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E-reading strategy model to read E-school book in Libya

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Abstract:- defining the stages for the reader to follow when reading e-resources is only one of several factors which can provide a significant understanding of the actual reading behaviour and cognitive process of reading. This article aims to compare reading processes that students follow when reading school books in two different media (paper and electronic). A sample of 80 students, studying in Libyan primary schools, and aged 9 to 12, were selected to investigate how students use and interact with both print and digital school–books, how they identify the e-reading process, and to define what students like and dislike in both versions. The results showed differences in the reading process between paper and electronic books read.

Keywords- reading process, reading online, school book.

I. INTRODUCTION

Reading e-texts brings several challenges to readers, such as the difficulty of reading on the screen in the case of long lines, difficulty of browsing and moving from page to page, and inability of the search tools to satisfy the needs and requirements of the reader. These aspects draw attention from many research areas, such as information science, computing science and human science. There are three categories to digital reading research:

I. Research has focused on the usability of e-text, e.g. comparing reading on-screen to paper reading [1, 2]; measuring the legibility and comprehension of text, and examining user behaviours in digital environments.

II. Research presents the 'new approach of technologies-supported reading on screen' which concentrates on new software and hardware, hypertext, and interface design[3-5] [4].

III. Finally, research focused on the phenomenology of reading, like studying human interaction with e-resources and reading process in both linear text and hypertext[6, 7].

Generally, reading is a complex activity. It requires different skills according to the purpose of reading. Furthermore, the reading scenario changes on the basis of the type of e-materials, starting from short text reading (i.e. e-mail) to long text reading (i.e. e-books). For instance, scholarly articles are not similar to books. In the first case, readers usually skip the abstract of an article, skim the introduction, read the research problem, and subsequently read various paragraphs on the theoretical perspective.

Notably, using hypertext raises several issues relating to their impacts and ability to improve the accessibility to information on e-environments and reading processes. Moreover, the impact of hypertext on academic reading remains unclear, although, there are several researchers who argue that reading in an e-environment becomes more of an interactive process [8], which can engage a reader in having a further authorial role and ultimately induces decision-making processes [9]. However, the design of hypertext in e-learning materials requires a good understanding of human cognition features, such as previous knowledge, memory structure, and the ability to impress in terms of the organisation of information.

The aim of this study is to observe how students read school books in e-format, to accordingly investigate reading behaviours adopted by students, and to examine how students' reading behaviours are changing in both versions. However, understanding these changes in the reading process would support us in designing an effective computer-based learning environment.

In this work, we will attempt to build an e-reading strategy based on users' cognitive and behavioural processes. The remainder of this paper is organised as follows. First, we illustrate related works in reading e-resources behaviours. Second, we define the methodology of research and dataset for analysis. Third, we provide two reading strategy models. Finally, we summarise findings and set forth our generalisations and recommendations for the reading process.

II. RELATED WORK

With the increase in the number of students who read e-text for pleasure or learning, there are still deficiencies in studies that seek to understand how the digital text is read as previous studies have shown, i.e. most research on e-reading have just focused on comparing issues without having a clear idea of

how readers deal with the e-text, or, whether this technology has affected the way that the reader reads the e-text.

Thus, research in the field of usability are concentrated on addressing questions such as why, what and how do people read a document to use it with any research interest in reading generally and e-reading specifically. Also, research is focusing on cognitive and behavioural aspects of the reader by asking these questions and bringing up issues related to context which appears in certain factors that affect the presentation of the medium.

For instance, Dillon [1] built two models of reading process, one for reading academic journal and the other for manual as be seen in *Fig. 1* and 2. This researcher noted that there is a distinction between text types in the characterization of usage they suggest.
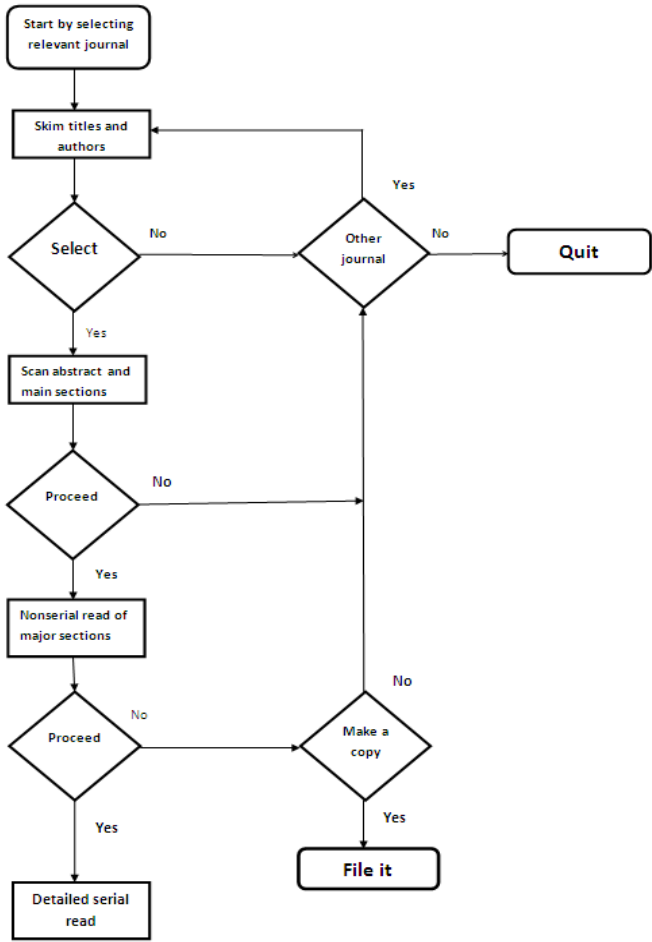

