

Determination of Secondary Students' Preferences Regarding Design Features Used in Digital Textbooks

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Abstract

The aim of this study was to determine secondary school students' choice of design features for digital textbooks. As a part of the research—which was conducted using a mixed technique—a literature review was carried out to source points to consider in the designing of digital textbooks and experts' opinions were obtained. Based on the results, an 88-question survey was then developed to elicit the preferences of secondary school students with regard to design features for digital textbooks. Also, in this study, three digital textbooks with different design features—but with the same content—were developed to be used by the students. The students were then informed about digital textbook technology by researchers and the digital textbooks were made available to them. Finally, the survey was administered in four separate sessions, and the results were revealed by analysis of the data collected. The findings showed that students would rather see digital books with a front page, back page and bookplate. They also pointed out that elements for switching between pages are necessary along with the table of contents, index, glossary and search tools. Lastly, they expressed a desire for images in digital textbooks, especially three-dimensional lifelike drawings, videos and animations.

Keywords

Digital textbook; E-textbook; Multimedia; Design principles; Secondary school

I. Introduction

Following the advent of digital book technology, which began to spread in the 1990s, various definitions of the technology were provided by the relevant literature. Some stated that a digital book is the electronic content which could be displayed on computer or dedicated hardware (Chen, 2003; Cox & Muhammed, 2001; Hillesund, 2001; McKnight & Dearnley, 2003; Wilson & Landoni, 2001). According to Morgan (1999), the concept of digital book means a combination of hardware and software. Likewise, in definitions formulated by Tennant (2000) and Armstrong, Edwards, & Lonsdale (2002); hardware and software were considered essential components of the concept of a digital book. In a definition by Connaway (2003), a digital book was considered a structure consisting of three components as software, hardware and content. The component of content refers to conversion of the information in digital books into executable files. Hardware includes devices such as desktops, notebooks and tablets, mobile devices such as iPhones, and e-readers that can be used to store and read digital books. Lastly, software refers to the programs that make the content useable on the selected hardware. Hence, it is possible to define digital books as "a new generation of books, which have digitized contents supported by multi-dimensional items, possess qualities that evoke conventional books, and require a reader hardware and software for access."

As a common element of various definitions, it is stated that the content of printed books has been transferred to an electronic medium in the case of digital books. However, today's digital books provide high-level interaction which goes beyond mere 'transfer'. Digital books not only include linked texts. They have now become systems into which many contemporary technologies can be integrated such as augmented reality and artificial intelligence. Digital books offer some advantages over printed books. The advantages include availability of search within the text, high storage capacity, ease of transport, ease of access, provision of extended content owing to internal and external links, ease of ordering, low cost, suitability for personal use, provision of audio content, readability in the dark and not occupying much space (Ghaebi & Fahimifar, 2011; Gibson & Gibb, 2011; Kol & Scholnik, 2000). Digital books have also been used as an effective teaching material thanks to the multimedia features they possess (Lam, Lam, Lam, & McNaught, 2009). DeNoyelles & Seilhamer (2013) point out that features such as interactive tests and sharing of notes make digital books even more interesting course books. Owing to the abovementioned features, the use of digital books has become widespread in the teaching-learning process, and the concept of digital textbook has emerged. Jang (2014) describes a digital textbook as a future-oriented textbook that helps students learn in a self-managed way, when and where they want.

Digital textbooks, besides offering students the features of printed books; provide multimedia elements such as reference books, workbooks and videos with glossary, animations and virtual reality (Byun, Choi, & Song, 2006). Hallam (2012) thinks that with these features digital textbooks support different learning styles, providing students with more fun and environments with more control over their own learning. The use of digital textbooks is becoming more and more common every day. According to Lee, Messom, & Yau (2013), digital textbooks will be the most preferred educational material in the near future. The steady increasing number of academic studies on this topic seems to verify this prediction. A considerable portion of the works focuses on the cognitive and affective effects of digital textbooks on students. Wilson, Shortreed, & Landoni (2004) revealed that adding visual elements such as pictures and animation to different types of electronic content

including digital books facilitates the recollection of knowledge by students. In research conducted by Song, Jun, & Ryu (2007), the students using digital textbooks were found more successful than those that used only printed books. Maynard & Cheyne (2005) found out that digital textbooks increased motivation in study groups. Lin's study revealed that using digital books affected students positively in both cognitive and affective aspects (Lin, 2010).

Printed books have the usual design features. However, the same is not the case for digital textbooks. Therefore, digital textbooks that are digitized versions of printed books or similar in design to other multi-material materials (such as web sites, educational software, etc.) are often encountered. Suggestions that the design should be similar to printed books (Landoni, Wilson, & Gibb, 2000; Malama, Landoni, & Wilson, 2005) are in fact intended to facilitate the adoption of digital textbooks by students. However, digital textbooks are distinguished from printed books due to multimedia and interactivity and from other multimedia materials in that they are books. Moreover, students' expectations of digital textbooks require much more than transfer of the content into digital environment (Bierman, Ortega, & Rupp-Serrano, 2010).

The combined effect of changing demographics and expectations of today's students (Prensky, 2001) requires ceasing of text-based feature of learning materials in electronic format, containing items facilitating a high level of interaction instead. In addition, it is extremely important to take into account students' views on the design of multimedia learning materials in order to achieve higher levels of student satisfaction and material availability. It is important to determine the preferences of students regarding digital textbooks as they are frequent users of such material. Parker (2004) suggested that, in the case of the development of digital textbooks, by creating design guidelines for different cultures and age groups, the material could be assimilated more easily and made more appealing to students with different learning styles. According to Landoni (2010), design is an important aspect to consider in the context of digital textbooks and one of the strong factors affecting their quality. Digital textbooks should not be developed independently on the target audience's preferences (Huang, Liang, Su, & Chen, 2012; Woody, Daniel, & Baker, 2010). Therefore, it is thought that the studies that regard digital textbooks as multimedia materials with features peculiar to them and that focus on student preferences for design could contribute significantly to the relevant literature.

