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Designing Student-Centered Online Learning Environments Framework, Principles, and Guidelines

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Abstract
Even though technology can offer many opportunities for various forms of communication, the design of the learning environment is the factor that has the most influence in the quality of the learning experience. This chapter's endevour is to provide some of the design guidelines for designers and developers to create the quality of online learning environments based on the experiences at a funded University in Turkey. As a learning management system (LMS) Moodle in a computer literacy course allowed students to follow their online class both asynchronously and synchronously via Adobe Connect.

1. Introduction

The educational paradigm is based on standardization, which is similar to the logic behind the mass production of the industrial era. Different students learn at different paces and have different needs. However, the aim of today's educational paradigm is to teach the same content in a limited time to a large group of students. Traditional education is efficient in terms of delivering the content this way, but it is not effective. Standardized education was ideal for comparing students and identifying the brilliant students, which was important in the industrial era since the aim was to separate the managers from the workers. As the focus has turned towards quality, responsible, analytical and problem-solving individuals emerged. In order to respond to this need in industry as well as for lifelong learning, it is necessary to change the focus of our education system.

Since different people learn in different paces, a focused learning system gives a student the time that he needs to accomplish his learning aim. Taking on the responsibility of problem solving with a variety of perspectives is needed in societies and families. Today's educational paradigm is based on cooperation and students are expected to do what they are told. Therefore, changing only the content will not be sufficient; the paradigm itself must be changed (Banathy, 1991, Reigeluth, 1995).

Instructional systems design is about both product and process. A learner-centered paradigm requires a shift from standardization to personalization; from offering the material to responding to the learner's need; from just transferring

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knowledge to helping him to understand this knowledge; from passive learning to active learning; from teacher-centered to learner-centered learning. The learner-centered educational paradigm of instructional design theories would make the teacher's role that of a facilitator with well-designed resources. The educational definition of cognitive theories includes the integration of the new information with the learner's own knowledge instead of simply transferring it. Another definition would be doing everything to facilitate meaningful learning.

If someone wants to learn a skill, then the introduction of that skill, the description of how it would be realized, practicing, giving feedback would definitely make learning that skill more successful. Behaviorists, cognitivists and constructivists accept these methods. Instructional design theories previously focused mostly on the cognitive field. Instructional design theory's new paradigm needs to be directed towards learning and the variety of types of learning and the need to offer guidance to create a mix of learning environments, self-owned and support, self-direction and structure.

The general principles do not differ much in the literature. The main difference originates from the response to the question "what kind of educational system do we want?". The general principals and the characteristics of the instructional design are to be a project based study, systematic process, target group, learner-centered approach, meaningful performance, measurable learning outcomes, self-adjusted functionality, team study, and creative products.

Several instructional design models have been produced. The similarities and differences in these models can be observed in both the design parameters and the process. While some models follow the linear flow during the process, others include loops, others also have interactive structures and cognitive flexibility.

All the models include steps based on systematic detailed studies. Since the process is complicated, the instructional technologist does not follow any specific model but rather his own preferences. Generally, instructional design studies start with educational needs originating from the problems and end up producing a designed, experienced and adjusted instructional system to respond to those needs. The philosophy of the design shows itself in the model studied. If the instructional design follows adjacent steps, linear models are used; if recursive steps are followed, then models will include more loops or be interactive.

Some of the models originated from the difference between the teaching-learning approaches (teacher centered, learner centered), some from the needs or the structural characteristics, some from their own design process dynamics and still others from the type of the product that will be produced (material/system).

This chapter will explain how instructional design principles are used in the design of an online computer literacy class and how these dimensions are related to student-centered learning and quality in an online class. The chapter will end with recommendations to instructors for improving their classes.

2. Theoretical Background

Model research aims to produce new design and development models. As new models are developed the characteristics of existing models are being improved.

