

Analysis of User Preferences for Management and Search Features in E-book Reader Libraries in Smartphone Environments

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ABSTRACT

There has been a significant paradigm shift in the book industry from print to digital, with the increased use of electronic books (e-books) on e-book readers. The major online booksellers and publishers are devoting their energies to the growth of the e-book market, resulting in an upward spiral in e-book usage, and a resultant increase in the number of downloaded e-books in an e-book reader library. However, there are comparatively few features for e-book management and search in most e-book reader libraries, particularly in smartphone environments. In addition, the user interfaces of e-book management in e-book readers are highly diverse, which has led to major usability issues. In this paper, we analyze user preferences for e-book management and search in the libraries of the five most commonly used e-readers for the Android smartphone platform via a questionnaire survey. Then, we suggest ideal alternatives in addition to user-friendly features based on user preferences for managing e-book libraries, to allow users to more easily browse collections, thereby enhancing the usability of e-book readers.

Key words: E-book, E-book Reader, E-book Reader Library, E-book Management and Search, E-book Collection Management.

1. INTRODUCTION

The electronic book (e-book) industry has been steadily growing with the popularization of smart mobile devices, providing instant access to e-books on the Internet [1]-[3]. Major online booksellers and publishers, as well as portals and communication companies, are leading the growth of the e-book market. Currently the ratio of e-books among new published books is 30% in the United States publishing market [4]. PricewaterhouseCoopers (PwC) expects that the sales revenue from e-books will surpass that from printed books in 2018, reaching a total of US\$8.69 billion, up from \$2.31 billion in 2011 [5]. Amazon.com, which controls 67% of the United States e-book market [4], launched the 'Kindle Unlimited' service on July 2014 to expand its service to more users, allowing them to utilize over 80 million e-books and thousands of audiobooks on any device for \$9.99 a month [4], [5]. Such a subscription service will accelerate growth of the e-book market, changing the paradigm of this industry. The increasing use of tablets and smartphones will also escalate revenue from e-book sales [1], [3].

An e-book is an electronic version of a printed book [6]. It consists of text, images, or both in digital form that can be read on dedicated e-reader devices or on other electronic devices using e-book reading software [7], [8].

In other words, an e-book is an electronic or digital book that is readable on electronic devices, such as dedicated e-book reading devices, desktop computers, netbooks, tablets, and smartphones using an e-book reading application with many additional features such as notes, dictionaries, navigations, bookmarks, voices, and book management [1], [3]. An e-book refers to not only book-length publications but also to documents, journals, articles, newspapers, magazines, blogs, and other content in digital form [9]. The content may be called an eBook, e-Book, e-book, ebook, digital book, or even e-edition [10]. Many different types of e-book formats exist, such as the Electronic Publication (EPUB), HyperText Markup Language, Portable Document Format, and Mobipocket. The EPUB (also abbreviated ePub, Epub, or epub) format is a free and open e-book standard developed by the International Digital Publishing Forum [10], and is the most widely supported vendor-independent e-book format based on Extensible Markup Language [11].

E-books represent a completely new means of information transfer, and are not simply a replacement for paper books. Users can now exchange knowledge, information, and emotions regarding the content that they are reading in real time [4]. A typical example is 'social reading,' which enables e-book readers to communicate thoughts and ideas through reviewing, recommending, and sharing interests and experiences via social media platforms [12].

Users can read e-books on dedicated reading devices or on general-purpose universal electronic devices by downloading them to their own devices. Representative dedicated e-reader

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devices (also referred as e-book reading devices or e-book terminals), in which e-book reader applications are embedded, include the Amazon Kindle [13], the Kobo mini/touch/glo/aura [14], and the Sony Reader Touch Edition [15]. To read e-books on a universal electronic device, such as a computer, tablet, or smartphone, users are required to download and install an e-book reader application to their device. E-book service providers not only support dedicated e-reading devices but also many different versions of their e-book applications. For example, the version of Kindle that runs on a tablet and a smartphone for iOS or Android is an e-reading application, which includes eBooks [16] for iOS and Aldiko [17], Kindle [18], Kobo [19], Google Play Books [20], and Kyobo eBook [21] for Android. Here, the terms 'e-book reader software' and 'e-book reader application or app' are generally referred to as an 'e-book reader' or 'e-reader.'

Currently, various types of e-book readers are used. However, their user interfaces, including the menu for the main features and e-book management in the reader libraries, are highly diverse, which has led to major usability issues [1], [3], [22]. As many new e-book service providers are emerging, numerous new e-book readers that are configured in various ways will be released. In addition, the e-book sales revenue continues to increase [5], and the major online booksellers and publishers are devoting their energies to the growth of the e-book market, resulting in an upward spiral of e-book usage [4], [5]. With this growing use of e-books, the number of downloaded e-books in an e-book reader library will be also continuously augmented over time. However, e-book management and search features in most reader libraries, particularly in smartphones, are very diverse and inconvenient. Dedicated e-reading devices and tablets such as iPads, Galaxy Tabs, and PlayBooks are the most appropriate devices for reading e-books because of their reasonable screen size and portability. However, e-books are most widely used in smartphones due to their popularity and portability. Gartner forecasted that, in 2015, the numbers of smartphone and tablet users will be 2,098,450 and 580,946, respectively, worldwide [23], [24]. In Korea, 44.1% of e-book users utilize smartphones to read e-books, whereas only 2.3% and 38.1% of users utilize dedicated e-reading devices and desktops or notebooks, respectively [25].

In this paper, we analyze user preferences for management and search features in the libraries of the four most commonly used e-book readers (Aldiko, Kindle, Kobo, and Google Play Books) worldwide [26], [27], and the most popular one in Korea (Kyobo eBook) for the Android smartphone platform. The analysis is based on the main features of e-book management and search in the libraries of these e-book readers, and the objective was to determine the ideal management strategy for readers, in terms of usability, from the perspective of user preference and perception. Then, we suggest ideal alternatives for these features, to enable users to efficiently manage their library collections and conveniently and more easily browse through them. The content of this paper was partially introduced in a previous work [22].

The remainder of this paper is organized as follows. Section 2 and Section 3 describe related works and the main features of e-book management and search, respectively, in the

mentioned five e-book readers. Section 4 presents the survey method and questions, and Section 5 describes the survey results and includes some discussion. Section 6 summarizes the paper with the survey results.

2. RELATED WORKS

Usability issues are caused by many kinds of e-book readers consisting of different user interfaces with respect to function icons, menu configurations, and library management features. Currently, more than 100 e-book readers are available in the e-book market [11]. However, situations can occur where users have multiple e-book readers for access to a complete range of e-books that are supported by different providers. For instance, to read e-books from Amazon.com on an Android smartphone, users need to install Kindle for Android; to read e-books from Kobo Inc., the Kobo application for Android is required, i.e., a different e-book reader application. This can cause usability issues resulting from inconvenient and confusing situations with the different interfaces.