The aim of this study was to determine preferences of secondary school students regarding design features used in digital textbooks. The research problem was formulated as follows: 'What preferences do secondary school students have regarding design features used in digital textbooks?' In the process of identification of the sub-problems, the results of the literature review conducted in the first phase of the research proved beneficial. Design features of digital textbooks were grouped under six headings and each heading was transformed into a problem statement. The study was carried out to seek answers for the following questions:

In digital textbooks, what preferences do students have regarding;

- use of cover and design of the cover?
- navigation elements?
- text use and style?
- use of images and design of such images?
- the metaphor of printed books?

- distribution and personal use?

II. Method

In this study, mixed methods research design was used. Mixed methods cover collection and analysis of quantitative and qualitative data within a single or multiple studies conducted as part of a research project (Creswell, 2013). Researchers who apply the mixed methods approach must reach a decision on two major topics beforehand. First, they need to decide whether to carry out the different stages of research simultaneously or alternatively in a sequence. The second question is whether the quantitative or qualitative approach should take precedence (Johnson & Onwuegbuzie, 2004). The literature reveals some researchers who developed their own research designs by analysing the existing research on mixed methods (Creswell, 2013; Johnson & Onwuegbuzie, 2004; Leech & Onwuegbuzie, 2009; Morse, 2003).

The method of this study was created in the light of Morse's (2003) mixed method research designs. In this model, the qualitative method is applied prior to the quantitative method; yet, there is a sequential design in which the qualitative method is, nonetheless, the more dominant of the two. The research process is displayed in Figure 1 detailing the activities carried out.

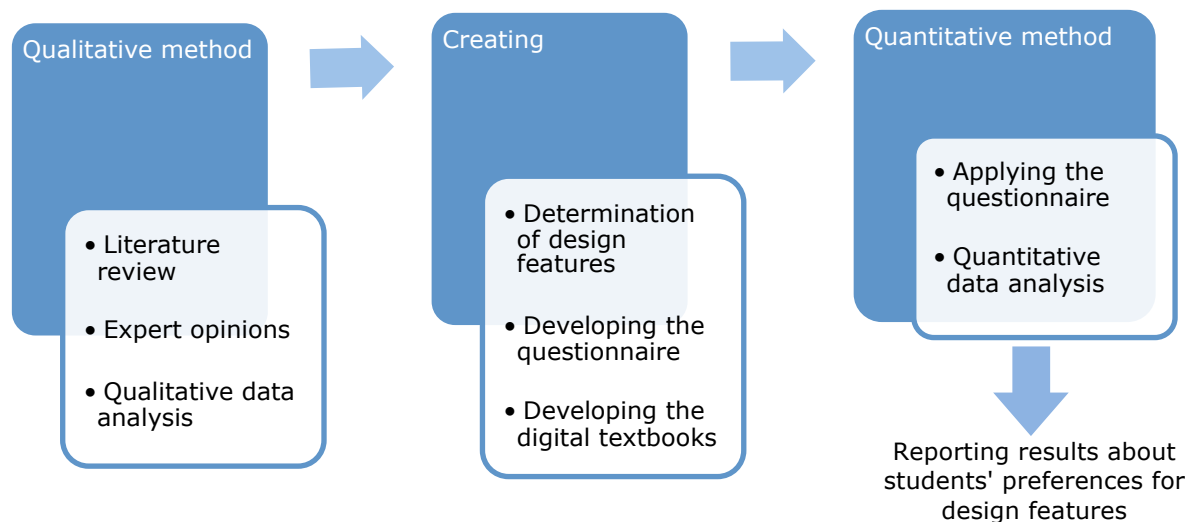


Figure 1. Research process with qualitative and quantitative methods

As can be seen in Figure 1, the qualitative dimension of the research included the review of the literature on the design of digital textbooks, obtaining of expert opinions, and the analysis of the data obtained through qualitative means. As a result of these steps, the criteria were elicited for design preferences of a digital textbook to be developed for secondary school students. Then the criteria were applied while developing the questionnaire to be given to students for their design preferences about digital textbooks. In addition, digital textbooks were developed in which students could see different design features satisfying the same criteria. As the other dimension, quantitative research steps included application of the questionnaire and analysis of the obtained data.

a. Sample group

The study participants were selected with situation sampling, a type of non-probabilistic sampling method. This method was preferred by the researchers as it was thought to facilitate selection of the precise sample they wanted. Such decision is considered essential because the research was carried out over a long period of time during which it was required to collect data from the sample in a consistent and easy way. In this study, the participants consisted of 257 students from the 5th, 6th, 7th and 8th grades in two secondary schools in central Trabzon in the north of Turkey. Of the total, males represented 44,0% of the participants, and females the remaining 56,0%. Throughout the study, the participants were divided into 24 groups of 13-14 students enrolled in the same grade levels.

b. The study implementation

In a three-stage structure, the works completed during the 18 weeks of the study are given in Figure 2.

