

# Designing an Online Case-Based Library for Technology Integration in Teacher Education

Mustafa Tevfik Hebebcı, Sirin Kucuk, Ismail Celik, A. Oguz Akturk, Ismail Sahin, Fetah Eren

**Abstract**—The purpose of this paper is to introduce an interactive online case-study library website developed in a national project. The design goal of the website is to provide interactive, enhanced, case-based and online educational resource for educators through the purpose and within the scope of a national project. The ADDIE instructional design model was used in the development of the website for interactive case-based library. This library is developed on a web-based platform, which is important in terms of manageability, accessibility, and updateability of data. Users are able to sort the displayed case-studies by their titles, dates, ratings, view counts, etc. The usability test is used and the expert opinion is taken for the evaluation of the website. This website is a tool to integrate technology into education. It is believed that this website will be beneficial for pre-service and in-service teachers in terms of their professional developments.

**Keywords**—ADDIE, Case-based library, Design, Technology Integration.

## I. INTRODUCTION

INSTRUCTION is a systematic process in which every element (i.e. teachers, students, materials, and learning environment) is very important to successful learning [5]. In the area of instructional technology, instructional design serves as a crucial process that guides the planning and development of effective learning environments [13]. Instructional design that implements sequence of instructions for developing educational programs or instructional materials [8]. According to Smith and Ragan [20] defined as instructional design is – a systematic and reflective process to insert optimized instructional principles into different learning resources like materials, activities and evaluation process. An instructional design model should show what many different aspects of the instruction process are to be like in order to achieve the desired outcomes under the expected conditions [14]. The characteristics of instructional models are that they are (a) learner-centered, (b) goal-oriented, (c) focused on real world, (d) measured in a reliable and valid way, (e) empirical, and (f) require team effort [8]. The instructional design

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principles constitute a systematic method that helps educators design learning activities consistent with learning objectives and evaluate learning outcomes.

Many up-to-date models have been developed on instructional design. There are more than 100 different variations of instructional design models (Dick and Carey, Kemp, Taylor, Smith and Ragan, etc.); however, almost all of them reflect the generic “ADDIE” process [2]. ADDIE is a well-known and most popular instructional design framework which is also base for most of the instructional design models [10]. The main goal of ADDIE is to increase the effectiveness and efficiency of education and training as well as eliminating peripheral knowledge from courses while ensuring that students acquire the necessary knowledge and expertise to do the job [2]. ADDIE model is integrated into instructional system throughout all phases of the process—analysis, design, development, and implementation, with the evaluation activities integrated into each phase of the process (Fig. 1).

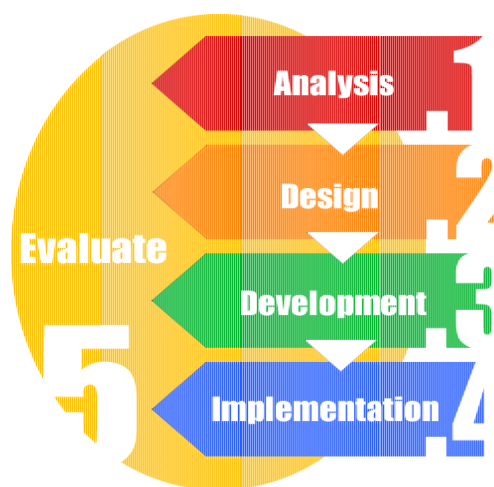


Fig. 1 The phases of ADDIE model

The ADDIE process is a series of procedures which addresses decisions about exactly what, where, how, and when to teach the skills, knowledge, and attitudes needed to perform every task selected for instruction [2]. Moreover, it provides a step by step process that helps instructors to plan and create training programs with a framework in order to make sure that their instructional results are effective and that their processes are as efficient [19].

The first phase which is called *analysis* involves analysis of the learner characteristics and needs, defining educational goals and objectives, deciding the material that must taught and recognizing learner’s previous knowledge [18]. Designing

of the lesson begins with the determination of the lesson objectives and follows with the decision on the right strategies to perform these objectives [3]. The decisions taken in the analysis process is the basis of all other phases.