To solve such issues, a number of studies have been conducted [1], [3], [22]. Kim et al. [1] analyzed user preferences for the menu configurations and use of feature icons in e-book readers, with the goal of establishing an ideal menu that would enhance its usability. Their study also assessed the ability to standardize feature icons. As an extension of this study [1], Kim [3] conducted a survey to analyze user preferences with respect to the feature setting option and use of screen touch actions in the six most commonly used e-book readers for smartphones. The analyzed features included the settings options for background color, brightness, font size, font color, and page turn effect; the information displayed on the screen during page movements using a scroll bar; and the lock screen rotation, day and light mode, bookmark, share, memo, highlight, display of the current page number, and action features of e-book readers according to their screen locations and touch types.

A number of other studies have been performed on the usability of e-book readers. Kwak and Bae [28] developed evaluation criteria and elements for testing the usability of e-book readers, and assessed these elements by applying them to the iPad, Kindle, and Galaxy Tab e-book devices. The authors found that the lack of touch features and portability of e-book devices impacted on their usability. Richardson and Mahmood [29] evaluated the user satisfaction and usability of five e-book readers, including the Amazon Kindle, Apple iPad, Barnes & Noble's Nook BNRV100, Borders' Kobo reader N647-BUS-S, and Sony Digital Reader PRs-950. The study found that poor navigation features, the ability to loan titles in the collection and have multiple books on a single reader, and the portability of the readers influenced user satisfaction and usability. Kim [30] conducted a comparative analysis on the usability of three distinct types of e-book reader interfaces (iPad, iRiver Cover Story, and Interpark Biscuit) from the perspective of performance, error frequency, and subjective satisfaction, and found that the iPad had the best usability, followed by the iRiver and Biscuit. Jardina and Chaparro [31] investigated the usability of three e-readers (iPad, Kindle Fire, and Nook

Tablet) for basic book navigation tasks, such as add/delete/locate bookmarks, page movements, highlighting text, changing text size, notes, and search features. The authors found no significant differences among tasks regarding user satisfaction, with each having their own strengths and weaknesses.

Although such studies have been performed, usability issues remain, such as with respect to the management of e-reader libraries [22]. With an increase in the use of e-books, the number of downloaded e-book collections in an e-book reader library will continuously increase. However, the management and search features in most e-reader libraries are inconvenient and insufficient, particularly in smartphone environments. The user interfaces of these features are also highly diverse. Therefore, this paper investigated ideal management features in an e-book reader library on the Android smartphone platform. To this end, user preferences regarding the management and search features of e-book reader libraries were analyzed in the five most commonly used e-readers for Android (Aldiko, Kindle, Kobo, Google Play Books, and Kyobo eBook) using a survey questionnaire. Nook by Barnes & Noble, one of the world’s largest publishers, was not included because its service is limited to certain Android devices and areas, such as the U.S. and United Kingdom. Kyobo eBook, supported by Kyobo, was included because Kyobo is one of the largest e-book sellers and providers in Korea [32].

3. MANAGEMENT AND SEARCH IN THE LIBRARIES OF THE FIVE E-BOOK READERS

Users can download e-books from an e-book service provider after installing a reading application (e-book reader) from that provider. Then, the downloaded books will be available in the library of the e-book reader. Users can read the downloaded books by synchronizing them across the supported devices that they own. Fig. 1 and 2 show examples of e-books in each of the five e-reader libraries presented, with the bookshelf and list views of each corresponding e-reader, respectively. The e-book libraries can be sorted by author, category, or collection.

Table 1 shows the e-book display, management, and search features of the five e-book reader libraries on a 5.5-inch Android smartphone. The symbol ‘X’ indicates that the corresponding e-book reader does not support a given feature. E-book readers present their libraries in several different ways. In general, they are displayed in a bookshelf (grid) view of book cover images, as shown in Fig. 1. Most readers (except Play Books) also support a list view (Fig. 2), which shows each book’s cover image, title, and author(s). Some list views also present each book’s publisher, size, as well as the amount of reading with the percentage of reading progress, current page of the total number of pages, or a reading progress bar, as shown in Fig. 2.

All of the five readers present the library books alphabetically, sorted in order of recently read books, title, and author. Some also provide other features, such as ordering by the most recent downloads, or in descending order of author (Authors Z–A), as shown in Fig. 3.

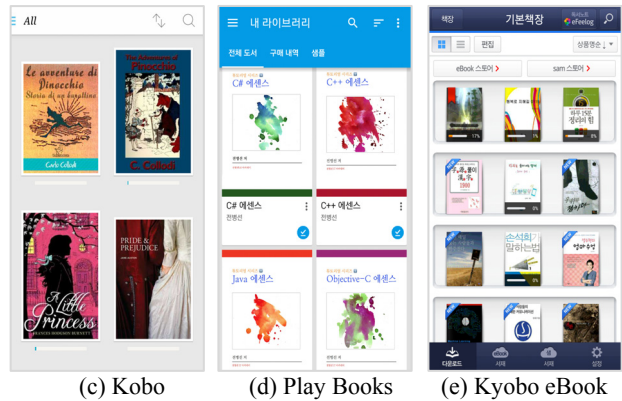
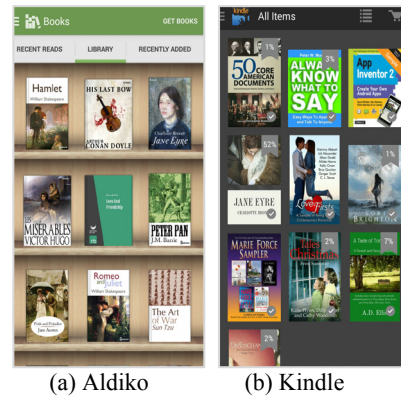


Fig. 1. Examples of e-books presented in the bookshelf view in each of the five e-reader libraries