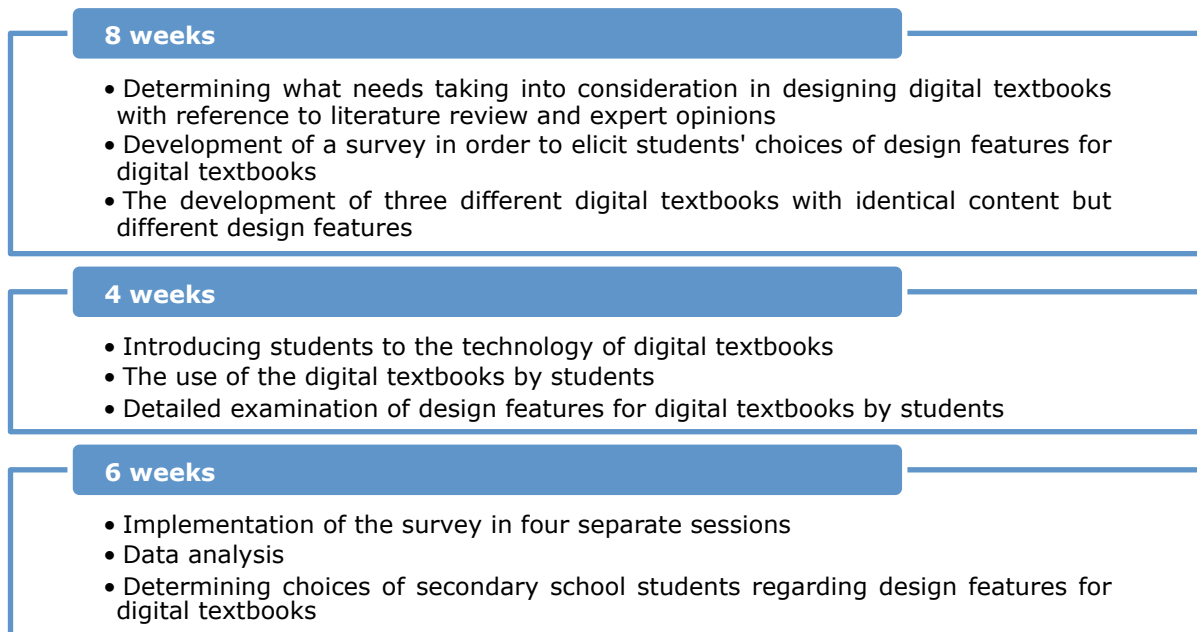


Figure 2. The stages of research and works carried out

In the first phase of the research, which lasted 8 weeks, a literature review was conducted relating to design of digital textbooks, and expert opinions were obtained on the matter. During the literature review, main emphasis was placed onto considerations in design of digital textbooks and relevant articles and project reports were examined. Instructional multimedia design principles (Mayer, 2005) were used as a complementary element due to the low number of studies which are directly related to the topic. In the light of the literature review, the design criteria for the digital textbooks for secondary schools were drafted and then finalized by taking opinions of the four specialists in the field of educational technology. The relevant criteria were grouped under six headings and then a questionnaire was developed to be used for finding out the design preferences of students regarding digital textbooks based on these criteria. Also three digital textbooks were prepared with the same contents but different designs so that the participants could see concrete examples of different designs. The contents of the textbooks were created in compliance with the topic of polygons in the mathematics textbook issued by the Ministry of National Education

(Turkey). Abovementioned topic was selected as it had already been covered by the students during the lesson, hoping to enhance their concentration on the actual design rather than the content. Detailed information is given about the digital textbooks in Table 1.

	Digital textbook 1	Digital textbook 2	Digital textbook 3
Cover use	The front cover (the name of the course and topic, contents page link, images on the topic) The bookplate (images related to topic and topic name) Back cover (images related to topic and topic name)	The front cover (the name of the course and topic) The bookplate (topic name) Back cover (images related to topic)	The front cover (the name of the course and topic, the author's name and animations about the topic) No bookplate Back cover (No text or visual)
Contents	Contents (unlinked texts)	Contents (linked texts and images)	No contents
Index	Index (linked texts and in unalphabetical order)	Index (unlinked texts, images, and unalphabetical order)	Index (linked texts and, images and in alphabetical order)
Search	Advanced search	Advanced search	No advanced search
Glossary	Glossary (not alphabetical, no images, accessible from every page)	Glossary (not alphabetical, images, not accessible from every page)	Glossary (images, alphabetical, audio, accessible from some pages)
Navigating between pages	<ul style="list-style-type: none"> • Navigating buttons between pages • Page flip • No connection to outside of book • Page review • Full-screen display 	<ul style="list-style-type: none"> • Navigating buttons between pages • No page flip • Connection to outside of book • Page review • Full-screen display • Page zooming tool 	<ul style="list-style-type: none"> • Navigating buttons between pages • Page flip • Connection to outside of book • Page review • Full-screen display • Page zooming tool
Headings	20 points, Times New Roman, left-aligned, bold All headings in the same colour throughout book All headings capitalised throughout book	22 points, Verdana, centred, italic, bold All headings in the same colour throughout book Only first letter of headings in capital throughout book	24 points, Comic Sans, right-aligned, underlined, bold All headings not in the same colour throughout book No standard capital/small letters for headings throughout book
Body texts	14 Points, Times New Roman, left-aligned, 1,5-line spacing No standard colour throughout book	16 Points, Verdana, italic, centred, 2-line spacing Standard colour throughout book	18 Points, Comic Sans, underlined, right-aligned, 2,5-line spacing Standard colour throughout book

Moving and still images	Numerous still images 3D graphic illustrations Still images left-aligned Videos, Animations Moving images centred	As many as still images to support texts No 3D graphic illustrations Still images centred No video, No animation	Quite a few still images No 3D graphic illustrations Still images right-aligned No video, No animation
Page layout	Edge spaces Summary notification on the page	Edge spaces Summary notification on the page	Edge spaces No summary notification on the page
Content tips	Bullets or numbering Page font plain white	No bullets or numbering Page font gradient (texture)	Bullets or numbering Page font coloured
Others	Digital book can be rotated on the plane Pages can be printed Digital book can be shared	-	Digital book can be rotated on the plane

Table 1. Design features of digital textbooks.

Screen shots of digital textbooks are shown in Figure 3.

