

Design Guidelines to Develop E-textbook Readers: A Task-technology Fit Approach

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Morné Botha¹ and Lizette Weilbach²[0000-0002-0827-2444]

¹ University of Pretoria, Pretoria, South Africa

² University of Pretoria, Pretoria, South Africa
lizette.weilbach@up.ac.za

Abstract. Electronic textbooks are gaining traction as the medium of choice in educational institutions across South Africa. The way in which readers engage with e-textbooks differs from the way in which they would read recreational e-books. E-textbook functionalities should assist readers with the construction of new knowledge and skills. These functionalities are not embedded in the e-book itself, but rather in the e-book reader software used to read the e-book. The task-technology fit (TTF) theory was used as a theoretical framework for the paper and semi-structured interviews were performed to collect data from secondary school learners. The aim was to determine the tasks required by learners when using an e-textbook, and consequently the functions which e-readers should contain to support these tasks. A set of guidelines is proposed which e-textbook reader developers could use to ensure the reader applications which they develop deliver a good fit to the task requirements of its users.

Keywords: E-book, E-textbook Reader, TTF Theory.

1 Introduction and Problem Statement

1.1 Background

The use of e-book reader software has recently been highlighted due to the State of the Nation address in which President Cyril Ramaphosa stated that the South African Government “will over the next six years, provide every school child in South Africa with digital workbooks and textbooks on a tablet device” [1].

E-books are already gaining traction as the medium of choice in educational institutions across South Africa, replacing traditional printed textbooks in both private and public schools. An e-book can be defined as a “digital object with textual and/or other content, which arises as a result of integrating the familiar concept of a book with features that can be provided in an electronic environment” [2]. Three components are

required to read an e-book: the e-reader hardware, the e-reader software and the e-book file [3]. The hardware refers to the device that displays the e-book. This can be a dedicated e-reader such as the Amazon Kindle, or a multipurpose device such as a desktop PC. The software is the application running on the hardware that renders the e-book to display on the device. This application typically offers more functionality than simply rendering the book content such as highlights, annotations and printing. The e-book file is the content of the book stored in a format the application can depict.

The use of electronic textbooks (e-textbooks) is different from that of recreational e-books as readers engage with these e-books in a different manner. E-textbooks should focus on the “additional goals of learning, even memorizing portions of the text” [4], where fictional e-books are purely read for pleasure. The difference in usage can be observed in the basic functionality of the e-book such as navigation, where readers typically do not navigate e-textbooks in the same linear fashion as they would in recreational e-books [5] or in more advanced features such as highlighting and making annotations [6]. In order for e-textbooks to be utilized it needs to differentiate itself from a recreational e-book by adding functions that assist readers with the construction of new knowledge and skills [7].

In this paper we report on a study which was done to determine the tasks that secondary school learners perform to construct knowledge, and consequently also on the functions which e-book reader software require to assist them with this process. A well-known information systems usability theory, the task-technology fit (TTF) theory was used as a theoretical framework for the paper and individual interviews were performed to collect data from secondary school learners who have been using a specific e-textbook reader for at least six months.

The paper contributes to the literature on the utilization and usability of e-books, and more specifically e-textbooks in the field of digital learning, by providing a set of design guidelines which e-textbook reader developers could use to ensure the reader applications which they develop deliver a good fit to the task requirements of its users.

2 Literature Review

2.1 E-books and E-textbooks

E-books can be defined as electronic files which are roughly the length of a book, contain words and images, and are formatted to be viewed on electronic devices referred to as e-book readers [8].

Vassiliou and Rowley [9] suggested the following two-part definition for an e-book as many previous definitions had become outdated or were only focusing on a specific platform or technology:

- “An e-book is a digital object with textual and/or other content, which arises because of integrating the familiar concept of a book with features that can be provided in an electronic environment. “

- “E-books typically have in-use features such as search and cross reference functions, hypertext links, bookmarks, annotations, highlights, multimedia objects and interactive tools.”

E-textbooks are considered a variant of e-books [4] and are read in a different way than recreational e-books. The latter are read in a linear narrative structure, whereas e-textbooks typically follow a hierarchical structure [5, 10].