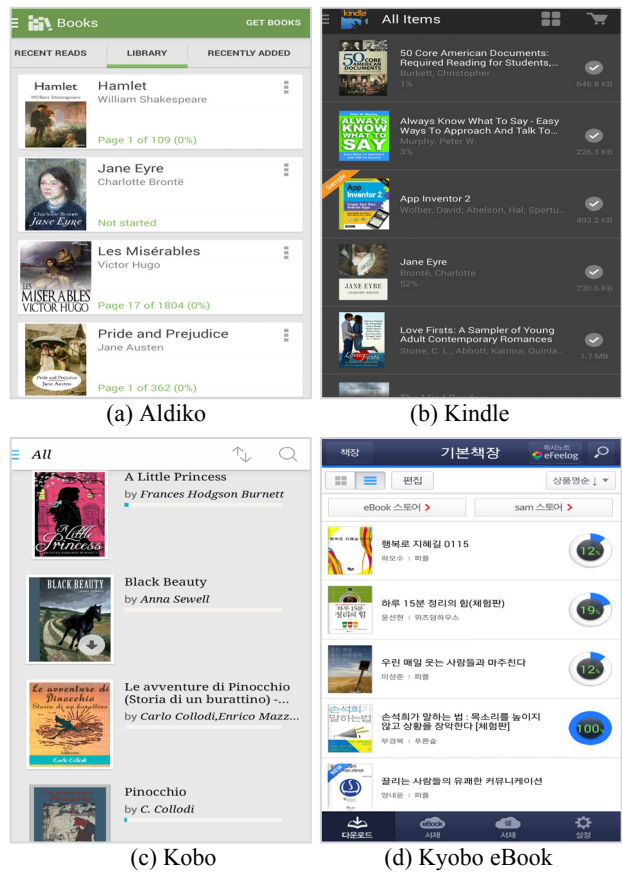


Fig. 2. Examples of the library e-books in the list view

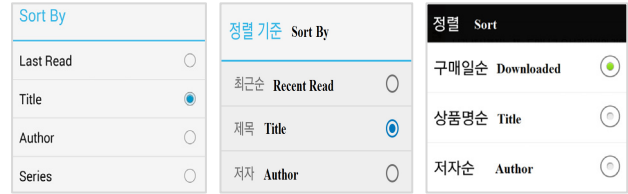
The books can also be viewed by author, category (tags), or collection. Only Aldiko supports the viewing of books by author. Aldiko and Kyobo eBooks provide a feature for viewing books by predefined categories, to group related books together in different interfaces, as shown in Fig. 4.

Table 1. Display, management, and search features of the five e-book reader libraries

E-book readers		Aldiko	Kindle	Kobo	Play Books	Kyobo eBook	
E-book features							
Main page of the reader		My Library	Home	Home	Home	My Library	
Display method	Shelf view	O	O(☐)	O	O	O(☐)	
	List view	O	O(☐)	O	X	O(☐)	
No. of books displayed on a screen	Shelf view	9	9	4	4	12	
	List view	4	5	3.5	-	5	
E-book information shown in the list view	Book cover	O	O	O	-	O	
	Title	O	O	O	-	O	
	Author(s)	O	O	O	-	O	
	Amount of reading	%	O	O	X	-	O
		Page Bar	O	X	X	-	X
	Size	X	O	X	-	X	
	Icon for detail	O(☐)	X	X	-	X	
Publisher	X	X	X	-	O		
E-book display order (how books are sorted)	By recent read	O	O	O	O	O	
	By title	O	O	O	O	O	
	By author A-Z	O	O	O	O	O	
	By author Z-A	X	O	X	X	X	
	By recent downloaded	O	X	X	X	O	
Viewing e-books in library	By all	O	O	O	O	O	
	By authors	O	X	X	X	X	
	By categories	O	X	X	X	O	
	By collections	O	O	O	X	O	
Organizing e-books in library by user-created categories or topics (Collections)	Interface	Hierarchy	Shelf	Hierarchy	-	Hierarchy	
	Presented order of the created topic	Alphabetical order	Alphabetical order	Created (changeable)	-	Created (changeable)	
	Display the no. of books at each topic	O	O	X	-	O	
Library search feature	By keyword (title&author)	O	O	O	O	O	
	By authors	O	X	X	X	X	
	By categories	O	X	X	X	O	
	By collections	O	O	O	X	O	
Filtering features for viewing e-books in library (which books will be shown)	Books	O	O	O	X	X	
	Magazines	X	X	O	X	X	
	Newsstand	X	O	X	X	X	
	Docs	X	O	X	X	X	
	Samples	O	X	X	O	X	
	I'm reading	O	X	O	X	X	
Already read	O	X	O	X	X		

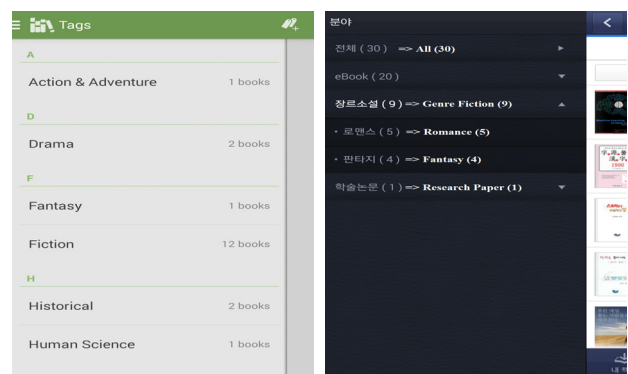


(a) Aldiko (b) Kindle



(c) Kobo (d) Play Books (e) Kyobo eBook

Fig. 3. Examples of the book display order provided by each reader



(a) Aldiko (b) Kyobo eBook

Fig. 4. Examples of viewing the library books by category

In both readers, an e-book can manage and retrieve books from more than one category (tag). Among the predefined categories, only the categories to which the library books belong are presented, along with the number of books that exist in each category. Aldiko organizes its library e-books in a single-level hierarchy based on the tags that the e-books belong to. Users can also add new tags (categories) to each book at their convenience, using predefined tags supported by the e-reader, as well as user-defined tags. Kyobo eBook organizes its library books according to a two-level hierarchical structure (i.e., subcategories under the top level categories).

With respect to the feature of viewing library e-books by collection, all of the e-book readers, except Google Play Books, allow users to organize their library e-books by user-created categories or topics (collections) in the different user interfaces, as shown in Fig. 5. That is, users can create collections to group and organize their downloaded e-books by certain topics, so that they can easily be found. For example, a user can create a collection named “Travel” for all of their travel books. The list of collections is presented in alphabetical order (Aldiko and Kindle) or in a created order (Kobo and Kyobo) with the number of books belonging to that collection. Kobo and Kyobo eBooks allow users to change the sort order by moving books to the desired position, in a random order. An e-book can be organized in multiple collections. When a collection is selected, the e-books in the collection are displayed by bookshelf or list views, as shown in Fig. 1 and 2.