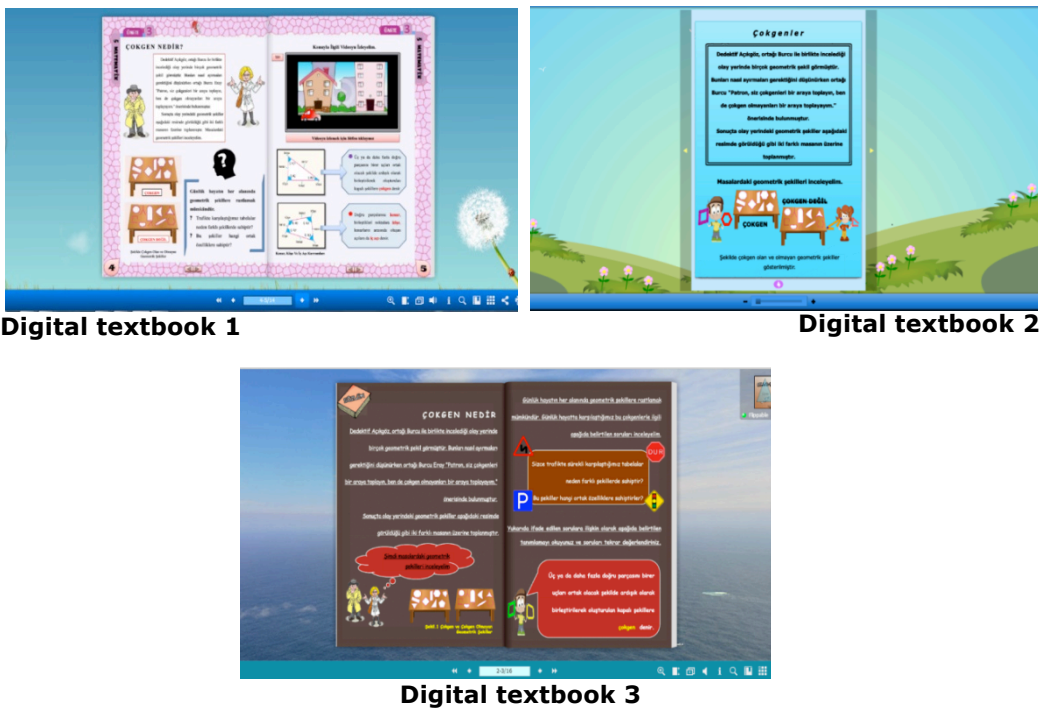


Figure 3. Screen shots of digital textbooks

In the second stage of the research, the participants were informed about the digital textbook technology, and the digital textbooks were given to the students. Each group took eighty minutes per week to scrutinize the texts, totalling 160 minutes. Then, in order to increase the awareness of students of the design features of digital textbooks, each digital textbook was examined in detail under the supervision of the researchers. Again, 160 minutes were expended by both groups in this exercise. In this way, the students could see examples of all of the questions related to design

they might encounter in the survey to be given later.

In the last phase of the research, the survey was administered to the groups in four sessions. The data obtained were analysed to reveal students' preferences. This phase of the research was completed in 6 weeks.

c. Collection and analysis of data

A survey was developed for the purpose of determining the students' preferred design features in digital textbooks. The following activities were conducted for the purpose of developing the survey:

- Academic studies were examined on digital textbook design and design features of materials developed in the context of projects about digital book development. Consequently, the recommendations regarding design of digital textbooks were presented under 6 different headings.
- In reference to the recommendations obtained from the literature review, an item pool was formed and the items were finalised by consulting the views of 4 experts in computer and instructional technologies. The final version of the survey was applied to another group of 26 students, and 3 participants from this group were then interviewed about the questions asked.
- Following the analysis of the data, the survey was finalised and grouped under 6 headings with 88 items in total.
- Due to the high number of items in the pool, it was decided to administer the survey in several sessions rather than at once. Eighty minutes were allocated for each session.

The implementation schedule was created in a way to allow one group to attend only one session on the same day. The surveys could be answered online, and applied in the technology classroom environment where each student was allocated a computer. The use of digital textbooks was free for the purpose of answering the survey questions. Thus, the students could see concrete examples of survey questions and examine them at the moment of survey administration. The data obtained from the structured questions in the questionnaire were analysed to create tables showing the percentage and frequency of students' preferences regarding the design features for digital books. The responses to the open-ended questions were read and coded by researchers so that themes could be found and then displayed in tables showing the percentage and frequency values.

III. Results

This section presents the study findings in tables. The students' preferences for the use of cover pages and design features for the covers are given in Table 2.

Cover type	Should be		Should not be		No matter		Design preferences
	f	%	f	%	f	%	
Front cover	233	90,7	11	4,3	13	5,1	Book's title (96,1%) Still images (89,5%) Link to contents (78,2%) Moving images (73,9%)

							Author's name (%48,6)
Bookplate	168	65,4	22	8,6	67	26,1	Images about topic (84,0%) Text about topic (67,7 images)
Back cover	245	95,3	0	0	12	4,7	Images about topic (68,1%) Text about topic (51,0%)

Table 2. Students' preferences regarding the use of cover pages in digital textbooks

As seen in Table 2, students expressed their preference for a front cover, bookplate, and back cover in digital textbooks. According to the students, the bookplate was not seen as important as the other two covers. A large proportion of the students (96,1%) said they would rather see the book's title on the front cover. The proportion of students who favoured use of still images was 89,5%. As many as 78,2% of the students sought insertion of a link from the front cover to the contents page. In relation to moving images, 73,9% were found to be in favour of their use. It was not deemed necessary to have the author name on the front cover by more than half of the students. A substantial proportion of students (65,4%) endorsed the idea of a bookplate in a digital textbook. Also the respondents took the view that there should be visual elements (84,0%) and text about topics (67,7%) on the bookplate. As for the back cover, 95,3% of respondents preferred a cover page on digital textbooks. Apart from that, the students (68,1%) preferred visual elements related to topics and text related to the topics (51,0%) on the back cover. Choices regarding tools for navigating in digital textbooks are given in Table 3.