Before studying the impact of the new model on the participants and its effects on the system, its validity must be proved through expert reviews and experimental research methods. These studies are important for designing and developing types that focus on the impact of the model based on usability principles. Hong and Choi (2011), Tracey and Richey (2007) and Fang and Strobel (2011) conducted studies on the design, validity and implementation of models.

A typical example of model research would be Shambaugh and Magliaro's instructional design course, which used an alternative approach (2001). In this project spanning six years, the main aims were to design the model, implement it and then assess students' learning based on their comments. Different data such as the study documents, emails, course descriptions, completed instructional design projects, two different conference notes, course assessments and individual assessments were collected and studied according to the design decisions, the implementation and the assessment of the model.

Instructional design models can be classified under six headings: nucleus (core) models, linear models, flexible models, interactive models, intuitional models, and compound models. Nucleus models are inspired by modern instructional definitions and study the instructional design in a larger context. The best known among the nucleus models is the ADDIE model, which was inspired from the constructivist learning theories whereas behaviorist models indicate the operations in detail and consider implementing the steps in order. The ADDIE model is the most used one in the field.

The model, which was developed by Briggs (1977), is also worth mentioning since it was one of the pioneers in this category. Compared to the ADDIE model, this model, which was later on referred to as Gagne, Briggs and Wager (1988), included institutionalization and expansion parameters. Even though the ADDIE model has the larger perspective, it is also criticized for being too systematic, costly, limited and time consuming.

Linear models are the ones in which the steps are adjacent and there are periods when many are completed at the same time. The best-known model is that of Dick and Carey (1985). The design process in Dick and Carey (1985) starts by defining the needs to determine educational targets, and then the target audience and educational context are designed. The parameters that are designed can affect the instructional decisions. The performance goals, which point out the outcomes are written according to the data obtained at the beginning. After the performance goals are written, the process follows a linear path and the production of assessment tools, the determination of instructional strategies, the selection and development of teaching-learning materials are all part of the process. At the end, adjustments are made according to the mid-evaluations and results of the developed instructional system. According to the data, a last evaluation is completed, which leads to decisions regarding institutionalization, generalization and expansion. The model has been called the Dick, Carey and Carey (2005) model in later years. The critics of this model focused on its systemic approach in which the development of the instruction rather than the design of instruction was the

focus. Moreover, the assumptions of high level learning outcomes, the student's activeness and the model's linearity are the crucial points.

The flexible models, instead of following an adjacent path, defend the view that the instructional designer determines the most convenient starting point and then follows a systematic path. Otherwise, it argues that creativity will be prevented and the whole process will become mechanical. A good example for the defense of flexibility when designing the instruction is Kemp, Morrison and Ross (1994).

Interactive models do not follow linear or loop paths, do not accept starting instructional designs from 0 and do not start them by determining the needs. This type of model is used to design entirely new instructional systems, instead of improving the elements that do not work in the process as in the flexible models. The unique characteristic of the interactive models is that there is an interaction in and between every step. According to the feedback, more than one step can be adjusted at the same time. From many perspectives, they look like nucleus models, but they do not postpone the assessment till the end; instead, they evaluate and adjust every step of the process immediately. Those models are not easy to implement, especially by inexperienced designers, since the process is quite complicated even though it seems to be simple.

The main criticism about the instructional design process is that it is extremely systematic. On this point, intuitional model designers indicate that they do differ from designers in other fields. Since instructional designers follow the systematic process and apply principles like the engineers in contrast to the most of the designers who work independently like artists do. One of the examples is Tripp and Bichelmeyer's (1990) Rapid Prototyping Model, in which a prototype is produced quickly and then tested. According to the collected data, the necessary adjustments are made and the design is completed when the product or the system works perfectly without error. One of the most important characteristics of this model is that it leaves the whole process up to the creativity of the designer. In the traditional models, after the product is completed and becomes usable, the assessment is made. However, in the Rapid Prototyping Model, even at the beginning of the design, a workable prototype is created and the product is completed with the adjustments during continuous assessment and adjustment loops.