All of the e-book readers also allow users to search a particular book in the library by entering the keywords (a word or phrase) corresponding to what they want to find into the search box, after tapping on the magnifying glass search icon. Then, the e-readers find e-books that contain the entered keywords in the titles or authors. In the cases of Koyo, Play Books, and Kyobo eBooks, the search icon is always visible in the top right corner of each e-reader. In the cases of Aldiko and Kindle, the search icon is hidden and appears when the navigation drawer indicator icon (☰, ☰) at the top left corner is tapped. Some readers also allow users to navigate to a certain e-book in the library by the list of authors, categories, and collections. The e-readers also support the filtering of books in the library to show fewer books. That is, if a library becomes too big to browse easily, users can filter it to show fewer books e.g., by showing only the books, magazines, newsstand items, or documents that are currently being read.

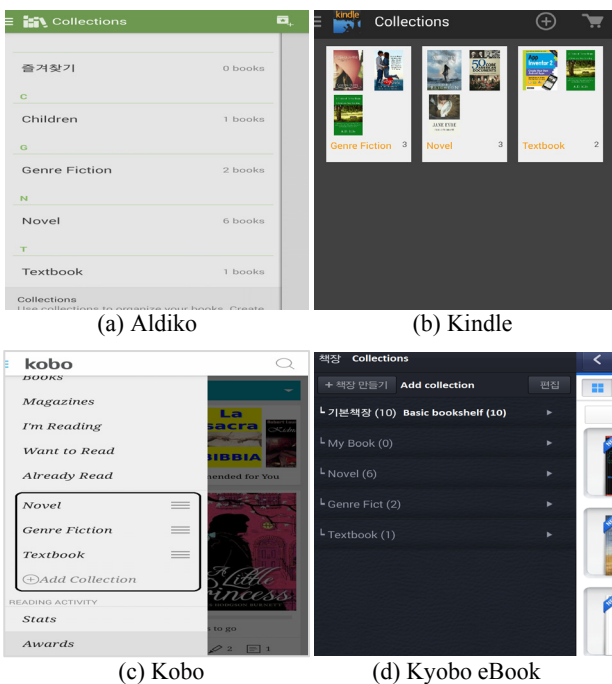


Fig. 5. Examples of managing library e-books by collection

4. USER PREFERENCES FOR E-BOOK MANAGEMENT AND SEARCH

4.1 Survey Method

A survey was used to analyze user preferences with respect to e-book management and search functions, based on the library features of the five e-book readers available for Android. Seven (two females and five males) university students participated in the survey, all of whom were majoring in computer science, education, or engineering, were using an Android smartphone at least 4.8 inches in size, and were novice e-book reader users. We chose to conduct personal, face-to-face interviews instead of written questionnaires because the survey questions contained some follow-up items to explore the implicit intent behind the participants' responses, and to confirm their understanding of the questions. The number of

participants included was reasonable for in-person interviews. Furthermore, we wanted to exploit the advantages of the interview method, such as the potential for non-verbal and more precise data collection [32], and the possibility of understanding participants' personal experiences and their interpretations of those experiences [33].

One month before conducting the interviews, we gave the participants an overview of, and instructions on how to use, the five e-book readers, and guided them on how to download at least 50 free e-books from several domains using each e-book reader, and from each corresponding website. We gave them 1 month to use the readers. To ensure more active participation, we recognized that these tasks represented an extracurricular activity, and therefore gave them a reward for their involvement.

Regarding the number of participants that should be interviewed for usability testing, one viewpoint is that "the evaluation of a design element's quality is independent of how many people use it" and "testing more users does not result in appreciably more insights" [34]. The Nielsen Norman Group [35], which has been a leading voice in evidence-based user experience research, training, and consulting since 1998, found a very small correlation between described usability issues and the number of participants in usability tests, with the exception of quantitative studies that use statistics (not insights), across 83 case studies and projects [34], [36]. Because our goal was to garner insights on how to enhance the usability of the user interface on e-book readers, we believed that including seven interviewees was appropriate for our study.

4.2 Design of the Survey Questions

We developed 16 survey questions to investigate user preferences with respect to the management and search features in an e-book reader library, in terms of usability, and 4 questions to examine users' understanding and overall satisfaction, as presented in Tables 1 and 2, respectively.

Table 2. Questionnaires used for Part1 of the survey

Qu.	Content (Features)
Part1	Questions about the display, management, and search features of the e-book reader library (Which interface do you prefer [for the / in] ...)
Q1	Different views of the library 1) Shelf view only 2) List view only 3) Both
Q2	Number of e-books displayed on a device screen 1) Shelf view (4, 9, or 12 books) 2) List view (3, 4, or 5 books)
Q3	Switching method between shelf View and list View 1) By tapping the view changing icon on the Action-Bar: the icon is always visible on the reader's screen (Kyobo eBook) 2) By tapping the hardware Menu button or the Menu icon and selecting the View item on the Menu: this feature is not visible on the reader's screen (Aldiko, Kindle, and Kobo) 3) Kyobo eBook's approach, but display the view-changing icon that can be toggled (Other)
Q4	Display method for the amount of reading in the list view 1) Percentage (Kindle) 2) Reading progress bar (Kobo & Play Books) 3) Current page of the total number of pages & percentage (Aldiko) 4) Reading progress bar & percentage (Kyobo eBook)
Q5	Display method for the amount of reading in the bookshelf view 1) None (Aldiko & Play Books) 2) Percentage (Kindle) 3) Reading progress bar (Kobo) 4) Reading progress bar & percentage (Kyobo eBook)

Q6	Book information provided in the list view [multiple choice] 1) Book cover 2) Title 3) Author 4) Amount read 5) Size (KB) 6) Icon for detail 7) Publisher
Q7	Display order (how e-books are sorted) [multiple choice] 1) Recently read (or date last read) 2) Title 3) Author (A-Z) 4) Author (Z-A) 5) Recently downloaded (or date created)
Q8	Changing the display order 1) By tapping the sort changing icon on the Action-Bar at the top of the reader: the icon is always visible at the top of the e-book reader (Kindle, Kobo, Play Books, and Kyobo eBook) 2) By tapping the hardware Menu button and selecting a display order: this feature is not visible on the e-reader screen (Aldiko)
Q9	Viewing e-books in library [multiple choices] 1) By all 2) By author 3) By category 4) By collection
Q10	Filtering features for viewing books in library [multiple choice] 1) Books 2) Magazines 3) Newsstand items 4) Documents 5) Samples 6) Currently reading 7) Already read
Q11	Viewing e-books in library by predefined categories 1) Alphabetical order in a single level hierarchy (Aldiko) 2) Alphabetical order in a two-level hierarchical structure (Kyobo)
Q12	Viewing e-books in library by collection 1) Alphabetical order in a single level hierarchy (Aldiko) 2) Generated order in a single level hierarchy (Kobo) 3) Generated order in a two-level hierarchical structure (Kyobo eBook) 4) Kindle's way – bookshelf structure (shown in Fig. 5 (b)) (Kindle) 5) Alphabetical order in a two-level hierarchical structure (Other)
Q13	Preferred method for adding e-books to a collection? 1) Aldiko 2) Kindle 3) Kobo 4) Kyobo eBook
Q14	General library search feature [multiple choice] 1) By entering a keyword(s) (title and author) 2) By browsing the list of authors 3) Categories 4) Collections
Q15	Visibility of the magnifying glass search icon 1) Hidden (Aldiko & Kindle) 2) Visible: always visible on the Action-Bar of each reader (Kobo, Play Books, and Kyobo eBook)
Q16	Information provided during the process of performing a keyword search [multiple choice] 1) Title 2) Author 3) Book cover image