Navigation tool	Should be		Should not be		Does not matter		Design preferences
	f	%	f	%	f	%	
Contents	237	92,2	4	1,6	16	6,2	Each heading should provide a link to the relevant section (80,9%) Images should be used for content in section headings (75,9%)
Index	209	81,3	14	5,4	34	13,2	Must be alphabetical (74,7%) Each of the concepts in the glossary should be a link leading to the relevant part (79,0%) Images should be used in the index about the concepts (82,9%)
Glossary	233	90,7	6	2,3	18	7,0	Each page should have access to glossary (77,8%) Must be alphabetical (77,0%) Words must be displayed together with images (80,5%) A talking glossary should be available for the concepts in the glossary (79,0%)
Search	249	96,9	0	0	8	3,1	'Simple Search' and 'Advanced search' options should be available (78,6%)

Table 3. Students' preferences regarding navigation tolos

According to Table 3, 92,2% of the students favoured insertion of a table of contents in digital textbooks, 80,9% believed that the contents page should include links to relevant pages, and another 75,9% wanted to see images on chapter headings related to the relevant part of the content. With respect to an index and glossary, 81,3% of the students emphasised the need for an index, and 90,7% for a glossary. A high proportion of the students (79,0%) expressed a wish for an associated text structure in the index. An even higher percentage (82,9%) of the respondents stated that visual elements related to the concepts should be contained in the index. Other preferences included access to the glossary from every page (77,8%), a glossary in alphabetical order (77,0%), provision of the words together with images in the glossary (80,5%), and voicing of concepts in the glossary (79,0%). The proportion of those who thought that there should be a search tool for digital textbooks was 96,9%. Lastly, 78,6% of the students opted for simple and advanced search options as they allow for structured navigation. Other preferences of students regarding other elements for navigating between pages are presented in Table 4.

Tool / Element	Should be		Should not be		Does not matter	
	f	%	f	%	f	%
Zoom in/out scaling tool	225	87,5	7	2,7	25	9,7
Forward-back button for switching between pages	209	81,3	16	6,2	32	12,5
An area leading to the section whose page number is entered	210	81,7	12	4,7	35	3,6
'Go to the first page' button	206	80,2	16	6,2	35	3,6
'Go to the last page' button	200	77,8	20	7,8	37	14,4
A compact tool showing all pages in small scale	171	66,5	29	11,3	57	22,2
Links to Internet sites	142	55,3	47	18,3	68	26,5

Table 4. Student preferences related to navigation tools between pages

As seen in Table 4, most of the students (87,5%) took the view that a tool was necessary in digital textbooks for zooming in/out the pages. In addition to that, certain navigation tools were regarded necessary such as forward-back between pages (81,3%), going to a page after entering the page number (81,7%), going to the first page (80,2%), and going to the last page (77,8%). A tool displaying all the pages in small scale was preferred by 66,5% of the students, and 55,3% required links to outsources on the web. Student preferences related to text features in digital textbooks are listed in Table 5.

Feature	Preference	f	%
Alignment	Centred	108	42,0
	Left-aligned	79	30,7
	Does not matter	46	17,9
	Right-aligned	24	9,3
Letters	Bold	110	42,8
	Does not matter	69	26,8
	Italic	46	17,9
	Underlined	32	12,5
Large/Small letters	All letters in capital	116	45,1

	Random; all large or the first two letters in capital, remaining letters small	71	27,6
	Only first letters in capital	70	27,2
Text Size	24 points	105	40,9
	20 points	62	24,1
	Does not matter	45	17,5
	22 points	44	17,1
Font	Comic Sans	116	45,1
	Times New Roman	61	23,7
	Verdana	46	17,9
	Does not matter	33	12,8
Colour	Headings should be colourful	149	58
	The same type of headings should be the same colour	67	26
	Does not matter	41	16

Table 5. Student preferences regarding formal features of headings

As seen in Table 5, students' preferences related to the use of headings in digital textbooks were reported by the following rates: Centred (42,0%), bold (42,8%), entirely in capital letters throughout the book (45,1%), 24 font size (40,9%), Comic Sans font (45,1%), colourful throughout the book without a standard colour or colour group (58,0%). Apart from these, the students' design preferences for formal features and paragraph structures of body text in digital textbooks are given in Table 6.

Feature	Preference	f	%
Alignment	Left-aligned	112	43,6
	Centred	70	27,2
	Does not matter	40	15,6
	Right-aligned	35	13,6
Bold	Bold should be used when necessary	146	56,8
	Does not matter	59	23,0
	Entirely bold font should be used	41	16,0
	No bold font should be used	11	4,3
Italics	Italic should be used when necessary	98	38,1
	Entirely italic font should be used	67	26,1
	Does not matter	61	23,7
	No italic font should be used	31	12,1
Underlined	Underlined text should be used when necessary	146	56,8
	Does not matter	39	15,2
	Entirely underlined text should be used	36	14,0
	No underlined text should be used	36	14,0
Text Size	18 points	100	38,9
	14 points	58	22,6
	16 points	53	20,6
	Does not matter	46	17,9

Font	Comic Sans	97	37,7
	Times New Roman	74	28,8
	Does not matter	44	17,1
	Verdana	42	16,3
Colour	Fonts should be in several colours for certain features	112	43,6
	One colour should be selected for the font throughout the whole book	57	22,2
	Fonts should be colourful	46	17,9
	Does not matter	42	16,3
Bullets or numbering	Should be used occasionally	123	47,9
	Should be used often	68	26,5
	Does not matter	59	23,0
	Never	7	2,7
Paragraph indentations	Should be	202	78,6
	Does not matter	42	16,3
	Should not be	13	5,1
Paragraph spaces	1.5 lines	116	45,1
	2.5 lines	59	23,0
	Does not matter	42	16,3
	2 lines	40	15,6