Compound models put the related design steps into groups and then construct adjacent relationships between those groups. The first group is based mostly on the design decisions while the second includes development activities. Seels and Glasgow (1990) designed a compound model which combined the nucleus and interactive models. Compound models' priority is the analysis of problems and needs. Data collected in this stage leads to starting decisions, then goes from task analysis to goals and strategies and finally to environment decisions. There is also an expansion stage in this model, especially in educational systems, since expansion and institutionalization are important for instructional design studies.

Finally, the intersection point of all the models is the framework they present for the creation of systematic instruction. Instructional design models include determining strategies to overcome problems, structuring the content, arranging

the environment, developing the materials and determining how to conduct the assessment. At the end of all this, testing and adjusting the developed model are the dimensions that instructional design models should take into consideration. In other words, instructional design models are the structures that show the entire picture of the elements related to the production of the instructional system that will lead to solving the existing problems in the most convenient way (Çağıltay & Göktaş, 2013).

In this section, the term instructional design was explained first, and then the best-known instructional models in the literature were discussed in turn. Designers should decide on the most appropriate design model according to the situation. Institutional conditions, the target audience, the components of the program, technological structure, educators' qualities, project context and the competencies of instructional designers are important factors.

3. Methodology

3.1. Research Design

In this research, because of its flexibility and creativity such as determining the most convenient starting point and improving the elements that do not work in the process compared to the other instructional design models, the Kemp, Morrison and Ross's flexible model (1994) has been used. In this model, even though all the steps are in a loop in the instructional design, it is argued that the steps should not be in order to prevent it from becoming mechanical. The basic components in the instructional design are students, methods and evaluation. As a process, instructional design is based on the planning of the relationships between those components. In this model, the components in the instructional design are:

- Determining the instructional problems and clarifying program targets,
- Reviewing students' qualities during the planning process,
- Determining the content and analyzing the detailed tasks related to the goals,
- Indicating clearly instructional goals for student,
- Arranging the content items in each instructional unit for logical learning,
- Designing instructional strategies to enable each student to achieve competency in the goals
- Planning how to present content during the teaching-learning process,
- Developing measurement and evaluation tools to determine to what degree the performance goals are achieved,
- Choosing the resources that support the teaching-learning activities.

Even though the model starts by determining the problems encountered in the instruction then advances clockwise and logically, the order changes according to the nature of each component, so flexibility is possible. Moreover, the components are not interconnected with arrows or lines as they are not adjacent or linear.

According to the instructional problem, the designer can start from the most convenient component (Şimşek, 2011).

3.2. Research Setting

A funded university in Ankara, the capital of Turkey started to conduct a computer literacy course online with e-learning methods in a learning management system (LMS) Moodle by the Information and Communication Technologies (ICT) Coordination Unit as of the 2016-2017 academic calendar year (September 2016). Prior to that date, starting in 2007, this was a blended course conducted mostly in the computer labs for two hours each week and partly online in Moodle, lecturers were encouraged to use LMS Moodle in their classes. Each section had around 20-30 students according to the faculty/vocational schools requirements when it was conducted blended compared to 100 students when it was conducted fully online with e-learning methods. In the blended version, Moodle was used only for downloading some of the materials and for announcements.

3.3. Participants

This first year service course was compulsory for all students excluding engineering students during either the fall or spring semester of the academic year. For example, at the end of the spring semester of 2015, out of the 774 students in 48 sections enrolled in the Computer Literacy course (when it is blended), 236 students answered the online survey questionnaire prepared for evaluating the usability of the Moodle e-learning platform, resulting in a response rate of 30% compared to the 58% response rate of online survey questionnaire prepared for evaluating students' satisfaction of the Moodle e-learning platform. Both studies conducted SEM analysis to explore the relationships between constructs.

1976 students in 23 sections were registered during the spring semester of 2017 after the course started to be conducted fully on LMS and 786 students answered the online survey questionnaire, resulting in a response rate of 39.78. Table 1 summarizes their demographics and there were more women than men since only one fourth of the 786 students were men (205 men versus 581 women). All respondents were undergraduate students, and their ages ranged from 18 to 24.