Table 3. General questions used for Part2 of the survey

Qu.	Content (Features)
Q1	Size of the smartphone used for the testing
Q2	Understanding for the library features of the five e-book readers 1)Very low 2)Below average 3)Average 4)Above average 5)Very high
Q3	Preference on the main page of an e-book reader 1) Reader's Home 2) My library
Q4	Overall satisfaction for the usability of the e-book readers: choose two e-reader in order of satisfaction

There are many definitions of usability in the literature. The International Standardization Organization (ISO) developed usability standards for Human Computer Interaction, and defined usability as “the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use” [ISO 9241–11]. A prerequisite of this is an appropriate user interface and interaction method, requiring a user-centered design process and the organizational capability to apply this process [37]. Nielsen [39] defined usability as “a quality attribute that assesses how easy user interfaces are to use,” and stated that usability had five quality components: learnability, efficiency, memorability, errors, and satisfaction [38], [39]. Shackel [40] defined usability as “acceptance of the product,”

specifying that acceptance is associated with usefulness, usability (effectiveness, learnability, adaptability, and attitude), pleasantness, and low cost. Thus, the product or application must be easy to use, learn, remember, and must not put users in confusing situations. It should also be consistent, acceptable, and comfortable for use, with a proper user interface and interaction method. Focusing on such usability components, we developed survey questions based on the display, management, and search features in the libraries of the five e-book readers presented in Table 1. The ultimate purpose of managing e-books and presenting them in various ways in an e-book reader library is to enable users to easily and quickly find books. To achieve this goal, we developed survey questions and conducted interviews based on the questionnaires, to confirm the reasons why certain features were preferred.

5. SURVEY RESULTS

The survey results of the questions in Part 1 are summarized in Tables 4–7. Table 4 shows the user preferences of the e-book display methods in each of five e-book reader libraries. All of the participants thought that the library books should be displayed in both bookshelf and list views. Regarding the number of books that should be presented on an e-book reader screen, 86% of the respondents felt that nine books would be appropriate by shelf view, as is the case with the Aldiko and Kindle (Fig. 1 (a) and (b)). For the list view, all of the respondents chose four to five books. Therefore, it would be ideal if an e-book reader could present library e-books in both a bookshelf view with about nine books on the screen, and a list view with about four to five books shown.

Table 4. User preferences on the e-book display method

Qu.	Features	Results				Total	
		Shelf view only		List view only		Both	
Q1	Different views					n	%
	No. of respondents	0	0%	0	0%	7	100%
Q2	Number of books presented in the shelf view	4 books (Kobo, Play)		9 books (Aldiko, Kindle)		12 books (Kyobo)	
	No. of respondents	0	0%	6	86%	1	14%
	In the list view	3.5 books (Kobo)		4 books (Aldiko)		5 books (Kindle, Kyobo)	
	No. of respondents	0	0%	3	43%	4	57%

Table 5 summarizes the user preferences for the questions in Part 1 pertaining to e-book display, management, and search features.

Table 5. User preferences for the e-book display, management, and search features: data from the questions in Part1

Qu.	Features	E-book readers			E-book readers			E-book readers		
			n	%		n	%		n	%
Q3	Changing the display view	other	6	86%	Aldiko			Kyobo	0	0%
					Kindle	1	14%			
					Kobo					
Q4	Display method for the amt. of reading	Aldiko	6	86%	Kyobo	1	14%	Kindle		
								Kobo	0	0%
								Play		

	in the list view										
Q5	In the shelf view	Kyobo	3	43%	Kindle	2	29%	Aldiko	1	14%	
								Play	1	14%	
Q8	Changing the display order	Kindle	6	86%	Aldiko	1	14%	-	-	-	
		Kobo Play Kyobo									
Q11	Viewing books by categories	Kyobo	6	86%	Aldiko	1	14%	-	-	-	
Q12	Viewing books by collection	other	5	71%	Aldiko	1	14%	Kindle	1	14%	
								Kobo Kyobo	0	0%	
Q13	Adding books to a collection	Kindle	5	71%	Aldiko	2	29%	Kobo Kyobo	0	0%	
Q15	Visibility of the search icon	Kobo Play Kyobo	7	100%	Aldiko Kindle	0	0%	-	-	-	

Regarding the method of switching between the two display views (Question 3), 86% of the participants appreciated the visual changing icon in the Kyobo eBook's Action-Bar, although all of them thought that this icon should have a toggle mode; i.e., if the library is in shelf view (☰), the view icon in the Action-Bar of the corresponding e-reader should have an image of the list view icon (☰) for changing between the two display views, and vice versa. Therefore, the view-changing icon should always be visual on the reader's screen, and should have a toggle mode. Regarding the reading progress display mode in the list view (Question 4), the majority of participants (86%) preferred that of the Aldiko, which displays the current page number of the total number of pages and the percentage of reading progress (e.g., Page 111 of 203 (54%)). Regarding the shelf view, respondents had similar preferences. That is, three of the seven participants preferred the display on the Kyobo eBook (reading progress bar shown as a percentage), two selected that of the Kindle (percentage only), one chose that of Kobo (reading progress bar only), and one respondent selected those of the Aldiko and Play Books (no information given). Thus, it seems that it is better to at least show some reading process than to display no information at all.

Regarding the question on how to change the display order of the library books (Question 8), 86% of the respondents preferred to tap a sort-changing icon located on the Action-Bar at the top of each e-reader, and to select a display order from the list of sort options supported by each e-reader through a pop-up menu, as on the Kindle (sort changing icon: ☰), Kobo (☺), Play Books (☰), and Kyobo eBook (☰). That is, the participants generally preferred having a sort-changing icon that could be visualized at the top of each e-reader. On the Aldiko, this feature is not visual, and only appears when the hardware Menu button, located at the bottom of the device, is tapped. Regarding the sort-changing icon images on the e-readers, all of the respondents noted the need to develop a proper icon image, because they found it difficult to understand the exact meaning of the current icons. In other words, the icon images did not clearly represent its corresponding feature.