In order for e-textbooks to be utilized, it needs to have functions that assist readers with the construction of new knowledge and skills [7]. These functions are usually not embedded in the e-textbook itself, but rather in the e-textbook reader which is used to read the e-textbook.

2.2 The Task-Technology Fit (TTF) Theory

The TTF theory aims to provide a model that can be used to explain the utilization of a given computer system. To explain utilization, TTF finds the relationship between task requirements and technology characteristics. The model was introduced by Goodhue and Thompson [11] as a means to describe the impact of the relationship between tasks and technology on user performance.

The higher the TTF, the better performance by users [11, 12]. Similarly, the use of information systems will be high if the task fit for that system is high [11]. The need for TTF arose out of the lack of a theoretical basis in traditional user evaluations [13].

TTF forms part of the technology-to-performance chain (TPC) [11] which investigates how individual performance is impacted by technology. In addition, the TPC builds upon earlier work by DeLone and McLean [14] on the Information Systems Success theory.

The TTF theory has been widely used by researchers in both Information Science and other disciplines [15] and TTF is also one of the most used theories in predicting individual performance in Information Systems research. It has in this regard been used as the framework of choice for this research and by various other authors [12, 16-19].

2.3 TTF and E-reader Fit

The TTF model focuses on the ability of a system (e-reader) to match the tasks users (learners) need to perform using that system [11]. A high TTF will result in a greater performance impact and greater usage of the system.

D’Amra, Wilson and Akter [18] used the TTF model to evaluate the adoption of e-books by academics and to determine how it is influenced by its fit and performance. They consequently provided an e-book TTF construct which could be used to evaluate academic task fit and confirm the hypothesis that task, technology and individual characteristics influence the use and performance of e-books in an academic setting.

As educational applications are tools that individuals (learners) use to complete certain tasks (studying, assessment etc.) it can be evaluated using TTF. This will require the authors to present a set of scales of measures designed for this specific audience. TTF has also been used by other authors to evaluate e-learning systems. In one such an

example, the TTF was measured for two user types (instructors and students) in a tertiary learning environment by using a questionnaire [20]. Another study investigated the relationship between perceived fit and the continued utilization of an e-learning system in a blended learning environment [21].

2.4 Educational Tasks

Although this research is not focused on the educational outcomes (performance impacts) of e-books but rather on the utilization thereof, it is worth mentioning two categories of educational tasks namely cognitive and metacognitive activities. The tasks learners execute while using the e-book reader, fit into one of these two categories and, as discussed below, can have a direct or indirect impact on learning. The categorization of tasks in the educational environment is important when identifying the task characteristics to ensure non-educational tasks do not form part of the evaluation. For the sake of consistency with the TTF theoretical framework, activities will be referred to as tasks.

2.5 Cognitive Tasks

Cognitive processing tasks are the tasks learners execute that lead directly to learning and understanding [22]. These tasks assist learners in becoming more skillful or knowledgeable in a subject or topic. Examples of such tasks include thinking of examples that match a piece of theory; or establishing relationships between entities in the subject.

2.6 Metacognitive Tasks

Metacognitive regulation tasks regulate the cognitive learning tasks which in turn indirectly lead to learning results [22]. Metacognitive tasks can include identifying difficulties while studying for a subject by doing self-assessments; or by having greater control over the learning environment. Learners who have a greater control over their learning environment have been found more able to easily execute their cognitive tasks [23]. Metacognitive tasks were found to be an influencer of the perceived usability (utility) and satisfaction of e-learning platforms [24].

3 Research Design

The research was operationalized through an interpretive exploratory case study. The use of a single e-textbook reader, the EduReader¹, was investigated at three different schools. The EduReader is an interactive e-reader that was developed specifically for educational use. The e-reader was developed by EduCorp², a company based in Pretoria, South Africa. EduReader can be used to read the two most popular e-book formats,

¹ The name of the e-textbook reader has been pseudonymized to protect the identity of the company that developed it.

² The name the company who implemented the e-book reader software has been pseudonymized to protect the company's identity.

EPUB and PDF. The app is downloadable for free on Windows Store, Google Play Store and the Apple App store. The EduReader application is currently used by more than 80 000 users from a variety of primary, secondary, tertiary and corporate education environments.

