diabetic patients, it was stated that the app made a positive contribution to the patients' maintenance of their own glycaemic control. In addition, the data transferred to the clinic prevented the loss of time in among patient intervention and that the problems could be

solved before reaching the hospital admission stage (7). In another study, a mobile app was found to be effective in maintaining shoulder and arm exercises after axillary therapy in breast cancer patients (8). When the researches on the subject are examined; verbal expression is generally preferred in patient education in our country. In addition to verbal expression, methods such as brochures, individual counselling and booklets are used in patient education (9, 10).

In recent years, individuals have access to information and prefer the internet and mobile app rather than printed media such as brochures and books. Besides facilitating access to information, these apps are interesting and increase the rate of reading and practising (11). In a study conducted with patients with breast cancer, the mobile app developed to report symptoms and to cooperate with the hospital contributed positively to the acceptance of the disease and the treatment process (12). The study conducted with the mobile app in the education and follow-up of breast cancer patients regarding the disease could not be reached. Based on this information, we aimed to develop a mobile app for patients with breast cancer surgery. The main purpose of this mobile app was to train patients on how to manage symptoms that may occur after surgery and answer their questions. We aimed to support their self-care and to contribute positively to their quality of life thanks to this app. In this article, the authors share the process of creating a mobile application structured according to the ADDIE model for use in patient education.

Instructional Design and Technology

"ADDIE model" was used in creating the content of the mobile app. ADDIE is shorthand for the systematic execution of a process for developing an educational tool (13,14). ADDIE is a systematic approach process that takes its name from the following stages; 1. Analysis, 2. Design, 3. Development, 4. Implementation and 5. Evaluation. Each of these stages of this model is interrelated and serves as a flexible roadmap for designing an effective training method. ADDIE does not have a strict linear progression across its steps. Each phase of the model is made up of different procedural steps. For example, analysis typically includes needs analysis, learner, context, and content analysis. The output of the analysis phase is learning objectives, which serves as the input to the design phase. When each stage is completed in itself, it includes tasks that can be passed on to the next stage (Fig. 1).

The ADDIE model in the design of the app is that the model has detailed processing steps and repeated correction possibilities during the training material design process (Figure 2). It is also stated that the ADDIE model creates effective results in the structuring of health practices and patient follow-up (15).

ADDIE is a model that facilitates comprehensive knowledge transfer in adult education. With these features, it has been used primarily for developing multimedia learning content for years (16). The use of these process steps in creating mobile application content was deemed appropriate for our research (14). A detailed description of each step is given in Table 1 to describe the use of the ADDIE approach model in mobile application.

Table 1
Stages of ADDIE

	Mission	Output
Analysis		
Develop learning profiles	Existing level of knowledge	Information need
	Symptom identification	Symptom statement
	Patient identification	Patient profile
Design		
Develop online learning spaces	Write objectives	Measurable objective
	Develop text items	Instructional strategy
	Identify resources	
	Modify technology options	Selection avatar
Development		
Decide whether to insource or outsource tasks	Collaboration with software developers	3D video
		Script
		Exercises
		Prototype app
Implementation		
Prepare educators to educate	Patient training	Patient comment
	Tryout	Data
Evaluation		
Collect and assess the data	Record data	Recommendation
	Interpret test result	Revised prototype
	Revise product	

Analysis Phases

The analysis is the first step of ADDIE model in the design of educational materials. At this stage, it is necessary to create the "overall picture" of the instructional design integrity. This is a "contemplative"

stage where it is necessary to think about the patient-centred approach for the design of of materials. The researchers' focuses of the design in this phase are the patients and project goals. This process is detailed in Table 2. The content of the app was arranged in line with the literature and researcher experiences, according to the answers to these questions (17–22). Questions were prepared on the basis of existing problems in the literature (13–18) for breast cancer symptom management and adult education.

Table 2
Need Analysis Sample Question

Step	Section	Output
First	Sociodemographic background	Gender Knowledge level for breast cancer Information need
Second	Patient need	Content description Learning outcomes Content design
Third	Opinion & suggestion	Virtual presentation environment <ul style="list-style-type: none"> • Online • Video • Text • Animation Teaching and learning strategies
Fourth	Obstacle	Possible limitations Teaching methodology
For that reason, we asked these questions:		
Q1	What information do women undergoing breast cancer surgery need for postoperative problems?	
Q2	What are the distinctive characteristics that may affect learning?	
Q3	What are the behaviours we aim to learn?	
Q4	Which ways to transfer information?	
Q5	What information?	
Q6	Which medium (video, text, animation) should be taught?	