The *design* phase of ADDIE involves answering some important questions about how students will learn, how they will demonstrate what they have learned and how the learning will occur [7]. Therefore, in this phase, instructional developers/instructors write objectives in measurable terms [5]–[20], select instructional material and media, determine instructional strategies [2], and specify instructional content, resources and process [7]. In the design part, instructional designers also determine assessment methodology [6]. After the completion of the design phase, development phase begins.

During the *development* phase, results from the analysis and design phases are used to develop instructional materials and activities. In other words, the development is a production phase of ADDIE instructional design model. In this phase, the instructional designer is concerned with the most appropriate medium for instruction such as how the visual design of the instructional materials can support and facilitate learning; and whether the materials are "usable" or whether they actually get in the way of learning [8].

In the *implementation* phase, the analysis, design and development phases come together and learners gain important knowledge and skills as a result of instruction [14]. This phase deals with the actual delivery of instruction and the achievement of the course objectives [7].

The last phase of the model is *evaluation*, which is not generally part of the instructional design process. Evaluation involves formative and summative evaluation which often appears in various phases of the model. Instructional designers test the instructional materials to determine what kind of changes and revisions need to be made in them. Formative evaluation involves identifying needed revisions to the instruction; summative evaluation involves assessing the overall worth of the instruction, in either absolute or relative terms [8]. Evaluation provides a feedback in order to back the necessarily phases of the model.

A case which is called a story described with situations, problems, knowledge and skills to be used also helps to transfer learning to various job settings [11]. Case is a method that the pre-service teachers confronted with problems are likely to be faced in real classroom settings and prepares them for life [15]. The benefits of case-based learning are facilitating critical thinking, deep analysis, problem solving and meaningful learning [17].

The purpose of this paper is to introduce an interactive online case-study library website developed in a national project. The design goal of the website is to provide interactive, enhanced, case-based and online educational resource for educators through the purpose and within the scope of a national project. The ADDIE instructional design model is used in the development of the website of an interactive case-based library. The reason why the ADDIE instructional design model was chosen in this study is that it is a

model that can be valid for all kinds of instruction and at the same time application of the ADDIE process has improved the quality of instruction in consistent manner [2].

## II. METHODOLOGY

### A. Participants

Participants were 91 pre-service teachers at the Computer and Instructional Technology Education Program in the Faculty of Education.

### B. Research Instruments

In this study, usability test, originally developed by Çağiltay [4], was used to examine the usability of the website. This research is a pilot study that was designed for usability of the web page.

### C. Data Analysis

The data from this study were analyzed using SPSS 20 (Statistical Package for Social Sciences) software. Descriptive statistics were used to analyze the data. For this, the average, standard deviation, and reliability have been examined.

## III. FINDINGS

### A. Design and Evaluation

The ADDIE instructional design model was used in the development of the website of interactive online case-study library. The five core elements are: Analyze, Design, Develop, Implement, and Evaluate (ADDIE) [1]–[21]. Fig. 1 shows that the development of web sites according to ADDIE instructional model phases. ADDIE instructional model contains other instructional models' components [9]–[12] and most instructional models are developed based on ADDIE model [16]. As seen in Fig. 1, each of the core elements of ADDIE (analyze, design, develop, implement and evaluate) informs the other as development takes place and revision continues through the process at least until the instruction is implemented [8]. This situation saves time and cost. In this project, the assessment of the website is conducted in terms of user feedback and online error reports during the implementation of the website through the circular framework of ADDIE model. After the errors are analyzed, the web site is improved and developed. The development phases of websites are given below according to the ADDIE instructional model.

**Analysis:** Design goal of the website is to provide interactive, enhanced, case-based and online an educational resource for educators through the purpose and within the scope of the project.

The following objectives were implemented within the scope of this website:

- Informing website users about projects' aims and achievements
- Explaining the scope of the project by giving information about case-based method and TPACK (Technology, Pedagogy and Content Knowledge)
- Enabling users to submit digital observations via a membership system

- Giving opportunities to users for reviewing and editing their observations
- Ensuring that observations sent by project implementers (the website administrator) are shown via a control panel and broadcast, after being turned into case study format, again via the control panel on case study library with appropriate labels and explanations
- Giving opportunities to users for voting and making comments on published case studies
- Allow reviewing, approving / deleting / editing operations by site managers via control panel
- Presenting quick (with keywords) and advanced (content, author, tags, area, location etc. selective) search features for case-based learning
- Giving opportunities to users to list search results of case studies according to specific criteria (title, score of voting, count of read, date added)
- Placement of “Report an error” link and the form under the case studies because of the inclusion of users in the feedback process
- Presenting a communication form under the “Contact Us” menu to take websites users’ opinions and suggestions about the project and the website