To understand the functionalities offered by the EduReader, one of the researchers downloaded the EduReader for iOS and purchased a couple of textbooks in both EPUB and PDF format. He consequently played the role of an expert evaluator while identifying the technological characteristics contained within the EduReader e-book application. Furthermore, the technological characteristics of e-readers as reported on in existing literature, was also investigated.

In addition, to determine the task characteristics required by the user of the EduReader, qualitative data was collected by means of semi-structured individual interviews as it allows the interviewer to focus on the topics while still having an open conversation [25]. Participants were presented primarily with open-ended questions which assisted in identifying their attitudes and preferences when using e-textbooks [26]. This method was chosen as it allows the interviewer to rephrase or clarify questions to enable a better understanding by the interviewee [27].

In order to prevent the introduction of bias, the interviewer asked the respondents to describe the daily tasks they perform within the e-reader application rather than validating predetermined assumptions on what they used the e-textbook application for. Due to the exploratory nature of this research, no predefined tasks were mentioned to the participants during the interviews. This is different from quantitative studies reported on in literature where statistical data was collected on a predefined set of tasks identified by the researchers in each case [13, 28, 29].

During the interviews, the researcher maintained a neutral stance to all responses provided by the interviewees. The script was followed as closely as possible but, in some cases, where the researcher felt more details could be provided the script was adapted real-time to explore certain topics more deeply. Interviewees were given sufficient time to provide responses, and when they misunderstood a question the researcher provided further explanations in a non-guiding way, in most cases avoiding the need to provide examples.

The data collected by the interviews appear to be of sufficient quality to draw conclusions from. Tests for construct validity [30] by comparing interview data to previous studies provided positive results. Tasks identified by interviewees matched those identified by previous research done on the subject [31-35]. The data saturation point can be described as the point in the interview process where no new themes, concepts or problems are identified in the data [36]. The number of interviews done proved sufficient as the saturation point appeared to be reached in the second last interview.

Kitchenham and Pfleeger [37] define the target population as individuals that are capable of answering the questions presented to them and individuals to whom the outcomes of the research are applicable. The target population for this research was South African secondary school learners, aged between 15 and 17 that have used the EduReader application in an educational environment for at least two school terms i.e. for more or less 6 months.

Due to the time and resources required to gather responses from the entire population, a sample that represents the population was determined. A small element of convenience sampling was also introduced as learners were only selected from schools in Gauteng, the researcher's geographic location. The geographic location should though not have a significant influence on the findings as all the learners who make use of the EduReader live in relatively similar socio-economic conditions in South Africa.

For ethical reasons the names of the schools where the learners were interviewed were also pseudonymized.

To match the population characteristics, learners were chosen from schools that match the following criteria:

- using the EduReader reader for at least six months
- in grade nine, ten or eleven (aged 15 – 17)
- use the EduReader in class

Three schools were identified and contacted regarding the research. For each of these, the principal agreed that the researcher could interview five learners, thus a sample size of 15 was determined.

4 Data Analysis

The interviews were recorded with the permission of both the interviewee and the interviewee's parents. The recorded data was transcribed in MS Word documents - a single interview per document. The documents were then coded to identify themes across all the documents. Coding is the process of assigning labels symbolising some meaning to parts of the text [36]. First cycle coding is the first method of discovery which the researcher uses to start assigning a deeper meaning to the data collected. Due to this discovery process, there was no pre-defined list of codes. As new themes had emerged from the data, new codes were added, and previous interviews were revisited and recoded using the new coding list.

Two coding processes were used as a form of hybrid coding. Process coding uses gerunds, or words ending in -ing as its labels, for example 'highlighting' or 'note taking'[38] and was used to identify all the actions in the interview data. These actions were the tasks which the learners performed on their e-book readers. The next coding process used was descriptive coding. Descriptive coding (also known as topic coding) labels sections of data as a short phrase or a single word [38]. The descriptive codes were assigned primarily to index the themes and the categories which arose from the data. All coding was done using the popular free application called QDA Miner lite.

5 Discussion

5.1 The Technology Characteristics of the EduReader E-book Reader Software

The functionalities available in the EduReader application will now be discussed. Unless specified, each function is available in both supported e-book formats (EPUB and PDF).