Table 6. Student preferences for formal features and paragraph structures of body text

According to Table 6, the students' outstanding choices for the formal characteristics of texts in digital textbooks were as follows: left-aligned (43,6%), bold when necessary (56,8%), should be italicised when necessary (38,1%), underlined when necessary (56,8%), 18 points font (38,9%), Comic Sans font (37,7%), and in several different colours according to certain features (43,6%). In addition, students expressed the following preferences: bullets and numbering only occasionally instead of constantly (47,9%), paragraph indentations (78,6%), and 1,5 lines spacing between paragraphs (45,1%). Student preferences related to font density and content tips on the pages of the digital textbooks are given in Table 7.

Feature	Preference	f	%
On each page, a section that summarises the content of the page	Necessary	215	83,7
	Does not matter	33	12,8
	Not necessary	9	3,5
Position of the content summary in page	On top of page	138	53,7
	In bottom of the page	83	32,3
	In the middle of the page	36	14,0
Density of font in pages	Text, but should be used as little as possible	144	56,0
	Does not matter	65	25,3
	Pages should be filled entirely in text	34	13,2
	No text, only visual elements	14	5,4

Table 7. Students' thoughts about density of the texts and content tips

As can be seen from Table 7, students (83,7%) opted for the content tips that summarise the information on that page on every page of digital textbooks, and such content positioned at the top of the page (53,7%). In addition, more than half of the students (56,0%) took the view that the pages should contain writing without much density. Student preferences related to the use of still and moving visual elements in digital textbooks are given in Table 8.

Tool / Element	Should be as much as possible		Should be as much as needed		Should be little		None		No idea	
	f	%	f	%	f	%	f	%	f	%
Still images	66	25,7	159	61,9	10	3,9	4	1,6	18	7,0
Video	71	27,6	148	57,6	18	7,0	5	1,9	15	5,8
Animation	74	28,8	139	54,1	25	9,7	3	1,2	16	6,2

Table 8. Students' opinions on the use of still and moving images in digital textbooks

According to Table 8, more than half of the students think that visual elements should be used as much as needed only. The rate of preferences for such elements was found to be 61,9% for still images such as photos, pictures and graphics; 57,6% for videos, and 54,1% for animations. The types of visuals to be used and page layouts are reported in Table 9.

Feature	Preference	f	%
Page layout of the visual elements	Centred	90	35,0
	Left-aligned	71	27,6
	Does not matter	54	21,0
	Right-aligned	42	16,3
Type of still images	3D, realistic drawings	133	51,8
	photos of real objects	56	21,8
	Does not matter	49	19,1
	2D drawings	19	7,4
Page background texture	Textured	131	51,0
	Plain colours	69	26,8
	Does not matter	57	22,2

Table 9. Student preferences regarding still images, page layout and page background

As seen in Table 9, centred page layout of visual elements (still or moving) seemed to be the outstanding preference in this regard, recording support by 35,0%. With respect to still visual elements, lifelike three-dimensional drawings were preferred most of all (51,8%). On the other hand, the least preferred type seemed to be the two-dimensional drawings, registering endorsement by only 7,4%. Lastly, 51,0% of students stated their preference for textured page backgrounds. Table 10 displays student preferences for transferring some of the features of printed textbooks to digital textbooks.

Feature / Tool	Yes		No		Does not matter	
	f	%	f	%	f	%
Pages should be numbered	224	87,2	10	3,9	23	8,9

Pages should be turned just like in a real book	216	84,0	8	3,1	33	12,8
I'd like to see the digital book from different angles in the plane	185	72,0	21	8,2	51	19,8
Just like in a real book, there should be a pen to 'underline' the text	211	82,1	18	7,0	28	10,9
There should be a tool for taking and saving notes	228	88,7	12	4,7	17	6,6
There should be a bookmark to indicate the page I left reading	223	86,8	6	2,3	28	10,9

Table 10. Students' choices of design features for digital textbooks borrowed from printed books

Also, as seen in Table 10, page numbers were regarded necessary by 87,2% of the students. Just as with printed books; 84,0% of the respondents reported preferring to hear the turning of the page. Again, 72,0% of students expected to be able to see the digital book from various angles just as in the case of printed books allowing to flip over for a careful look over before deciding to use them. In addition, 82,1% of the students wanted to have a pen for underlining the text just as in the case of a hard copy. Significantly, 88,7% reported the need for a tool to take and save notes. Lastly, 86,8% of the students took the view that a specific tool was necessary to mark the last read page. Student preferences relating to suitability of digital textbooks for distribution and personal use are given in Table 11.

Feature / Preference	Yes		No		Does not matter	
	f	%	f	%	f	%
There should be high-level interaction between the digital textbook and user	226	87,9	18	7,0	13	5,1
User should be able to determine the background colour of page	198	77,0	19	7,4	40	15,6
User should be able to determine the font of the text on pages	173	67,3	31	12,1	53	20,6
User should be able to determine formal properties of the text (bold, italic, underlined) on pages	190	73,9	37	14,4	30	11,7
User should be able to determine the colour of the text on pages	194	75,5	20	7,8	43	16,7
User should be able to share the book with my friends via the Internet	196	76,3	29	11,3	32	12,5
User should be able to print pages	209	81,3	13	5,1	35	13,6
User should be able to download digital book	192	74,7	20	7,8	45	17,5

Table 11. Student preferences for distribution and personal use in digital textbooks

According to Table 11, 87,9% of the students stated that there should be high-level interaction between digital textbooks and user. Also, a significant portion of the students expected their preferences for text and colour to be applied to digital textbooks. A high proportion (77,0%) wanted to be able to choose the background colour of the page. With respect to the importance of formatting elements; font type was chosen by 67,3%; font style by 73,9%; and font colour by

75,5%. Sharing of the digital textbook on the Internet was found necessary by 76,3% of students, the printing of pages deemed important by 81,3%, and the downloading of pages considered significant by 74,7%.