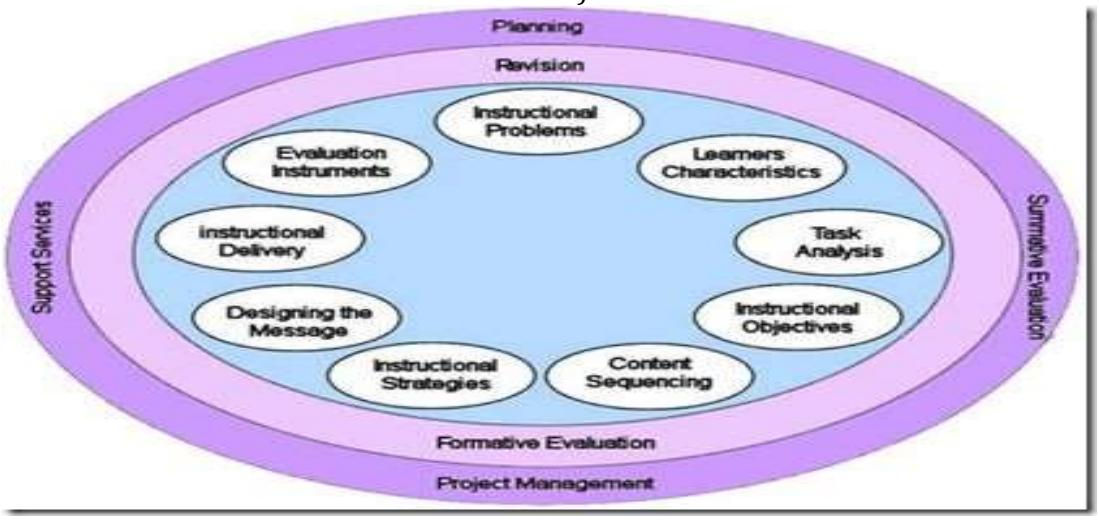
Table 1. Demographics of Survey Participants

Measure and Item	Frequency	Percentage
Gender		
Female	581	73.9
Male	205	26.1
Age		
18	203	25,8
19	185	25.5
20	209	26.6
21	114	14.5
22	38	4.8
23	22	2.8
>=24	15	1.9
Faculty		
Faculty of Dentistry	45	5.7
Faculty of Medicine	30	3.8
Faculty of Education	75	9.5
Faculty of Science and Letters	35	4.4
Faculty of Fine Arts, Design and Architecture	35	4.4
Faculty of Law	47	5.9
Faculty of Economics and Administrative Sciences	78	9.9
Faculty of Communications	35	4.4
Faculty of Health Sciences	35	4.4
Faculty of Commercial Sciences	62	7.8
Vocational School of Social Sciences	75	9.5
Vocational School of Health Sciences	74	9.4
Vocational School of Technology	6	0.7
Adana Vocational School of Health Sciences	49	6.2
Kazan Vocational School	50	6.3
Konya Vocational School of Health Sciences	37	4.7
State Conservatory	18	2.3
Prep Student		
Yes	71	10.1
No	165	89.9

4. Data Analysis

As Figure 1 shows below;

Figure 1. One of the flexible instructional design models (Kemp, Morrison and Ross Model, 1994)



According to the components of the model;

- First, instructional problems in the old system were identified;

The system quality and structure need to facilitate students' ease of use and access was found to be a critical factor in students' satisfaction with e-learning. With the old system, students were not using LMS Moodle effectively since some factors prevented successful implementation of the platform. Like any other database system, it required constant monitoring, updating and maintenance over time. Technical problems like Internet speed were even preventing students from logging into Moodle. The platform was used mostly as a technological tool to support the face-to-face learning, mainly for downloading the materials and making announcements. LMS should not be seen only as a technological tool but also as a mean of teaching and learning practices that are an important part of it. Another main problem was the students' engagement with the course. There were several reasons for this, one of which was the many opportunities during their academic studies to take and pass this course, which created a tendency to postpone it to later years.