To view the library e-books by the predefined categories or tags (Question 11), 86% of the participants preferred that of the Kyobo eBook, which groups related books together in a two-level hierarchical structure based on predefined categories (subcategories under the top level categories), as shown in Fig. 4(b). Only one respondent (14%) preferred that of Aldiko, which groups e-books into a single-level hierarchy. Note that, only Aldiko and Kyobo eBook support this category management feature. We interviewed the respondents who favored the two-level hierarchy to determine the reason for this preference. They replied that, although not a big problem when dealing with a small number of books, as the number of books increase, the two-level structure was more efficient and useful.

Regarding the ability to view library e-books by collection (which can also be referred to as user-created personalized categories, classifications, tags, or topics; Question 12), 71% of the respondents indicated that they preferred a two-level hierarchical structure presented in alphabetical order as the default option, but all of them felt that the structure should be able to be changed to an arbitrary order according to user preferences. One respondent (14%) chose the viewing option on the Aldiko, which organizes its library e-books in an alphabetically sorted, single-level hierarchy. Another respondent (14%) selected that of the Kindle, which utilizes a bookshelf structure, ordered alphabetically as shown in Fig. 5(b), because it can indicate the books that belong to each category using book cover images. No respondents chose the display of the Kobo and Kyobo eBook, which organize collections according to a user-created order. The answers to Questions 11 and 12 led us to conclude that a two-level hierarchy organized in alphabetical order is the most appropriate structure for organizing e-books, not only by predefined categories but also according to user-created collections. The reason for this is that the number of downloaded e-books in an e-book reader library will be continuously augmented over time. Through Question 12, we also confirmed that information on how many books belong to each collection should be provided. In addition, we identified that the length of a created collection name should not be limited (as it with the Kyobo eBook, which imposes a limit of 10 characters).

Concerning the feature for adding e-books to a collection (Question 13), 71% of the respondents preferred that of the Kindle, another 29% preferred that of the Aldiko, and no respondents selected those of the Kobo and Kyobo eBook. Table 6 describes the procedure for adding e-books to a collection in each e-book reader, and Fig. 6 shows examples. The adding processes appear to be relatively similar to each other, but actually differ considerably. The respondents who preferred the Kindle indicated that the user interface was generally acceptable on the Aldiko (provides e-book titles only) but, in some situations, it was difficult to distinguish books based only on their titles (if there were numerous books in the library). In such a case, the Kindle interface would be preferable, because it provides more information on the books, including book cover images, titles, and authors. Moreover, it also supports the addition of books to a collection by allowing them to be found with a keyword search of the book titles or authors. However, the respondents felt that the overall adding

process was quite complicated, and that a more efficient and simple method needs to be developed. In the cases of the Kobo and Kyobo eBooks, all of the participants replied that the book-adding processes were too complicated.

Table 6. Procedures for adding e-books to a collection (Q13)

Reader	Procedure
Aldiko	1) Select a collection to add e-books 2) Tap the 'Book Add' icon (📖), located on the Action-Bar at the top of the reader 3) Select the book(s) to add to the collection from among the books in the library, which are presented in the list view with book titles only, as shown in Fig. 6 (a) 4) Then, click the 'OK' button, located on the bottom of the book selection screen (see Fig. 6 (a))
Kindle	1) Select a collection to add e-books 2) Tap the 'Book Add' icon (📖), located on the Action-Bar at the top of the reader 3) Select the book(s) presented in the shelf view with book cover images or in the list view with book cover images, titles, and authors, or search for a book by title or author, as shown in Fig. 6 (b) 4) Then, click the 'ADD' button at the top right-hand corner of the page (see Fig. 6 (b))
Kobo	1) Select a collection to add e-books 2) Tap the hardware Menu button located at the bottom of the device, or the Feature icon (☰) on the Action-Bar at the top right-hand corner of the reader 3) Select the 'Edit' item in the Menu 4) Select the book(s) presented in the list or shelf views by tapping the Add icon (📖) on each book cover image, as shown in Fig. 6 (c) 5) Then, tap the 'DONE' button at the top left-hand corner of the page (see Fig. 6 (c)). While selecting book, users can sort the library by last read, title, author, and series, and can also edit the collection name or delete the collection
Kyobo eBook	1) Select a collection to add e-books 2) Tap the 'Book Edit' button (📖) on the top of the reader 3) Select the book(s) to be moved to the collection by tapping the Selection icon (📖) on each book image, as shown in Fig. 6 (d) 4) Click the 'Book Movement' icon (📖) at the bottom middle of the page as shown in Fig. 6 (d). After that, the screen is changed to select a collection as shown on the right-hand side of Fig. 6 (d) 5) Then, click the collection where the selected book(s) is to be moved

Regarding the visibility of the search icon when using the magnifying glass function on the Action-Bar at the top of each e-reader (Question 15), all of the respondents preferred the visible approach of the Kobo, Play Books, and Kyobo eBook. They felt that the search feature is one of the most frequently used features of an e-reader; thus, a visible approach is the most convenient. In the cases of the Aldiko and Kindle, the search icon is hidden, and only appears when the navigation icon, located at the top left corner of each reader, is tapped.

Table 7 summarizes the results of the questions that were given in multiple-choice format in Part 1. Question 6 was about the e-book information that should be provided in the list view. All of the respondents selected the book cover image, title, author(s), and the amount read. The feature providing further details was chosen by most of the respondents (86%), but none indicated that information on the publisher should be provided. Therefore, it would be preferable to provide the book title and author(s), cover image, and reading progress, in addition to the feature for viewing detailed information on each book in list view. Aldiko provides all of this information in list view, as can be seen in Table 1 and Fig. 2(a). Regarding the display order (Question 7), all of the respondents replied that the library books should be sorted by book title, author (Author A-Z), and books recently read (date last read) and downloaded (date created). Accordingly, it would be better to support such features for book sorting to enhance user satisfaction. Aldiko provides all of these features. A total of 43% of respondents selected the feature of descending order of author (Author Z-A).

Regarding the e-book display feature in each library (Question 9), all of the participants replied that the e-books should be able to be viewed by all categories (tags) or collections, as is the case with the Aldiko and Kyobo eBooks. Library books can also be viewed by author, a feature that was selected by 43% of the respondents. For the filter option for viewing (Question 10), the features for books, magazines, newsstand items, documents, and books currently being read, were selected by all of the respondents. A total of 57% and 43% of the respondents chose the features for samples and already read books, respectively. Therefore, it would be preferable for an e-book reader to support the ability to view library e-books, magazines, newsstand items, documents, and books currently being read.