IV. Discussion

In this part, research results are discussed with reference to related findings in the literature. Karadeniz (2006) pointed out that printed books have an overall structure and conceptual standards, to wit, book cover, table of contents and preface are placed in the book's opening pages whereas glossaries, index and resources are located in the end. Page numbers and table of contents guide readers through the book. In this way, readers do not have to waste time becoming familiar with the structure of the printed books. However, a well-established design layout is not yet available for digital books. This survey showed that students wanted to see three types of cover pages in digital textbooks: front cover, back cover and a bookplate. In relation to the front cover design, it was seen that the preferred elements were similar to those in printed books; in addition to this, emphasis was placed on the need for moving images. The results obtained for the cover design seemed to comply with the principles of EBONI (Wilson, Landoni, & Gibb, 2002).

According to the survey, students believe in necessity for a variety of tools to navigate the digital textbooks. These included the contents page, index, glossary, search tool and transitions between pages. Students further took the view that the headings in the "Contents" and contents in the "Index" should have links to the relevant sections. They also expressed preference for alphabetical ordering of the Table of Contents, Index and Glossary and for the concepts in the index and glossary to be supported by visual elements. In addition, students deemed it necessary to be able to access the glossary from every page and expressed the view that the concepts should be provided in audio form. Again, results showed that, in the view of the participants, digital course books should feature a search tool with options such as simple and detailed search. In the literature, there were studies carried out on navigation in multi-media materials. DeBoard & Lee (2001) indicated that the table of contents was an important navigation tool which minimised the time spent on searching. Similarly, the study by Wilson et al. (2002) reported the necessity for the Table of Contents containing associated texts in digital textbooks. Similarly, the students in the study by Chong, Lim, & Ling (2009) requested a table of contents consisting of headings and sub-headings along with relevant page numbers in digital course books. Karadeniz (2006) stated that the need for a search tool further increases in parallel with gradual growth of multimedia content, and added that digital concepts should be presented in alphabetical order in an electronic glossary. Also there are studies which have drawn attention to the search tool as a major factor in determining understandability of the material, which not only differs from other navigation tools, but also directly affects the preference for such digital textbooks by users (Abdullah & Gibb 2008; Chen & Macredie, 2006). Other studies have also pointed to the necessity for a search tool in digital textbooks (Berg, Hoffmann, & Dowson, 2010; Bozkurt, 2013; Timpany, 2009).

According to the results of this study, students need elements to allow them to navigate easily between pages. These were reported as the ability to go to the previous page, to the next page, to the first page, to the last page and to the relevant page by entering the page number. Diaz, Sicilia, & Aedo (2002) revealed that such navigation elements are required for presentation of the digital content with hierarchical integrity. Also other studies revealed the importance of the use of

navigation tools to access the desired chapters in digital books and to prevent confusion (Bozkurt, 2013; Diaz, 2003; Timpany, 2009). Page numbers, sections and section headings, navigation bars, and other features such as highlighting the current position are all important for formation of the 'sense of place'. This, according to Chen, Fan, & Macredie (2006), strengthens the relationship between the reader and the book.

According to our findings, students wish to have a tool for zooming in/out all the pages as well as a tool for collectively showing all pages by zooming out in digital books. It is known that different types of navigation tools in multimedia allow each person to navigate within digital books according to their individual preferences (Chen et al., 2006). Moreover, Chong, Lim, & Ling (2008) argued that readers should be able to use the digital book interface without suffering eye strain. According to a different study, Chong et al. (2009), students attach importance to adequately large sized text in digital textbooks. Taking this into consideration, it can be said that scaling options are essential for easier reading of the content of digital textbooks.

With regard to navigation within digital textbooks, student preferences were found to be similar to the design proposals mentioned in the first phase of this study. However, a different choice was found in relation to provision of a link to outside the digital textbook. Especially, the design principles of EBONI (Wilson et al., 2002) commend forbearing from giving links to outside digital textbooks, or— if such links are to be provided—distinguishing them from other types of links. On the contrary, the present study revealed that students prefer being provided with links by digital textbooks to other resources on the Internet. Chen, Li, & Jia (2005) ventured that digital books can make considerable contribution to learning if they offer multiple links comprising properly configured headings and sub-headings.

Having regarded to the thesis that the design of digital textbooks should be tailored to the needs of the audience (Diaz, 2003), it is understandable that various design choices might be raised by students at different levels for font and colour. In our study, some students' preferences for text seemed similar to the results of other studies from the literature. However, most students opted for Comic Sans as their font choice in both headings and body text, and expressed the view that the headings should be colourful throughout the book. This situation is considered to be related to the age of the target audience because Chong et al. (2009) noted that university students preferred Times New Roman in digital textbooks. Again, in our study students preferred content tips summarising the information on every page and also for such tips to be placed on the top of the page. Students also reported that dense text should not be used on pages. Other studies also revealed that digital books should have a balanced density of information (Bozkurt, 2013; Diaz, 2003). These results suggest that over-loaded pages and interfaces are not likely to be preferred by students.

According to the survey, students need to see both still and moving images in digital textbooks. It was seen that lifelike three-dimensional drawings were the most preferred still images. As for moving images, animations and videos were found to be popular among students. Students wished to see those images centred on pages. In relation with the page background, it was found that students favoured textured pages. Chong et al. (2009) noted that students wanted to see visually appealing digital textbook pages.