In this respect, a team of colleagues specialized in educational technology (Distance Education Application and Research Center) studied, planned and designed to deploy strategies for the new system: online learning using e-learning methods via a platform. In the planning process, importance was given to the following aspects to ensure successful implementation.

- Reviewing students' qualities during the planning process;

The program target was to teach students the basic concepts involved in information and communication technologies (ICT). Along with basic computer

literacy, the Internet and widely used general application packages, students would be given more specific information and would be introduced to the ICT used at the University. Students are expected to use these basic skills during their undergraduate studies in their respective disciplines and having completed the course, they would be equipped to use and keep up with technology in their professional lives. Table 2 gives students' experience with E-learning platforms and their computer skills levels.

Table 2. Backgrounds of the Survey Participants

Measure and Item	Frequency	Percentage
Prior Experience with LMS Moodle		
None	425	54.1
1 Class	214	27.1
2 Classes	65	8.5
3 Classes	48	6.0
Computer Skills		
Beginner	135	14.8
Intermediate	573	73.3
Advanced	78	11.9

- Determining the content and analyzing detailed tasks related to the goals;

The contents were determined in the eight modules using standard and basic modules of ECDL - European Computer Driving Licence.

- Indicating clear instructional goals for student;

Instructional goal were written as follows:

By the end of the program, students are expected to be able to;

Navigate the University's web page,

Use the University Learning and Content Management System (Moodle),

Browse the Internet and use e-mail,

Explain fundamental concepts in information and communication technologies,

Outline the basic components of computer systems,

Evaluate how computers affect human health,

Discuss the copyright issue,

Identify, describe, and examine ethical issues, regulations, and laws related to the use of information, software, and technology systems,

Operate general application packages of Microsoft Office Program, including: using the word processing program MS-Word effectively, giving citations and references using the word processing program MS-Word, analyzing data using spreadsheets in MS-Excel, creating effective presentations in MS-PowerPoint, preparing tables and forms using the database program MS-Access,

- Arranging the content items in each instructional unit for logical learning;

The content items in each instructional unit were arranged as follows:

Module 1: Use of University Webpage, Use of University Webmail, Use of University Learning and Content Management System (Moodle), Use of Student Information System (BUOBS)

Module 2: Internet, Use of browsers, Use of Web, Web Outputs, Electronic Communication, Use of E-mail, E-mail Management

Module 3: Hardware, Software, Networks and Security

Module 4: Operating Systems, File Management, Utilities and Print Management

Module 5: Using Applications for Document Creation, Formatting, Preparing Outputs, Searching Academic Journals, Academic Writing, Using Digital Libraries

Module 6: Using Applications for Creating Cells, Managing Worksheets, Formulas and Functions, Preparing Charts and Outputs

Module 7: Understanding Databases, Using Applications for Creating Tables, Retrieving Information, Objects, Outputs

Module 8: Using Applications for Preparing Text, Charts, Graphical Objects, Outputs

- Designing instructional strategies to enable each student to achieve competency in the goals;

Instructional strategies such as Lecture, Q&A and Discussion teaching methods and techniques were used.

- Planning how to present the content during the teaching-learning process;

The planning and the presentation were as follows:

As Figure 2 shows below, synchronous online technologies such as live video conferencing and asynchronous technologies such as educational video were used.