For the search features in each library (Question 14), all of the participants replied that users should be able to search for library e-books by keyword, category (tags), or collection, per the Aldiko and Kyobo eBook. Similar user preferences were indicated for Question 9. Regarding the information shown during the process of performing a keyword search (Question 16), all of the respondents replied that the title and author(s) of each e-book should be provided, and 71% of the respondents thought that displaying the book cover image of each book was also necessary. Based on the results of Questions 14 and 16, it would be helpful if an e-book reader allowed users to search for a particular book in the library by entering keywords (for titles or authors) in a search box, and to browse the categories or collections. In the process of performing a keyword search, it would be useful to provide the book title, author(s), and book cover image, similar to the options provided in the Kindle, Kobo, and Play Books, as shown in Fig. 7.

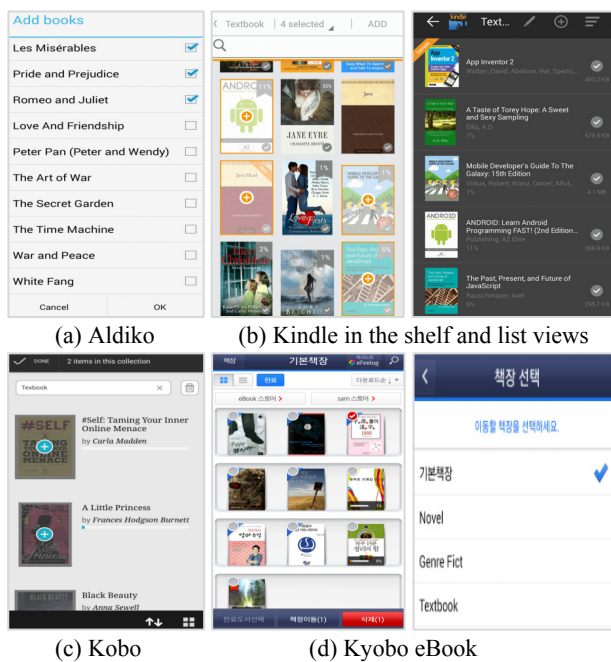


Fig. 6. Examples showing the adding of books to a collection using each reader

Table 7. Survey results regarding the questions given in multiple-choice format in Part I on e-book display, management, and search features

E-book readers		Aldiko	Kindle	Kobo	Play	Kyobo	n	%	
Questions	Features								
Q6 (Book information provided in the list view)	Book cover	O	O	O	-	O	7	100%	
	Title	O	O	O	-	O	7	100%	
	Author(s)	O	O	O	-	O	7	100%	
	Amount of reading	%	O	O	X	-	O	7	100%
		Page Bar	O	X	X	-	X		
	Size		X	O	X		X	3	43%
	Icon for detail		O	X	X	-	X	6	86%
Publisher		X	X	X	-	O	0	0%	
Q7 (Display order: how books are sorted)	By recent read	O	O	O	O	O	7	100%	
	By title	O	O	O	O	O	7	100%	
	By author A-Z	O	O	O	O	O	7	100%	
	By author Z-A	X	O	X	X	X	3	43%	
	By recent downloaded	O	X	X	X	O	7	100%	
Q9 (Viewing books in library)	By all	O	O	O	O	O	7	100%	
	By authors	O	X	X	X	X	3	43%	
	By categories	O	X	X	X	O	7	100%	
	By collections	O	O	O	X	O	7	100%	
Q10 (Filtering features for viewing books in library)	Books	O	O	O	X	X	7	100%	
	Magazines	X	X	O	X	X	7	100%	
	Newsstand	X	O	X	X	X	7	100%	
	Docs	X	O	X	X	X	7	100%	
	Samples	O	X	X	O	X	4	57%	
	I'm reading	O	X	O	X	X	7	100%	
	Already read	O	X	O	X	X	3	43%	
Q14 (Search features in library)	By keyword	O	O	O	O	O	7	100%	
	By authors	O	X	X	X	X	4	57%	
	By categories	O	X	X	X	O	7	100%	
	By collections	O	O	O	X	O	7	100%	
Q16 (Info shown during a search process)	Title	O	O	O	O	X	7	100%	
	Author	O	O	O	O	X	7	100%	
	Book cover image	X	O	O	O	X	5	71%	

an Android smartphone of at least 4.8 inches in size. Question 2, which measured respondents' degree of understanding of the library features of the e-book readers, validated the reliability of the survey: 86% of the respondents answered '4: Above Average' and one respondent answered '5: Very High' on a 5-point Likert scale. It is worth noting that, at the beginning of the survey process, all of the participants were novice e-book reader users. However, it appears that they gained experience through the survey process and practical usage. As a consequence, it can be said that the survey results are significant. Question 3 investigated user preferences regarding the homepage of the e-book reader. The Aldiko and Kyobo eBook present the user's library on the homepage; the Kindle, Kobo, and Play Books have unique home pages comprising other information, including recently downloaded books, recommended books, and new releases. The users can move through the library by tapping the Menu icon provided by each reader and selecting the 'library' icon. All of the respondents preferred having the library page as the home page, because they believe that the main purpose of an e-reader is to read e-books from their own library. They suggested that other information, such as recommended books and new releases, could be presented when users click on the bookstore link.

Question 4 investigated the overall satisfaction of the participants regarding the usability of the five e-book reader libraries with respect to the user interfaces and interaction methods. We required them to choose their favorite two e-readers, in order of satisfaction. Six of the seven respondents (86%) chose Aldiko as their first choice; Aldiko was the second choice of the other one respondent. Kindle was the first choice for one respondent, and 71% respondents selected it as their second choice. No respondents chose the Kobo or Play Books as their first or second choice, and only one respondent chose the Kyobo eBook as their first choice. We asked the respondents why they preferred Aldiko over the other options, and they indicated that this system has an appropriate user interface method, and emphasized its effectiveness, simplicity, consistency, and learnability (i.e., its ease of use). However, the respondents also mentioned that the usability of the Aldiko system could be significantly enhanced by incorporating the user preferences noted in the questions of Part 1.

Based on the survey results, we suggest the following improvements for e-book reader library management and search features on the Android smartphone platform.

