

Learning by Design in a Digital World: Students' Attitudes towards a New Pedagogical Model for Online Academic Learning

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Abstract. Despite the fact that the blended learning model is considered today the preferred model for online course design, there is still ambiguity regarding its implementation in educational systems and regarding the optimal proportions between online learning and F2F meetings in various learning scenarios. The present research examined students' perceptions of pedagogical and design issues of a fully-online course at the Open University of Israel, which offers a new model for blended online learning. Fifty-eight of the course's students completed a questionnaire regarding three major aspects of the course's design: (1) pedagogy, (2) textbook format (print vs. digital) and (3) usability issues in designing the course's learning environment. Results illustrate the importance of a particular in-advance pedagogical and visual design of online learning and the potential of the course's model in creating meaningful learning, which takes into account the state-of-the-art knowledge on the major pedagogical considerations in online learning.

Keywords: online learning, blended-learning model, usability, pedagogical model.

1 Introduction

In the last decade, the large-scale penetration of communication technologies into educational systems (schools and universities), industry and organizations, along with the availability of effective learning management systems, have led to an increase in online learning and training [3, 4]. However, recent studies report that the integration of online learning environments in the academia faces a wide range of problems, which leads to a disappointment of the limited effect of these technologies on the institutes' teaching and learning culture [5, 8]. Recent studies suggest that the limited success of instructional technologies in online learning results from the following major reasons: (1) Reading academic texts in a digital format is problematic for most learners [10, 16]; (2) Students report that feelings of loneliness and social detachment that are associated with the online setting have a negative effect on their learning [13]; (3) Teachers and students lack necessary cognitive skills for making effective use of online technologies

(Eshet, 2004) [9, 10, 15]; and (4) Most online courses adopt pedagogical approaches that fit the traditional-frontal teaching and learning, and do not employ pedagogical approaches that fit online learning [1, 6, 9, 11].

As of today, the Blended Learning Model, which combines online and F2F components in the learning process, is considered the most effective model for online learning [1, 14]. However, despite numerous studies that investigated the implementation of the Blended Learning Model in online academic studies, much ambiguity still exists regarding its utilization in real-life situations and the optimal proportion of its components in different instructional settings [5].

The common model for course design, development and instruction in most open universities worldwide (e.g. Israel and the UK) contains some paradoxes [12], the most central of which is the fact that courses are developed and written by experts, who do not teach them, and that the actual instructors of the courses are not involved in writing the textbooks and the learning-guides. As pointed out by various scholars (e.g. [12, 13], this kind of course-delivery model creates a gap between the course developer, the course instructor and the students, and has a severe negative effect on the learning process and on students' satisfaction. Guri-Rosenblit [12] emphasizes the importance of making special efforts to close this gap in the design of online courses in open universities.

The present study focused on a special case of a blended online course at the Open University of Israel in which online learning technologies were utilized to address the major problems that are involved in online learning in order to create an effective and satisfactory online learning environment. The paper presents results from a study of students' attitudes toward the interface and the pedagogic design of an M.A.-level online course at the Open University of Israel.

1.1 Course Description and Pedagogical Model

As of today, the use of online components in the learning process in most Open University's courses is relatively limited, consisting mainly of a course homepage, instructor's announcements, syllabus, assignments, occasional online resources and a forum for online discussions. In addition, in most cases, the online elements are considered "nice to have" and not mandatory or central to the learning process. Usually, they are added after the course development is completed. Consequently, the online elements usually don't have a significant impact on the learning process.

The course investigated in the present study, is an M.A.-level online course titled "Design Principles of Computer-Based Learning Environments". The course focuses on the major aspects of designing technology-based learning environments. Contrary to the typical "nice to have" online components in most online courses at the Open University, this course was designed as a fully-online course, in which all of the learning materials (e.g. online lectures, readings, textbook, time-table, assignments and exercises) are available online, and a major portion of the learning itself takes place online, in the especially-designed course's online learning environment.

The course design and development was based on the state-of-the-art knowledge on the major problems that underlie online teaching and learning in universities in

general and in open universities in particular [12]. Following recent research findings on problems involved in reading academic texts from digital displays [10], the course's textbook is made available to students in both digital and print formats. This allows students to choose their preferred mode of learning and to navigate freely between the text and the online environment. In order to bridge the above-noted gap between the course writer and the students [12], the course offers a variety of video lectures by the course writer. The course pedagogy follows the constructivist approach [7]. Accordingly, learning focuses on the students' ability to solve real-life authentic problems in an academic context, and the course assignments require the analysis of Internet-based learning environments and the design of user interfaces and educational simulations. The course's computerized learning environment (CLE) is designed according to state of the art usability standards, flexibility in navigation and principles in designing hyper textual learning environments. [2].