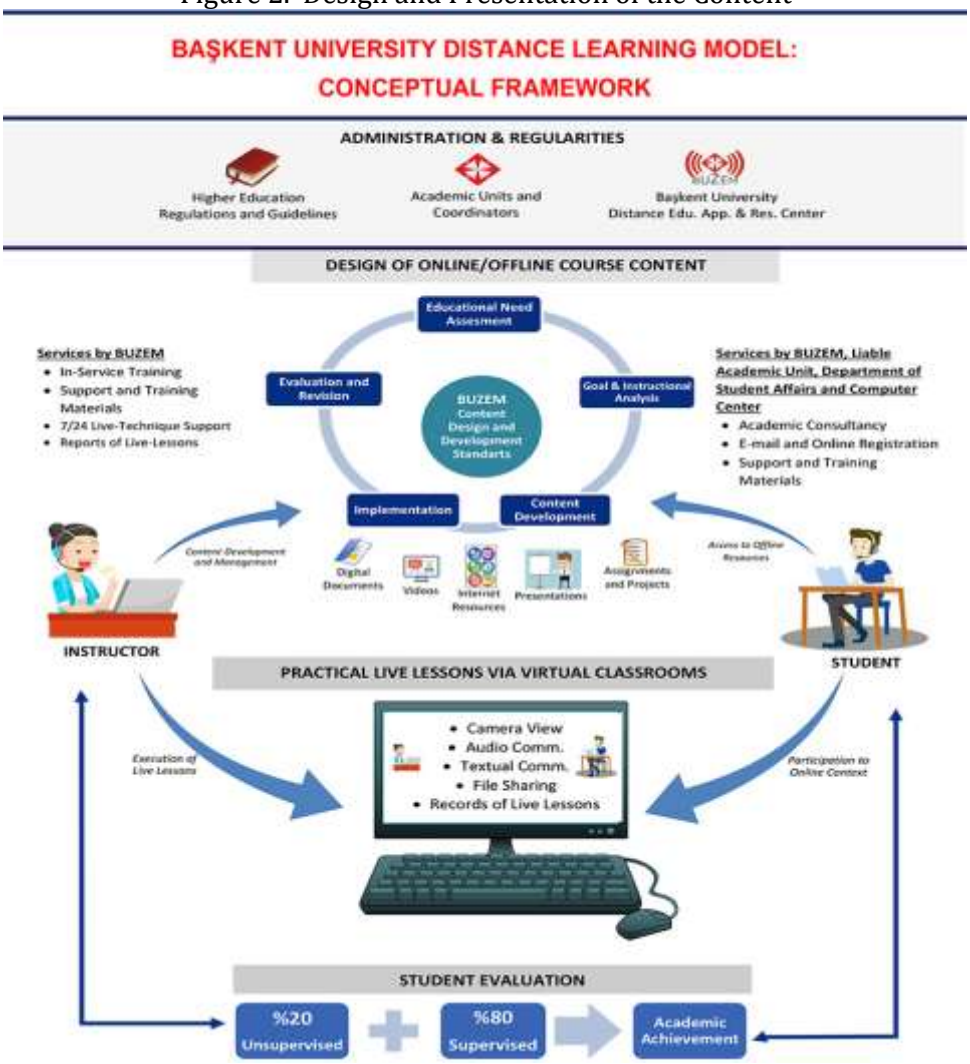
- Developing measurement and evaluation tools to determine to what degree the performance goals are achieved;

Two types of evaluation methods were developed: Supervised assessment (final exam) contributed 80% to overall grade whereas unsupervised assessment (four homeworks, each 5 points) contributed 20% to overall grade (Figure 2).

- Choosing the resources that best support the teaching-learning activities;

The resources were chosen as follows: Text-based materials, presentations, visual supported material, practice, interactive exercises and homeworks.

Figure 2. Design and Presentation of the Content



(http://buzem.baskent.edu.tr/index.php/en/conceptual-framework/)

5. Results

The first of two studies mentioned in the previous sections investigated the critical factors affecting students' satisfaction and determined what the students experienced and perceived using e-learning LMS Moodle as part of their blended learning. The students' responses revealed four significant factors: learner attitude toward computers, learner Internet self-efficacy, perceived usefulness, and perceived ease (Üstünel, 2016). The second evaluated the usability of the learning management system Moodle and aspects like help and documentation, recognition, diagnosis, and recovery from errors, aesthetic and minimalist design, consistency and standards, the match between the system and the real world, recognition rather than recall, flexibility and efficiency of use, visibility of the system status were taken into consideration in the research model after an exploratory factor analysis (Turhangil Erenler, 2017). Some of the usability problems were identified as follows: Lack of feedback, pace of feedback, difficulty in finding the objective (visibility of system status), confusion (match between the system and the real world), lack of guidance for novice users (flexibility and efficiency of use), too

much information (Authenticity and minimalism in design), difficulty in searching for information and slowness of the system (help and documentation). Users approved of the old system by only 60%, they did not have many opportunities to use LMS Moodle, which was generally used just for delivering content and therefore a need for a new instructional design of the course emerged.