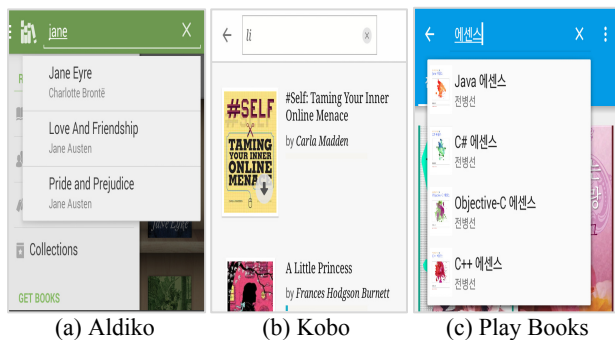


Fig. 7. Book info shown during the process of a keyword search

Table 8 summarizes the results of the questions in Part 2, such as the size of smartphone utilized for the survey, respondents' overall understanding of and satisfaction with the five e-book readers, and user preferences regarding the homepage of the e-book reader. All of the respondents utilized

Table 8. Summary of the results from the questions of Part2

Questions	Results					Total		
	4.8"	5.0"	5.1"	5.5"	5.7"	n	%	
Q1	Size	4.8"	5.0"	5.1"	5.5"	5.7"	n	%
	No. of resp.	1 14%	1 14%	1 14%	3 43%	1 14%	7	100
Q2	Overall understanding	1. Very low	2. Below Average	3. Average	4. Above Average	5. Very High	n	%
	No. of resp.	0 0%	0 0%	0 0%	6 86%	1 14%	7	100
Q3	Preferences for the front page	Home (Kindle, Kobo, Play)			My library (Aldiko, Kyobo eBook)		n	%
	No. of resp.	0 0%			7 100%		7	100
Q4	Overall satisfaction	Aldiko	Kindle	Kobo	Play Books	Kyobo eBook	n	%
	- First choice	6 86%	1 14%	0 0%	0 0%	0 0%	7	100
	- Second choice	1 14%	5 71%	0 0%	0 0%	1 14%	7	100

Table 9. Suggestions for e-book reader library management and search features to the Android smartphone environment

Features	Suggestions
Front page	My library
E-book display method	Support a shelf view and a list view - Bookshelf view with about 9 books - List view with about 4~5 books
Switching method between shelf view and list View	Provide a view-changing icon on the Action-Bar at the top of the corresponding e-reader to be always visible on the reader's screen - Provide the icon that can be toggled - Changing between views by tapping on the icon
Display method for the amount read	- In list view: display the current page number (of the total number of pages), with a percentage per the Aldiko system - In shelf view: display a percentage or reading progress bar
Book info shown in the list view	Book cover image, title, author(s), and amount read
E-book display order	By most recently read, title, author (Author A-Z), and most recently downloaded
Changing display order (sort order)	Provide a sort changing icon on the Action-Bar at the top of the corresponding e-reader to be always visible on the reader's screen - Changing between views by tapping on the icon - Ensure the icon has a clear image to enable users to identify its corresponding feature
E-book display feature in library	Provide to allow for viewing of library e-books by as a whole, category, or collection
Filtering for viewing e-books in library	Facility for filtering by books, magazines, newsstand items, documents, and currently being read items
Managing the library e-books by category and collection	Provide features to organize library e-books in a two-level hierarchy, in an alphabetical order - Manage according to both a list of predefined categories (provided by e-readers) and user-created collections - Indicate the number of e-books belonging to each category/collection - No limitation to the length of a user-created collection name - In the case of collections, allow users to specify the order of collections in an arbitrary, hierarchical manner according to their preferences
Procedures for adding e-books to a collection	Kindle's approach is described in Table 6 - However, the process for adding e-books must be developed to be more efficient - Include function for adding e-books to a collection by finding them with a keyword search
Search features in an e-book reader library	Provide function to find a particular e-book by entering keywords (book titles/authors) in a search box, and by browsing both the pre-defined categories (tags) and the user-created collections
Search icon	Provide a search icon with a magnifying glass image that is always visible on the Action-Bar at the top of the corresponding e-book reader
Info provided in a search process	Title, author(s), and book cover image of each e-book

6. CONCLUSIONS

This paper presented an analysis of user preferences regarding the management of, and search features included in, an e-book reader library for Android smartphones, based on the main library features of the five most commonly used e-book

readers. The objective was to determine the ideal e-features, in terms of usability, based on user preferences and perceptions. The ultimate purpose of managing e-books and presenting them in various ways within an e-book reader library is to enable users to easily and quickly find particular books. To this end, a better method for organizing and browsing e-books is needed. Thus, the goal of this study was to identify e-book management and browsing mechanisms that can allow users to more easily and conveniently find books in an e-book library in a smartphone environment. We developed survey questions to achieve this goal, and conducted interviews using the questionnaires, to understand the reasons behind user preferences.

The survey results indicated that the homepage of an e-book reader should feature the user's library, and the library books should be presented in both bookshelf (about nine book cover images) and list (about four to five books) views. In the case of the list view, it was suggested that the information provided should include the book cover image, title, author(s), and reading progress, in addition to a feature for viewing detailed information on each e-book. The survey results showed that the e-books should be managed and alphabetically sorted in order of most recently read books, title, author (Author A-Z), and most recently downloaded books. Our results also confirmed that library e-books should be navigable by the whole collection, by a list of predefined categories, and by user-created collections. In addition, an e-reader should also support the ability to filter all e-books, magazines, and other materials currently being read, so that fewer books are displayed for easy navigation. Our results on user preference for managing library e-books by category and collection allowed us to determine the ideal e-book management structure: a two-level hierarchy in alphabetical order that can be organized by predefined categories or user-created collections. For the structure of the collections, an e-book reader should also allow users to change the default hierarchical structure to an arbitrary order according to their preferences. Regarding the feature for adding e-books to a collection, we identified a need to develop a more efficient and simple approach. Furthermore, when a book is being added, information should be presented on how many books are in each category or collection, as well as the book cover image, title, and author(s). Books should then be able to be located by a keyword search of title or author, and by browsing both the categories and collections of the library. In addition, it would be preferable if the book title and author(s), as well as the cover image, were visible when users were performing a keyword search. The survey results also suggested that it would be beneficial for e-readers to have access to view-changing, sort, and search icons that are visible on the Action-Bar at the top of each e-reader, because these are frequently used features. In this study, the Aldiko system had the highest user satisfaction (i.e., usability), because its interfaces and interaction modes are simple, consistent, and easy to use. The survey results also suggested that if the Aldiko accommodated the user preferences noted in the questions of Part 1, its usability would be significantly enhanced.

In conclusion, we evaluated the management and search features of the e-book libraries of smartphones to not only allow users to efficiently and conveniently browse their book

collection, but to also enhance the usability of e-book readers. An e-book reader should be easy to use (and not be confusing), and should have proper user interfaces and interaction. Our results should help guide the design of future user interfaces and features of e-book reader libraries, and provide the basis for further investigations of additional usability issues associated with e-book reader libraries.

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