The course instruction is based on the Blended Learning Model [5, 14]: Most of the learning is done online, complemented by six optional face-to-face orientation meetings. According to the blended learning principles [5], the online learning in the course is more central for topics that emphasize practical issues (e.g. interface design, databases or simulation design), for which authentic tasks are assigned, whereas in the more theoretical topics (e.g. learning theories), face-to-face learning is more dominant.

As a course that focuses on the major aspects of designing computer-based learning environments and their underlying learning processes, it consists of five learning units (i.e. theoretical aspects of learning with technology, hypertext and hypermedia learning environments, user-interface design, designing data-bases and educational simulations). Each unit combines a discussion of the theoretical and the practical aspects of the topic. The theoretical background is provided by the course's textbook and the assigned articles for each unit. The course's tasks and assignments are designed to help students implement their theoretical knowledge in authentic, real-life situations. As noted above, designed as a "virtual classroom", the course's web-site serves as the major learning environment in which discussions take place, face-to-face meeting's summaries are posted, and assignments and tasks are submitted – making the content and the online learning processes inseparable.

1.2 The Study's Goals

The main goals of the present study were to examine students' attitudes toward the following topics:

1. Course pedagogy, including the pedagogical aspects that concern the design of the online and printed textbooks.
2. Issues which relate to text-format reading (print versus digital reading).
3. Usability issues in designing the course's learning environment.

2 Method

Participants. Fifty-eight of the course's students participated in the study during three semesters (Table 1).

Table 1. Distribution of the study's participants according to semester

Semester	Number of participants
Fall 2006	21
Fall 2007	14
Spring 2007	23

Tools. A structured attitudes' questionnaire was developed in order to examine students' attitudes toward the following issues: the course's instructional pedagogy, the technological tools and the learning materials and their influence on students' learning. The questionnaire consists of 78 questions that refer to the students' use of the various learning components, their usability (i.e. friendliness, ease of use and orientation) and their perceived contribution to learning. The questionnaire which was distributed during the Fall and Spring 2007 semesters was updated to include questions that were absent in Fall 2006 semester.

Procedure. Data was collected during three semesters in 2006-2007. Students completed the questionnaire during the last F2F course-meeting, or submitted it via electronic mail.

3 Results

Results are presented in respect to the study's three major goals:

1. Course pedagogy (pedagogical aspects of the online textbook's design, online video lectures and online discussion groups).
2. Issues which relate to text-format reading (print versus digital reading).
3. Usability issues in designing the course's learning environment (i.e. the online textbook and the course's website).

3.1 The Course's Pedagogy

Students' attitudes toward the pedagogical value of various instructional and learning components in the course were examined in the current study (Table 2). As can be seen in table 2, the instructional components that were perceived as most contributing to learning were the course's tasks (mean=4.72), the printed textbook (mean=4.54), the meeting's presentations (mean=4.42) and the F2F meetings (mean=4.15). The online video lectures were not found as a highly contributing component to learning (mean=3.83), however, 87% of the participants indicated that they would not give them up. The 'personal notebook' (an online annotation tool, which enables students to annotate selected sections of the online textbook) was the most unused component and was perceived as insignificant to learning (only 7.3% used it frequently; mean of contribution to learning = 1.6). The online textbook was considered an average contributor to learning (mean=3.32). However, almost half of the participants (46.5%) indicated that they used it frequently.

Table 2. Students' attitudes toward the pedagogical value of various instructional and learning components

Learning components	No. of participants	Contribution to learning		Frequency of use (%)	
		Mean*	Stdv	High**	Low**
Online textbook	56	3.32	1.42	46.5	53.5
Printed textbook	37	4.54	0.87	83.8	16.2
Video lectures	54	3.83	1.24	73.7	26.3
Online time-table	55	3.45	1.26	63.2	35.1
Personal notebook	48	1.60	1.11	7.3	92.7
Discussion groups	53	3.51	1.12	56.1	43.9
Meeting's presentations	55	4.42	0.94	86.2	13.8
List of links in the textbook	55	3.93	1.09	82.5	17.5
Tasks***	29	4.72	0.8		
F2F meetings***	26	4.15	1.26		

*The answer's scale was 1 – "no contribution" – 5 "high contribution"

**High frequency – "continuously", "frequently"; Low frequency – "seldom", "never"

***Items that were not included in the Fall 2006 questionnaire

3.2 Pedagogical Aspects of the Textbook and the Video Lecture's Design

Following constructivist principles of learning via problem-solving in authentic situations [7], the online textbook contains links to brainwork exercises, performance tasks and links to articles and authentic examples on the internet. The current study examined students' attitudes to the above components. As table 3 shows, items 1-3 assessed the actual use of the brainwork exercises by the students. It was found that the more demanding the tasks, the less students favored them (from high preference for examples (mean=3.94) to medium preference for performance tasks (mean=3.17). Nevertheless, the contribution of these components to students' understanding and motivation was found to be high (mean=4.2). Note that the 'components contribution to learning' measure was calculated as a mean of the scores of items 4-9 (Table 3). These items measure the contribution of knowledge construction, relevance to the learning themes, dynamic learning, understanding and internalization of the learning material, satisfaction and fulfillment from the learning and the level of interest in the texts. These six items were found to have high internal validity (Cronbach Alpha=0.91).