The survey included both structured and open-ended questions on the suitability of digital books for distribution and personal use. Analysis of the responses to these questions suggested that students were looking for a highly interactive interface in digital textbooks. According to Henke (2002), interaction components of course books constitute one of the most important reasons for the choices of students. Survey results have shown that students expected some of the elements in the digital textbook interface to be configured according to their own choices. Students also requested printable pages in digital textbooks. Also they expressed a desire for features such as sharing on the internet and downloading of digital textbooks. Bozkurt (2013) demonstrated that students needed to be able use digital textbooks both online and offline. Jang (2014) pointed out that such a feature, which is used for distribution of content of digital textbooks, played a pivotal role in determining the way teachers and students used such materials. Byun, Choi, & Song (2006) indicated that digital textbooks should be materials such that can be used by students in the classroom or be taken home when they want.

According to this research, majority of the students preferred digital textbook pages, suitable for turning, just like the printed book. Certain preferences such as numbered pages, page-turning sound, turning the digital textbooks to be seen from different angles, underlining the text, taking notes on pages and marking the page left could imply students' wishes for transferring the properties of printed books to digital textbooks. Also the results of the study conducted by Chong et al. (2009) showed that students desired to have bookmarks, text mark-up and annotation elements in digital textbooks. There are other studies demonstrating the positive effects of designing digital books with a similar structure to printed books thereby building on the success of the printed material (Landoni, et al., 2000; Malama, Landoni, & Wilson, 2005). These features also help students to customise the content themselves. Diaz (2003) drew attention to the importance of the ability of students to amend the content of digital textbooks according to their needs. According to Soules (2008), users' ability to edit the content increases the usability of digital textbooks.

V. Conclusions

In this study, preferences of secondary school students were found out regarding the design of digital textbooks. The questionnaire used to collect data was applied in sessions spread across a period of time. The digital textbooks developed before and during implementation of the questionnaire made it possible for the students to have a preference by experiencing. According to the findings of the study, secondary school students' preferences for the design of digital textbooks were as in Table 12.

Design element/feature	Student preference
Covers	<ul style="list-style-type: none"> • Front cover should be (Book's title / Still images / Link to the contents page / Moving images / Author's name) • Bookplate should be (Visual elements about topic / Text related to topic) • Back cover should be (Visual elements about topic / Text related to topic)
	<ul style="list-style-type: none"> • Contents should be (Linked text leading to relevant section if clicked / Content-related visuals in section headings)

Navigation	<ul style="list-style-type: none"> • Index should be (Alphabetical / Link on each concept in index leading to relevant part / Visuals related to the concepts in index) • Glossary should be (Access from every page / Alphabetical / Related visuals beside words / Voicing of the concepts in glossary) • Search tool should be ('Simple search' and 'Advanced search' options) • Navigations elements should be used between pages (Switch buttons to previous-next page / Go to first page button / Go to last page button / Element leading to the page by entering page number) • Scaling tools should be (Tool for zooming in/out pages / Tool for showing all pages in small scale -similar to print preview)
Text	<ul style="list-style-type: none"> • Headings (Centred - Bold - All in capitals throughout book - 24 points size - Comic Sans font - Colourful rather than mono colour) • Body text (Left-aligned / Bold as necessary / Italic as necessary / Underlined as necessary / 18 points size / Comic Sans font / In several colours grouped for certain features / Occasional use of bullets and numbering / Paragraph indentation / 1.5 lines spacing between paragraphs) • Other (Content tips summarising each page / Decreased density of text on pages / Content summaries on top of page)
Visuals	<ul style="list-style-type: none"> • Should contain still and moving images (Especially 3D / Videos / Animations) • Visuals should be centred on page • Page background should be texturized
Distribution/ Personal use	<ul style="list-style-type: none"> • Highly interactive interface • Digital course book interface should be customisable by students (Should be able to select page background / Should be able to select text font / Should be able to select text style / Should be able to select text colour) • Storing and distribution should be flexible and easy (Book should be able to be shared on Internet / Book should be able to be downloaded /Book should be able to be printed)
Similarity with printed books	<ul style="list-style-type: none"> • Numbered pages • Page-turning sound • Rotating the digital textbook • Underlining the text (pen) • Note-taking tool • Bookmark or mark-up showing the last seen part

Table 12. Secondary school students' choices for the design of digital textbooks

In a nutshell, secondary school students' preferences regarding digital book design detailed in Table 12 can be listed as follows:

- There must be available a table of contents, index, dictionary, switching between pages, and a search tool for navigation within the digital textbook.
- There must be available a scaling tool supporting zoom-in, zoom-out, and print preview.
- Standard design criteria to apply throughout the digital textbook for the texts used for the same purpose should be determined and used (font type, font size, capitalization, font colour, alignment...). These criteria should vary for the title, body text, and text types except these two.

- Static and moving visual objects should be used to support textual content. Such images should be centred on page.
- The page background should be texturized.
- Digital textbooks are expected to contain high-level interactive elements and to be customizable. They also should be easy to access, store and distribute.
- Some features of printed books should be transferred to digital textbooks. These include: book covers (front cover, bookplate and back cover), numbered pages, page-turning sound, rotating the textbooks, underlining the texts, note-taking tools and bookmarks.

The design of digital textbooks should not be considered independently on students' preferences. Therefore, the design preferences as revealed by this study may provide guidance to both instructional designers of secondary school digital textbooks and teachers. Further investigation could be carried out to determine whether different groups of students hold similar design preferences. In addition, specific studies could be conducted on each of the design elements such as cover design, navigation, use of text, audio, and interaction in digital textbooks in order to collect in-depth data on each of these elements. We believe that the results to be obtained from such studies would be an extremely important contribution to the development of better digital textbooks.

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