Annotations and Highlights

Users can create notes, sketches and highlights in the EduReader reader. Different e-book formats have different ways to create these annotations though. Due to the reflowable nature of an EPUB, annotations cannot be created on the page, and are rather added to the right-hand margin of the book, attaching itself to an element within the EPUB to keep its location. A note is created by long-tapping a piece of text in the e-book and selecting 'Add note' from the pop-up menu. The notes created can only contain plain text, with no formatting such as colors, font-size or font-styles available. Once the note is created, the user can access it by swiping from right to left or clicking on the menu icon in the top right corner. Highlights are created by selecting the highlighting tool from the toolbar on top of the book views. There are six predefined colour choices available for highlights as well as an eraser option to erase existing highlights. When making a highlight the user has the ability to undo the last couple of highlights.

The EduReader offers a drawing functionality to its users for both PDF and EPUB formats, albeit a difference between the two formats. For PDFs with static, non-reflowable content, users can draw directly on the PDF page. Due to the reflowable nature of the EPUB format, users are not able to draw directly on the e-book. The added sketch is saved in the right-hand margin and keeps its vertical position even after the page is resized. The user cannot see the sketch and the page content at the same time.

Additional Resources

Content such as videos, images, URLs and assessments can be delivered to the EduReader application by educators through a push service. The educator uses a separate application to add content to parts of the e-book, similar to the way a learner will add a note. This content is then delivered to all learners in that educator's class and is also shown in the right-hand margin, alongside the learner's own content and annotations.

Summaries

The EduReader combines all annotations and additional resources into a digital summary. The summary allows users to show or hide notes, headings, and highlights based on colour. This summary can then be downloaded as a PDF to print and use for studying.

Navigation

The EduReader application offers several methods of navigating an e-book. All e-books offer a table of contents which contains a collection of hyperlinks, linking to the start of a section or page [39]. The table of contents is accessible from anywhere in the book by opening the left-hand drawer. This is done by clicking on the menu icon in the top right corner or swiping right with your finger or pointing device. The EduReader offers a table of contents search, which hides all options in the table of contents that does not match the search term entered.

Users can also search for a term throughout the book. While reading the book, a search icon in the top toolbar opens a search box. Terms entered in this search box are matching with content throughout the e-book. A list of each occurrence of the search term, including some context text and the page number is returned and displayed to the user.

If a user prefers to navigate directly to a page instead of a chapter or piece of text, the application has a page number selector within the book view. Users can navigate page numbers by clicking on the next or previous buttons in the bottom toolbar or by clicking on the page number itself. When clicking on the page number, a toolbox opens which allows the user to enter a page number manually. Unfortunately, page numbers do not always match the printed book, especially in the EPUB format, where reflowable content makes traditional navigation difficult. PDFs generally use the same page numbers as the printed book.

5.2 The Task Characteristics of the E-book Reader Software in an Educational Environment

From the interviews it was apparent that learners use their devices for more than the e-book reader software and will tailor their usage to a unique style that fits them. The same goes for the way in which they use e-books [35]. Throughout the responses, there was no clear pattern in the daily tasks they performed with the EduReader, with some interviewees making highlights, others making notes and others not making any annotations.

As discussed earlier, the EduReader allows educators to add additional resources to the learners' e-books. This functionality enables an enhanced version of the e-book, where relevant content such as videos and other documents are readily available within the application. Interviewees mentioned that educators add homework assignments to their e-books in the same way, instead of printing or delivering it via some other application.

A number of interviewees expected the e-textbooks to behave like a normal textbook, with a specific reference to navigation. They also expect the e-textbook should also contain all the content that the printed textbook does.

The interviewees also expected the EduReader to be stable. Printed books do not "crash", "glitch" or "freeze" and respondents expected the same stability from e-textbooks.

Highlighting is the functionality that the interviewees mentioned most and appears to have the largest positive impact on learning performance. This can be attributed to the aid highlighting provides in comprehending text [40].

An unexpected theme that emerged from the highlighting question was the temporary state of highlights and annotations in e-books, where learners can erase highlights from e-books unlike from printed books where once the highlight it made, it is permanent. This was not a common discussion in the literature studied on the subject.

Navigation in e-books can consist of browsing (paging), looking at the table of contents, searching and using the index [39]. It is important that e-books offer a variety of different navigation methods as learners will have different preferences and navigation should never intervene with the e-book's primary goal of studying.