3.3 Video Lectures and Discussion Groups

Video lectures, given by the course developer, as well as discussion groups, led by the course instructor, were included in the course's CLE in order to bridge the gaps between the course developer and the course instructor, the course instructor and the students and the students and their peers. More than 90% of the respondents reported that they observed at least one lecture and 87% of the respondents reported on the necessity of the video lectures. In addition, the possibility to listen to the lectures,

Table 3. Students' attitudes toward the pedagogy of the course's instruction and the influence of the learning environment design and content on learning processes

	Number of respondents	Mean*	Stdv
Exercises components in the textbook:			
To which extent did you:			
1. perform the exercises in the textbook?	48	3.17	0.97
2. stop and think about the questions and issues raised?	47	3.40	0.90
3. stop and examine the examples the text refers to?	48	3.94	0.81
The components' contribution to the learning process:			
4. Knowledge construction	47	4.15	0.81
5. Was relevant to the learning themes	46	4.33	0.70
6. Dynamic leaning	46	4.22	0.81
7. The level of interest in the text	48	4.23	0.81
8. Gratification from learning	48	4.21	0.82
9. Understanding and internalization of the learning material	47	4.15	0.81
Total 'components' contribution to learning' measure**	448	4.21	0.67
10. The online textbook's functional design lead you to refer to, think of, or understand the course's contents.	45	3.67	1.13
Video lectures			
11. The acquaintanceship with the course developer contributed to the learning experience	50	3.78	1.18
12. The lectures contributed to learning focalization in each unit	50	4.00	1.16
13. Listening to the lectures combined with the presentation and examples contributed to understanding the learning material	32	4.40	0.80
Discussion groups (DG)			
14. The satisfaction from the level of discussions	49	3.59	0.84
15. Organizing the discussion groups according to units contributed to focalization of discussions in the DG.	49	3.96	0.96
16. Organizing the discussion groups according to units contributed to receiving assistance when needed.	49	3.86	1.10

*The answer's scale was 1 – "not at all" – 5 "Very much"

**The measure was calculated as a mean of items 4-9 (internal validity, Cronbach Alpha=0.91)

combined with the presentation and the examples, was found to contribute the most to learning (mean=4.4, table 3).

Almost all respondents (98.2%) visited the discussion groups. Most of them (67.9%) reported that they continuously followed the activity in the discussion groups while others visited them occasionally. Of all the respondents, 28.6% reported on active involvement in the discussion groups. The students' satisfaction from the discussions' level was found to be higher than average (mean=3.59).

3.4 Course Textbook Format: Reading from Print versus Digital Displays

The optimal format for presenting the course's learning materials – in a printed or digital textbook – was examined in relation to three different learning assignments: reading, tasks' implementation and preparation for the final exam (Table 4). As can be seen from table 4, the overall preference of more than half of the respondents (57.9%) was for combining the printed and the digital textbook. Of all the respondents,

Table 4. Students' preferences regarding the textbook's format (printed, digital or combination) in relation to various learning assignments

	Digital textbook %	Printed textbook %	Combination %
How do you usually read the course's textbook?	10.3	50	39.7
Which book do you usually use to prepare the course's tasks?	15.8	57.9	26.3
Which book do you prefer to use prior to the final exam?	14	59.7	26.3
General preference*	5.26	36.84	57.9

*This measure integrates the respondents' preferences of the three learning assignments into one measure in the following way: students who preferred the digital textbook in all assignments – "Digital textbook", students who preferred the printed textbook in all assignments – "Printed textbook", all other preferences – "Combination".

Table 5. Print versus Digital – reasons that influence the respondents' preferences

	High/large influence %	Little influence %	No influence %	Number of respondents
It is hard to read long texts from the computer's screen	56.8	35.1	8.1	37
I'm used to reading and studying from printed textbooks	59.5	24.3	16.2	37
The digital textbook enables easy access to examples of computerized learning environments and other references	62.9	22.9	14.2	35
The printed textbook can be read everywhere	64.9	24.3	10.8	37
It is easy to navigate in the digital textbook	47.1	32.3	20.6	34
You can't mark or write notes in the digital textbook	55.9	32.3	11.8	34
The digital textbook contains interesting information that can not be found in the printed version	20.0	34.3	45.7	35
In the printed textbook you can find what you want easily	62.2	29.7	8.1	37
The reading in the digital textbook requires time investment	32.4	50.0	17.6	34

36.84% preferred the printed textbook solely while few students (5.26%) preferred the digital textbook solely. Results (Table 5) show that for most of the respondents (more than 60%), the most influential factors in choosing the printed textbook were the convenience of the printed book's accessibility and the ease in finding information. The major reasons for choosing the digital textbook were the fast access to online examples of computer-based learning environments and the easy access to other links, which are embedded in the text.