Design Phase

The information gathered from the analysis phase, in conjunction with the theories and models of instructional design, is meant to explain how the learning will be acquired. In this phase, the researchers focused on the conceptual construction of the mobile app particularly the app environment, what it can do and how to use it in order to fulfill the patients' needs. This phase was completed by following the steps below.

First step

Main headings of the mobile app; problems that may occur in the hospital after breast surgery, problems that may occur at home after breast surgery and care during breast cancer treatment. Problems that may occur in the hospital and at home after breast surgery; the practices expected from the patient after the surgery include information about preventing the development of problems and reducing their severity and recurrence if they do. These problems are for the patients both during the hospital period and the period at home; wound site, bleeding and drain, pain, infection, exercises, fluid collection (seroma) in the operation area, in addition to these, for the period at home; nutrition, use of drugs, loss of function due to movement restriction (frozen shoulder), swelling in the arm (lymphedema), sleep problems, body image change and sexual life. In the care head during breast cancer treatment; it includes information about patient follow-up frequencies, practices to reduce the risk of recurrence, chemotherapy, radiotherapy, hormonotherapy, pregnancy, nutrition, sexual life and emotional problems.

The mobile app was prepared in 12 punto, times new roman, 34-page A4 format text, in line with the aforementioned contents. Ensuring the suitability of the text content to be placed on the mobile app by experts (four academic nurses, one general surgeon, two clinical nurses, and ten breast cancer patients not included in the sample) will facilitate the environment design process. For this reason, it was first started by testing the suitability of the app text. For the text content, scope and validity of the app to be used; evaluated by our expert team. The opinions of the experts demanded that arm movements, lymphedema precautions and bleeding follow-up recommendations be included in the app in more detail. The new content that emerged after the arrangements was re-evaluated by them once again and content was finalized.

Second step

How will the information content that the application will provide to the patient be transferred to them (text, video, picture, etc.)? This step is completed by looking for an answer to this question. The content of the app was drafted by deciding how many interfaces it will have. In addition to the software developer who developed the app during the design process, it was made usable by getting support from a computer engineer. The text content of the mobile app was requested to have text, picture, video, sound equipment, and online consultancy service. It has been ensured that the mobile app has a separate interface for each problem, and each interface has a single problem-related text and animation content. The created interfaces were structured according to time and different colours were used for each interface. Animation videos were placed in the relevant section with the upper part and the text content at the bottom. All these operations, which can be done by entering a username and password, are secured with end-to-end encryption. In addition, encryption was used for the storage of patient messages in the online consultancy service department for patient's privacy and personal data protection policy.

Development Phase

The development of the software for the mobile app was handled by the software company in interactive contact with the researcher. The ".apk" extension file was created on the platform to be downloaded directly to the users' smartphones in the case of the patients in the intervention group. Visualize the text by adding an animated character to the app, since the trainings that address more than one sense organ would be more interesting and permanent, and provided the opportunity to access information by listening even if the patient could not read. The animation to be used in the design of the app was planned to be created according to its informative, supportive and summative features. The animation character was planned to be three-dimensional, considering that two-dimensional videos would be insufficient to create the desired effect for adults. In line with this plan, the app character was selected among the different characters created in the digital environment to create the animated character, and then the character was dressed by a theater artist in line with the prepared text. You can see the process of creating the character design by scanning the QR code on the side.

Implementation Phase

This phase allows mobile app to be tested to identify if they are well-functioning and appropriate for the intended audience. It is the process of converting the app content obtained up to this stage into a mobile app format. The test phase must verify the integrity and functionality of the created app. This stage ends with its conversion into an app that provides its functionality. The purpose of this test was to make the research material meet with breast cancer patients and to make improvements in the app. The total of patients who will participate in the implementation phase is 10 undergoing breast surgery. For this test, a mobile app was installed on the phones of the patients by the researcher.

Evaluation Phase

ADDIE model makes it possible to define two types of evaluation: intermediate (formative) and summative (16). We used intermediate evaluation. For this step actually started with first step which is analysis and continued last step. The app made available to the patients was downloaded to the phones by the researcher. This phase was completed by following the steps below.

First step

In the suggestions of the patients, larger visuals in the video in the app content and slower narration of the speaking woman were requested. In line with these suggestions, the relevant headings in the text content were expanded and the process steps were created. Hand gesture images were presented in a size that could reach the full screen and the time of the narration was extended. In addition, the patients who used the text colour, size and access to the question-answer section, did not request any changes in the videos or text content within the application.