Traditionally, e-books, especially those in the EPUB format offered no page numbers and this raised serious issues in studies done on e-books in the American K-12 education system [40]. A possible explanation for this was the technical difficulties attaching page numbers to reflowable content [39] as found in the EPUB format. The EduReader features page numbers in all of its e-books, even when the publisher did not create the e-book with page numbers. This feature drew positive responses from the interviewees, even though the page numbers do not always match the printed textbook.

As all e-book content and resources are backed up throughout the day by the EduReader application, an account is easily recoverable when a learner loses his/her device. Interviewees mentioned that this accessibility offered by the e-reader presents an advantage over printed textbooks, where if it was lost or damaged, you would need to recreate all your annotations.

Digital summaries, where the e-reader takes the collection of annotations created by the learner and automatically summarizes it into a single view, saves the learners time when doing preparation for tests and exams. The annotations, resources and e-books are all shared across the learner's devices, which means that they can use a tablet or notebook at school to save space, and at home they can make use of a desktop PC with a larger screen and more ergonomic keyboard and mouse.

A number of e-textbook task characteristics were identified. These task characteristics were not listed in a single interview question and many of the characteristics came forward as part of discussions on other topics regarding the e-textbook reader. This is an advantage of having the task characteristics emerge from qualitative data, rather than quantitative data, where the number of tasks identified could have been limited.

The following task characteristics emerged from analyzing the interviews discussed above.

Making Annotations

Interviewees listed "looking over the notes" and making notes as some of the typical daily tasks they execute with the EduReader. The notes are then backed up and "allows you to keep your notes everywhere, so if your book is lost for whatever reason, you still have your notes". Interviewees expected the e-book reader software to "make it easier to make notes" and the functionality to be available at all times.

Creating Highlights

Interviewees mentioned highlighting as one of the major functionalities that e-books offer which improves their learning experience. One interviewee commented on the e-book highlighting functionality which allows for multiple colors that “I love having color in my books. It helps me learn”. Highlighting in e-books has its advantages over its printed counterparts, especially when a user “highlights something accidentally in the e-book”, as “you can erase it”.

Reading Aloud

The EduReader does not have any form of read-aloud support. One interviewee requested a read-aloud functionality as the feature she would want to be added to the EduReader as it would allow her to “make physical notes while listening to (my) textbooks”. The lack of interest in the read-aloud functionality may be related to the lack of exposure to this functionality due to the feature not being implemented in the EduReader, and it being the only e-reader used by the majority of interviewees. The interviewee who requesting this feature is one of only a few interviewees that has some experience with other e-readers, and in this case with the Amazon Kindle application which has the reading aloud functionality.

Additional Resources

Interviewees identified the purpose of additional resources and mentioned that “teachers are also able to send you things that you need that is not in the book”. The additional resources assisted in filling the gaps in the learner’s knowledge where educators “send us presentations and extra notes when we don’t understand it”.

The delivery of these additional resources can add strain to the institution’s network infrastructure where a sudden increase in traffic can cause sluggishness and slow delivery times. Interviewees found it problematic when an educator “send us our tasks, our newspaper or answers for an activity and you cannot receive it” and when the e-book reader software “doesn’t receive your resources the first time”. It was not possible to determine the exact cause of the resource delivery problems from the interviews as further investigation will require technical expertise. It is problematic, however, that functionality intended to ease a burden on learners is causing issues for the learners.

Navigation

Navigating an e-book can be cumbersome to a user if the e-book does not offer the ability to browse content [39]. To make up for this lack of functionality, e-book reader software offers the user additional functionality to aid in navigation. A well-structured table of contents with working hyperlinks to the correct section in the book “allows you to go through all of the things in the textbook” and enables the user to “just click on the option and it takes you directly to what you want to do”. An e-book usability study targeting medical academics in Australia stated that academics consider index and contents page browsing some of the most important functionalities of an e-book [41]. In-

interviewees did not mention any negative aspects towards the table of contents navigation of the EduReader and complimented “the chapters listed on the slide to the left of the tablet”.