The target groups of the website comprises of pre-service teachers and in-service teachers who are using the FATiH Project applications in education and instruction. At this phase, design tasks and success criteria were listed in terms of the current knowledge, characteristics and learning competencies of the target groups. Based on the expert views, the tasks were identified, the revisions were made, and the website was developed in the project work-time schedule.

**Design:** At this phase, educational, visual and technical design strategies were used in terms of objectives and tasks determined. The suitable strategies and methods were decided for the target groups. User interface of the website was designed using these determined strategies and methods. Also, how the content format and layout would be presented to the users was decided.

Experts’ views were taken throughout the designing of the interface phase. In designing of the interface phase, the graphical interface of the website was planned in detail and reported with a storyboard. The first storyboard study revealed the basic appearance of the website (Fig. 2).

Formation of a draft website map before the system is prepared is of great important in the process of system design and planning. Moreover, a website map application was prepared that showed the menu components needed for the website, and the connection between the pages, which revealed the hierarchical structure of the website (Fig. 3).

After the stages of creating a draft and a menu hierarchy, a storyboard belonging to the homepage was formed (Fig. 4).

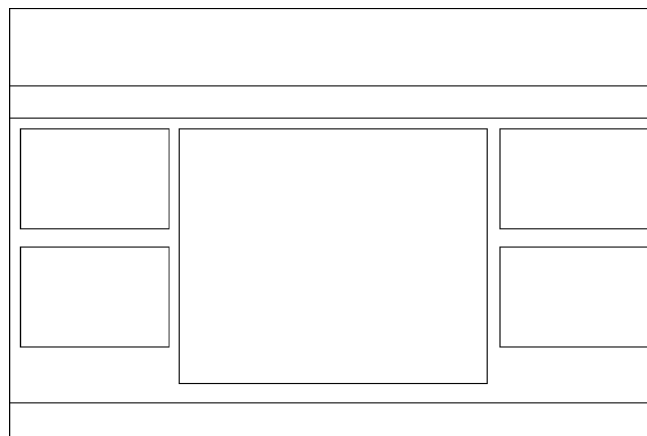


Fig. 2 The first template for the website

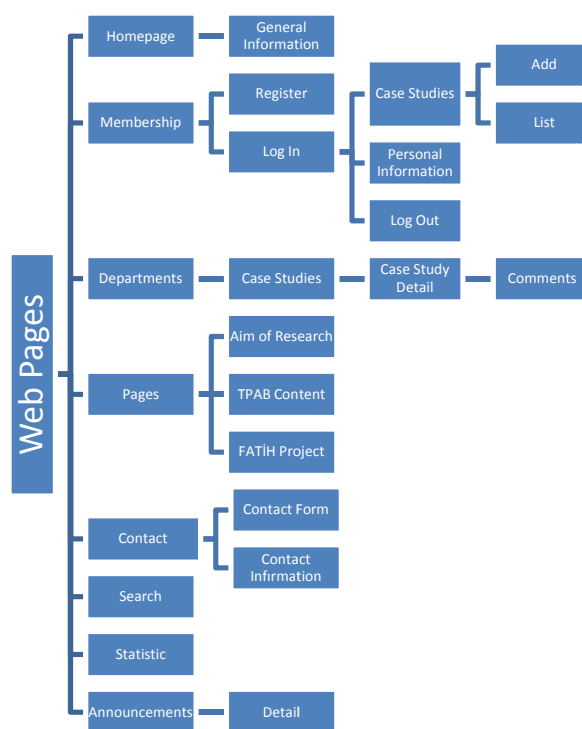


Fig. 3 The hierarchical framework of the website

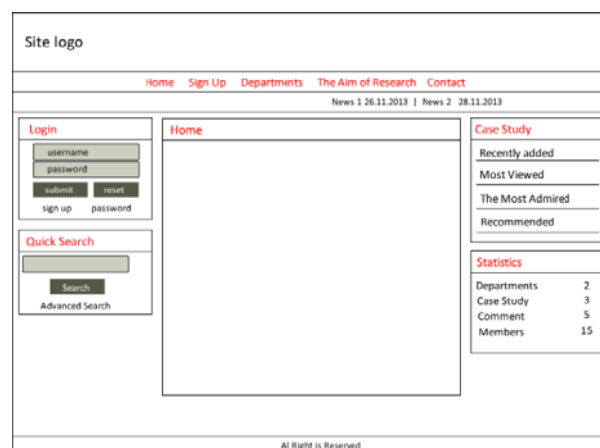


Fig. 4 The homepage storyboard of the web site

At this phase, the architecture of the website programming, web design, programming technologies and tools were determined. Moreover, it was important to fulfil this phase comprehensively and meticulously because all the coding and technical development steps of the web site depend on the storyboards and user interface report.

**Development:** In this phase, preparation of the design of the graphic user interface and storyboards was implemented by the web designer and the web programmer using technological tools and strategies as a visual/software. While the web designer integrated the graphic interface into web technologies by using the templates and prototypes in the design stage, web programmer created the web components that organized and managed the content of the web page, which would be compatible with this interface, and that would enable the fulfillment of project tasks. Web designer and web programmer worked harmoniously and cooperated at certain points to develop visual and dynamic structures by considering the dynamics and interaction framework of the website, which made the process faster and easier. During the developmental stage, as components were completed, debugging procedures were implemented by testers and thus feedback was provided. In addition, the developmental process was continually revised by taking expert views.