Table 6. Students' attitudes toward the design of the digital textbook and the video lectures

	Number of respondents	Mean *	Stdv
The digital textbook:			
1. Text's design – chosen font	46	3.41	0.62
2. Text's design – font's size	46	3.41	0.62
3. Text's organization in layers	46	3.46	0.69
4. Tasks' integration	45	3.74	0.63
5. Links and examples' integration	45	3.64	0.53
6. Navigation	44	3.39	0.75
<i>Total Usability measure**</i>	46	3.50	0.50
The video lectures:			
7. Functional design of the video lecture's interface	49	3.45	0.68
8. Time length of the video lectures	48	3.25	0.86

*The answer's scale was 1 – "is not suitable for learning" – 4 "Very suitable for learning"

**The measure was calculated as mean of items 1-6

3.5 Usability Aspects of Course Design

Students' attitudes toward usability issues in designing the course's online textbook and website were examined in the current study (Table 6). Results indicate the students' high satisfaction from various usability aspects of the course's CLE (i.e. its ease of use and friendliness) and the digital textbook. Results show that the organization of the course's digital contents facilitated navigation and reading (mean=4.28). High scores were given to specific design elements, such as the font's type and size (mean=3.41 for both), text's organization (mean=3.46), the integration of tasks and examples in the course's CLE (mean=3.64) and the ease of navigation through the text and the CLE (mean=3.39). The general usability measure, as calculated from items 1-6 in table 6, was high (mean=3.5). In addition, the navigation in the course's CLE, which offers the students flexibility in reaching the course's contents 'from everywhere', was found to be highly usable and the students used this flexibility wisely and in various ways. For example, half of the respondents reached the course's readings via the "Articles" button in the course's CLE homepage, while 20% of the respondents reached it via links in the digital textbook or the "time-table" area in the course's CLE.

4 Discussion and Conclusions

The purpose of the current study was to examine students' perceptions of pedagogical, design and usability issues regarding a fully-online course and its learning environment. Results of the current study make a meaningful contribution to our understanding of students' perceived value of learning and instruction in online environments. Students' high rating of the pedagogical and design course elements illustrates the great importance of 'designing in advance' (contrary to 'designing in retrospect'), which takes into account the problems involved in online learning in present-days academic courses [15]. The students' strong preference for the Blended Learning model, which was found in the current study, is compatible with reports by

most current studies on online learning models. Our findings illustrate the need to adjust the instructional model to the content and the learning objectives [6]. Findings of the current study indicate students' high evaluation of the interactive learning components, such as discussion groups and constructivist tasks.

Results of the current study reinforce the widely-reported students' preference for reading academic texts in a print format compared to the digital one [16], mainly because of navigation, availability and ownership reasons. Only few students preferred the digital over the printed textbook because of the accessibility to the online examples. Nevertheless, as indicated in many studies, (e.g. [10]), our knowledge of the nature of digital reading is not yet clear, emphasizing the need for solid research data in order to reach conclusions regarding the preferred format for reading academic texts.

The high satisfaction from the usability components of the course's CLE, which was found in the current study, is exceptional compared to the general low satisfaction of LMS sites reported by many studies (e.g. [3, 4]). Extremely high satisfaction (mean=4.7 on a 1-5 scale) of the course's CLE was also found in the general course's instruction surveys that was given to students at the end of each semester. We believe that this high satisfaction is an outcome of the major investment in designing the pedagogical and usability elements of the course 'in advance'. Nevertheless, the usability of some components (i.e., the personal notebook) was evaluated as low. Further research is needed to clarify the reasons for these evaluations.

It should be noted that results of the current study have a few limitations: (1) the sample was relatively small (2) participants were M.A. students in an educational technology graduate program, and many of them have higher computer skills than the average student. Thus, the high level of satisfaction found in the research might not represent students from other disciplines and (3) even though the questionnaire utilized in the study was modified from the Open University's standard instruction satisfaction questionnaire, it did not undergo through a large-scale validation process.

In futures studies, after validating the questionnaire, special emphasis should be put on testing a larger group size, comparing students' attitudes from various disciplines and of different proficiency levels, and comparing online courses that are based on different pedagogical models.

Notwithstanding, results of the current study shed new light on our understanding of the proper design of a blended online academic course: in-advance pedagogical and visual design of online learning. In addition, results indicate the potential of the current model in bridging the gap that is typical of online learning between students and instructors and students and their peers, and in creating meaningful learning by employing "online pedagogical considerations" to course design.

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