Page numbers have traditionally been a problem in e-books, especially reflowable EPUB e-books [39]. As discussed earlier in this paper, the EduReader attempts to solve this by linking page numbers to anchors within the e-book content. The functionality included by the EduReader makes navigating through the e-book using page numbers easy and interviewees commended the ability to just “type a number of the page”. “You don't have to swipe through, or page through to find a page”.

Dictionary

The EduReader offers two types of dictionary integration within the e-books. Firstly, it provides learners with the native platform dictionary. This was perceived as favorable by the interviewees as “you can also directly click on a definition of the word. It gives you direct access and it's quick.”

Searching

At the time of the interviews, full-text search was a newly released feature of the EduReader, and only one interviewee had experience using it. The feature seemed to be well received with the interviewee stating that “there's a lovely little search function so if I'm looking for one specific thing in the book I don't have to flip through pages and pages looking for it”.

Assessments and Activities

In the printed textbook environment activities or assessments are normally completed in an additional workbook or notebook, as printed textbooks are owned by the school and given back at the end of the year. E-books offer students the ability to complete activities such as these in their books with no fear of damaging or losing the textbook. “Answering the questions using the textbook” was one of the common daily tasks mentioned by the interviewees.

Another advantage of e-books is the shorter feedback loop which reduces the time within which a learner gets feedback on his/her assessment. Except for essay type questions, most question types can be marked by the e-reader and feedback can be provided. Although the EduReader platform offers this functionality, interviewees still requested that if they could “do activities on the tablet and then it marks it for us, it would be very useful”.

Making Summaries

Creating electronic summaries from annotations in the e-book has not been discussed in previous literature. Generating summaries is a well-used studying tool exercised extensively while studying using both e-books and printed textbooks. While highlighting and note taking are tools offered by e-book reader software for educational use, these

features are just as commonly used for non-educational purposes such as highlighting an inspirational quote in a biography or making a to-do list in a self-help book.

The electronic summary functionality of the EduReader summarises these highlights and annotations for educational use. Although summaries are not a common feature in e-book reader software, interviewees saw the value of it with one interviewee commenting that “the way that you can sum up all your work on one small thing... that makes everything easier.” It was not clear from the responses whether the interviewees would prefer to rather use another application such as a word processor to create the summaries, but being able to copy large parts of the textbook may have certain legal implications with one interviewee realizing “we are not allowed to because it's got copyright”.

Referencing

Internal referencing has not been given much attention by the EduReader application, with simple functionality such as bookmarks not present. This functionality is an important factor for the academic use of e-books [41], but the functionality was only mentioned by one or two interviewees, indicating that it might not be such an important feature for the school level use of e-books. One interviewee mentioned that the e-book “has a glossary so if I don't know a word, I can quickly go to the glossary and figure out stuff”.

External referencing was widely used by the interviewees and learners would “sometimes use the Internet because my e-book reader software would not have the complete information that I'm looking for. So, I'd usually just go onto the Internet and when I get the relevant information, I'd go back to my e-book to access the questions”. The clear advantage e-books hold over printed textbooks is the time it takes to do external referencing. Google was the only service specifically mentioned by interviewees for referencing use and interviewees indicated that they frequently swapped between the e-book reader software and Google while working in their e-book.

Recording Voice Notes

To make up for the inability of electronic textbooks to be laid out across a table and seen as a big picture, interviewees use other features of the devices. Voice recordings offer learners an additional layer of note taking which can be played back while studying or revising for a test. “I memorize it and repeat what I learn. I record it, so when I'm at school, I listen to it on my earphones and then it just goes through my head”. Recording the notes, a learner repeats to herself is much quicker than typing the notes using a tablet and is not limiting in terms of physical space as another interviewee mentioned that “you can make voice notes and you can listen to them anywhere”.

5.3 Guidelines for E-textbook Reader Designers/Developers

On matching the EduReader's functionalities with the task characteristics required by the EduReader users, it is possible to provide a set of guidelines for e-book reader software developers to ensure the app they are developing delivers a good fit to the task

requirements of users. Table 1 presents a set of e-book reader software developers' guidelines. The guidelines are formulated as a set of statements representing the characteristics of the educational tasks which need to be supported by the technology (the e-book reader software/application) to achieve a good fit between the tasks and the technology. The task category describes the type of task as discussed in section 2.4 of this paper.