The results of the study conducted after the new design of the course showed that 62% of the students easily accessed the e-learning platform and 32% of the students accessed Adobe Connect video-conference system while 78% of the students accessed other educational materials using their latest mobile technologies. 80% of students mentioned that the multimedia features such as audio-video downloading, sending e-mails and browsing through the internet also contributed to their learning. They approved of using mobile technologies as part of their E-learning program on Moodle. They added that using such technologies did not create any serious technical or other problems (Turhangil Erenler, 2018).

The main task for the students was learning and the components such as platform, course, course content, video conference system and mobile technologies came from different sources (instructors, designers and developers), which makes learning rich. Moreover, the study also showed that the new design of the course conducted using e-learning methods with the integration of mobile technologies to learning was an enhancing factor that increased students' interactivity with learning materials, instructors and the learning environment, which contributes to learner-centered learning.

6. Discussion

In the learner-centered paradigm of education, the development of intrinsic motivation, self-regulation skills, mastery of knowledge and skills, transferal to real contexts, development of collaboration skills, and emotional, social and character development (including empathy) are highly valued. The methods, pace, content of instruction, and the methods of assessment are customized to each learner. Learners learn by doing (task-centered instruction), receive just-in-time support while learning by doing (instructional scaffolding), while also learning from peers through collaboration. They manage their own learning and set their own goals (self-determination, self-regulated learning), assess their own learning (self-reflection, self-evaluation) and make decisions about their learning (Lee, Myers & Reigeluth, 2016).

As mentioned in the above section, using the flexible model in the new instructional design of the course created the quality of learner-centered online environment, enhancing interactivity between different components such as e-learning platform, instructor, course content, video-conferencing system, student and mobile technologies, by first identifying the problems in the old system, then applying all the steps in the model.

Some of the design guidelines were also incorporated;

In addition to the content, self-assessment tests helped students to create opportunities to review what they have learned (cognitive presence). Instructor encouraged students to participate in synchronous lessons via virtual classrooms

by sending text messages to their smart phones each week, stimulated their participation and interaction by creating online activities with immediate response and collaboration with online discussions (social presence) (Kapp & Driscoll, 2009).

7. Conclusions, Implications, Limitations and Future Work

New technologies promote new ways of thinking and interaction. It is necessary to understand the changes in technologies and their impact on instructional design. Providing many learning options and experiences while encouraging participation and creativity are the main strengths of well-designed e-learning environments.

To guarantee quality in learner-centered e-learning environments, collaborative knowledge-creation environments must be designed. Planning needs to be given importance and effective strategies must be applied. Technologies should not be seen only as technological tools but also as an important part of learning practices. In order to do this, instructional designers need to incorporate some of the following tasks for learning using the instructional design models mentioned in the previous sections.

- Instructional content must be compatible with the e-learning environment.
- Usability problems like navigation, network, display, screen problems must be solved.
- Course materials must include real life examples and offer practical information to users, ease of use and fast support services are crucial factors for students' satisfaction with e-learning systems.
- The focus must be on connecting students and understanding how the course must be conducted collaboratively.
- The quality and structure of the system must facilitate students' use of the contents.

The main limitation was that the population was limited to freshman students who enrolled in the computer literacy course at the university. The model should also be tested with respect to other LMS courses at the university. Therefore, further research is necessary. These findings will be valuable for both academics and practitioners of E-learning systems.

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