Second step

In addition, a promotional brochure was prepared with the software developer who developed the app. This brochure provided information on how to use the steps, how to log in from the main screen in case

of a possible problem, and where to access the option to ask a question. App was designed to determine its impact on contributing to symptoms management of patients undergoing breast surgery.

Prototype mobile app

The final tested product was not completed in a format that patients could use. Fonts and images were prepared for the patients and made ready for use. The text content was prepared in line with the literature and the patients were tested. Username and password have been created in order to ensure that patients' questions are kept confidential on the mobile application. Thus, all patient information was kept confidential (Fig. 2). In order to ensure that this information is records that only the researcher can access, the data was secured with end-to-end encryption. The home page provides information about the research to the patients and is located on the home page (Fig. 3). The page that opens contains a list for patients to describe which problem they are experiencing (Fig. 4). Thus, patients were given the opportunity to select their problems from the list. They were provided with information about the problem they chose, both in writing and via video. In the light of this information, the patients were directed to the problem that could not be resolved and they were provided to reach the researchers with the question-answer section (Fig. 5).

Conclusion

Web-based programs or mobile app to maintain health services is increasing day by day. These programs serve valuable purposes such as information, guidance and monitoring opportunities for people. However, app with low level of evidence content can be downloaded from stores and endanger the health of individuals. For this reason, it is important that these apps are under the control of health professionals. In addition, health care professionals should work with different disciplines such as computer engineers, program developers, graphic designers in the creation of such apps. Thus, the product to be created will serve its purpose more. In order to achieve this, the healthcare worker must have a good grasp of computer terms and the types of digital software in the app content.

The article conveys a mobile application design process with written/verbal/visual content that brings together different team members. These experiences can make it easier for those who will walk the same route to prepare content, help them determine their roadmap, and shed light on their path as they walk. ADDIE can be a guide and an effective road map that you follow in designing a product to be used in education. The mobile application is an acceptable tool for patients to manage a health problem. The process of creating a technological product is exciting for the healthcare worker. We can say that researchers who want to experience this process will make you very happy when the product is finished.

Declarations

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Disclosure of potential conflicts of interest

None of the authors or affiliated institutions associated with this manuscript submission has any financial or personal relationship or affiliation that could influence the present work.

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Research involving human participants and/or animals

All applicable international, national, and/or institutional guidelines for the care and use of animals were followed.

Informed consent

Informed consent was obtained from all individual participants included in the study.

Ethical Approval

The approval has taken by the manager of Karadeniz Technical University Faculty of Faculty of Ethical Council on (Approval no. 24237859-124, Approval date: 26.02.2018) for the conduct of the study.

Author Contributions

A.A. and A.G carried out the study concept, design, data collection, and manuscript writing.

A.A carried out the data collection, statistics and manuscript writing. The authors declare that they have no competing interests.

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Figures

Figure 1

Figure 1. ADDIE process^{Kaynak}

Figure 2

Figure 2. Design and development process

The image shows a mobile application interface for a 'User Login' screen. At the top, there is a header bar with a back arrow icon on the left and the title 'User Login' in the center. Below the header, there are three input fields: 'User name', 'Password', and 'Login'. The 'Login' field is positioned below the 'Password' field. Below the 'Login' field, there is a link that says 'Create new account'. The entire form is overlaid on a large, semi-transparent pink ribbon graphic that serves as a background.

User Login

User name

Password

Login

[Create new account](#)

Figure 3

Figure 2. User login page

Smartphone Healthcare

Hello

This application was created by aydanur aydin so that you can use it to manage your post-surgery problems. The information to be obtained from you while using this application will be kept with end-to-end encryption. This information will not be shared with other individuals. With the username and password information given to you on the login page, you can stay in the application as long as you want and use the application as many times as you want.

Figure 4

Figure 3. Main page

Figure 5

Figure 4. Period tab at home

The home is a risky environment for the development of infection in the wound on the operated side. At home, you should not open the dressing of the wound and take care to keep it clean. If the dressing gets wet, first make sure your hands are clean and replace the old dressing with a new dressing.

The drain is removed on the 5th or 7th day after surgery. Wipe bath until the drain is removed, after removal, you can take a bath without wetting the seams. Powder, deodorant, lotion, perfume or cream should not be used before the surgical area is healed.
Have a nice day

Figure 6

Figure 5. View of video and text on screen