Table 1. – A set of development guidelines for e-book reader software developers/designers.

E-Book Reader Software Tasks	Task Category	True	False
Making Annotations			
1. Users can make textual annotations in their e-books.	Metacognitive		
2. Users can make freehand (drawing) annotations in their e-books.	Metacognitive		
3. Annotations are synced across all devices the user is signed in to.	Metacognitive		
4. User annotations are visible while browsing the e-book.	Metacognitive		
Creating Highlights			
5. Users can create highlights in their e-books.	Metacognitive		
6. Users can create highlights in multiple colours in their e-books.	Metacognitive		
7. Users can erase highlights made in their e-books.	Metacognitive		
Reading Aloud			
8. The e-reader can read sections of the book aloud.	Metacognitive		
Additional Resources			
9. Educators can share additional content with users in a specific location of the e-book.	Metacognitive		
10. Users are notified when new content has been shared with them by the educator.	Metacognitive		
11. Users can copy text and images from the textbook to use in other applications such as word processors.	Metacognitive		
Navigation			
12. The e-reader offers TOC navigation.	Metacognitive		
13. The e-reader supports page numbers and users can navigate using page numbers.	Metacognitive		
Dictionary			
14. Users can look up the definition of a word without the need to use another application.	Metacognitive		
15. Users can define a word quickly by selecting the word in text and tapping define.	Metacognitive		
16. Definitions provided by the dictionary are context and region dependent.	Metacognitive		
Searching			
17. The e-reader has an in-book search functionality that performs a full text search across all the pages of the book.	Metacognitive		
18. Users can search within the TOC to filter sections within the e-book that does not match the search phrase.	Metacognitive		
19. Users can search application wide within the e-reader to find books and content that matches the search phrase.	Metacognitive		
Assessments and Activities			

20. The e-reader offers the ability for users to complete assessments within the application.	Cognitive		
21. The assessments in the e-book have a self-marking functionality to provide real-time feedback on student answers.	Cognitive		
22. The e-reader supports common learning object formats which allow e-book publishers to add their own in-line assessments to e-books.	Cognitive		
23. Educators can provide assessment feedback to users and the feedback is delivered by the e-reader.	Cognitive		
Making Summaries			
24. The e-book reader software can create summaries based on the user's annotations and highlights.	Cognitive		
25. Users can edit these summaries after summary generation to add additional notes and content.	Cognitive		
26. The summaries are correctly formatted and readable within the e-reader.	Cognitive		
27. The summaries are printable by the user.	Cognitive		
Referencing			
28. Users can use external search tools such as Google Scholar within the e-book reader software.	Metacognitive		
29. Users can generate references from the e-book they are working with to use in assignments.	Metacognitive		
Recording Voice Notes			
30. Voice notes can be created by the user and added to sections of the e-book.	Cognitive		

6 Conclusion

The purpose of this paper was to identify the task requirements of e-book reader software in the South African secondary education environment. For fit to be determined between a technology such as an e-book reader and the actions users want to perform with it, an accurate representation of these actions, namely the task requirements, should exist. The TTF theory was used as a methodological framework to provide a model that can be used to explain the utilization of a given computer system.

As the TTF model can be employed to explain utilization, the use of these task requirements as a component of the task-technology fit model can help researchers and developers determine the fit of the e-book reader software to the task requirements.

The task requirements presented in this paper can be reused by researchers to determine the task-technology fit of other e-book reader software in South African secondary schools. These requirements can also be validated in other countries by determining the task requirements for those schools and comparing it to this set. Opportunities for research exist in determining the evolution of task requirements for learners throughout their educational career by comparing primary school learners to secondary and tertiary learners.

As a practical contribution, this paper presents a set of task-technology fit task requirements that e-book developers/designers can consider when developing e-book reader software for the South African secondary school market sector.

In conclusion, for e-book reader software to be utilized in South African secondary schools, it needs to fit the task requirements of the learners. This paper identified those task requirements and presented them here. E-book reader software developers/designers who wish to achieve high levels of utilization should keep these task requirements in mind when developing an e-book reader application. Future research could contribute to the confirmation and or enhancement of these guidelines and could be done exploring a different e-book reader application used for educational purposes.

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