**Implementation:** In this phase, all of the codes, graphics, media, and the database files of the websites were transferred to web hosting server and the necessary adjustments were made as functional. In the implementation phase, by using an error report system and web analysis tools, user activities were tracked on the web site. Thus, the website was checked through the objectives which had been determined before. In this phase, if an error or deficiency was identified through the ADDIE cyclical process- turn back to the design phase if it is necessary- an update for the codes and contents of website was provided. At this stage, a few cases studies were entered by the project team into the web site to see if the web site worked smoothly or not and it was observed that the web site worked properly.

**Evaluation:** An evaluation was performed both in the design process and at the end of the design. The formative evaluation appeared in all phases of the web site development. Thus, it was checked that the website attained success criteria which had been determined in the analysis phase. The development phase of the website was used to enter pre-service teachers' observations. The formative evaluation is considered in this process. Similarly, a summative evaluation was conducted and the user opinions about design and project outcomes were taken. A product that was developed by students selected from a department was used and their views about their user experiences were collected and analyzed. As a result of the analysis, the realization levels of the design and the project objectives were stated.

Expert view was taken during the evaluation stage of the web site and the following corrections were made in accordance with these views.

- During the process of determining the stylistic characteristics of the web site, initially, the dominant

colors of the web site were chosen to be blue, red and grey. However, it was decided, in line with the expert view, that it would be more appropriate to select colors that would match the university's colors and would not tire eyes, which meant the selection of turquoise, grey and white.

- A section called "News" was not added while the website map, which would reveal the hierarchy in the web site was being prepared. However, a news module was created thinking that a module that would allow the web site administration to contact users might be needed in the course of time.
- In the section where the copyrights of the web site were mentioned, it was initially planned that a written article, the university's logo and the sponsor's logo (TÜBİTAK) would be included. However, this section was removed on the grounds that it occupied too much space and as a result a small section stating the copyrights was created.
- During the initial coding of the web site, it was checked continually by W3C Validator to ensure that stylistic features were in conformity with the international standards. (<http://validator.w3.org/>)
- Considering that inclusion of the section that rated the comments about case studies was unnecessary, it was removed.
- It was decided that Ajax technology be used in the case study page so that one would not have to go back to the beginning of the page each time a comment was added. Thus, instant data recording became possible.
- Using the paging system in the pages where sections and case studies were listed, the web site was prevented from being too long.
- Users were informed about what purpose the form components in the web site served by including a section which explained this.

The usability test was used to evaluate the usability of the web site which was designed based on the expert reviews. The mean scores about the usability of the web site that was prepared are given in Table I.

TABLE I  
 THE DESCRIPTIVE ANALYSIS RESULTS OF THE USABILITY TEST ITEMS

| Test Items  | n  | $\bar{X}$ | SD   |
|---|----|-----------|------|
| 1. I think I will often use this system.  | 91 | 2.94      | .94  |
| 2. I found the system unnecessarily complex.  | 91 | 3.49      | .95  |
| 3. I thought the system was easy to use.  | 91 | 3.61      | 1.04 |
| 4. I think I need technical assistance from someone in order to be able to use this system. | 91 | 3.90      | 1.00 |
| 5. I found several functions of the system well-integrated.                                 | 91 | 2.98      | 1.00 |
| 6. I thought there were too many inconsistencies in the system.                             | 91 | 3.48      | 1.04 |
| 7. I think many people can use this system fast.  | 91 | 3.39      | .92  |
| 8. I found the use of the system extremely clumsy.  | 91 | 3.51      | 1.03 |
| 9. I was self-confident while I was using the system.                                       | 91 | 3.62      | .85  |
| 10. I had to learn many things before I entered the system.                                 | 91 | 3.94      | .95  |

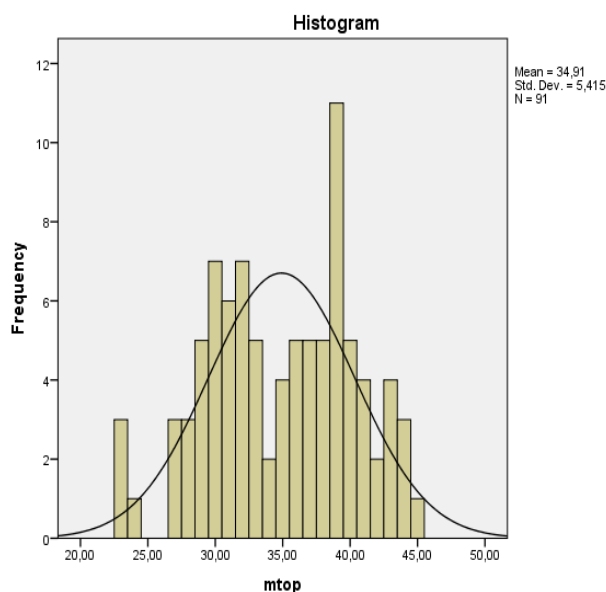


Fig. 5 The histogram diagram for the normal distribution of the items in the usability test

It was observed that the items with the highest scores in terms of usability were 10, 4, 9 and 3 respectively whereas those with the lowest scores were 1, 5, 7 and 2. When Fig. 5 is examined, it is seen that the distribution of the items in the usability test was slightly skewed towards the left (skewness - .190). It can be said that if it is within the limits of the coefficient of skewness (+1, -1), it does not exhibit a significant deviation from the normal distribution of scores. Therefore, this distribution can be considered normal. For the reliability of the scales, Cronbach's alpha coefficient was used. Cronbach alpha coefficients were found to be .75 for the usability scale. These results indicated that the acceptable level of reliability was evident for the usability scale.

#### IV. CONCLUSIONS

The purpose of this paper is to introduce an interactive online case-study library website developed in a national project. Within the scope of this project, an educational, interactive and case-based project was developed in order to create a source that teachers and students can resort to regarding problems and cases that they may experience in real classroom conditions. Moreover, the ADDIE instructional design model was taken as a basis during the preparation of this web site and the web site in question was prepared in accordance with the stages of this model. After the web site was designed, a pilot version was administered to 91 pre-service teachers. At this stage, the usability test was administered to the pre-service teachers. As a result of the analysis, it was seen that the pre-service teachers found the web site usable. Moreover, it was seen that the mean scores of items such as I think I will often use this system, I found the system unnecessarily complex, I found several functions of the system well-integrated, I think many people can use this system fast were higher than the other items. On the other

hand, the mean scores of items such as I thought the system was easy to use, I think I need technical assistance from someone in order to be able to use this system, I was self-confident while I was using the system, I had to learn many things before I entered the system were lower than the other items. As a result of the responses obtained from the students, it was understood that the students found the web site complex and therefore it was decided that we return to the design stage of the ADDIE model, make the web site simpler and remove unnecessary components. In conclusion, it was seen that the students' attitudes towards the usability of the web site were positive. It is believed that this website will be beneficial for pre-service and in-service teachers in terms of their professional developments.

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