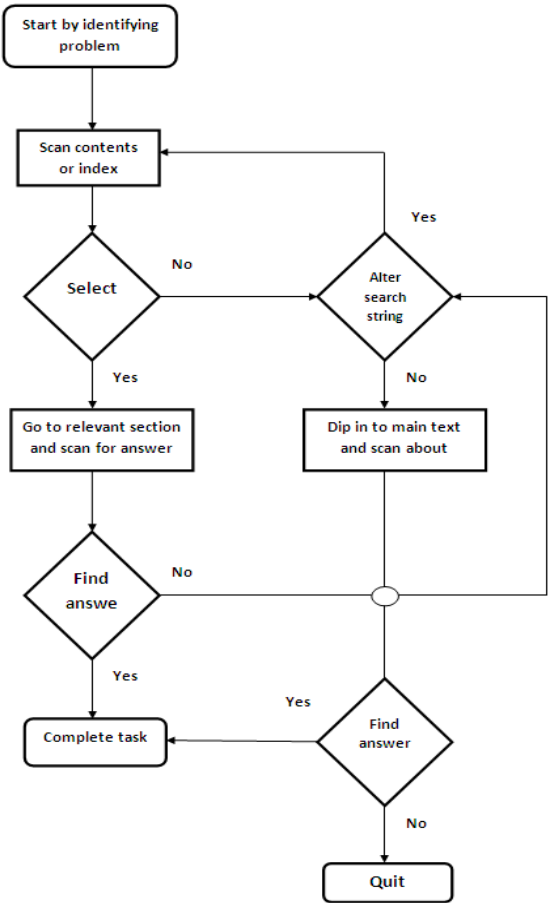Figure 1. Generic model of journal usage[1].

Figure 2. Generic model of manual usage[1].

Moreover, Terras [2] has suggested a model in terms of how experts read an ancient text by understanding a complex process in the humanities. Based on content analysis, focused interviews and thinking aloud protocols, the model was built. In addition, the study reported that the three experts used different methods to examine the document. They also spent a long time checking the text and the words in different orders.

In addition, they dealt with visual features before building up knowledge about the document. Moreover, the reading process is un-liner and is based on the interaction of different facets of expert knowledge as can be seen in Figure (3). These findings help to implement a computer system that can work in several approaches
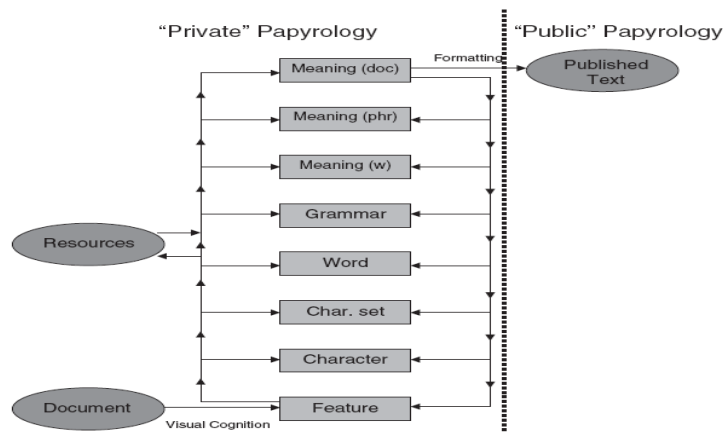
Figure 3: Model explains how experts read ancient text[2].

Alternatively, the reading process differs according to the purpose of reading and the type of material. For instance, Kol and Schcolink [10] argued that understanding reading strategy and teaching students how to deal with e-text could help students to read effectively from screen.

At the early stage, the reader tends to read documents from beginning to end. But with the growing in the amount of information acquired, the reader tends to skim, scan, and browse the document to search for relevant information. In the same perspective, Harrison [11] defined several reading behaviours, which can be classified into two types: comprehensive reading such as reading to learn, critique or edit; the other is skim reading such as reading to support listing, cross-reference or to answer questions.

III. METHODOLOGY

In order to follow-up and investigate in-depth users' cognitive behaviours with e-books, a sample of 80 participants—all of whom considered themselves confident with e-books—were selected. A follow-up method was selected to collect data in order to:

➢ Investigate how students use and interact with both print and digital school–books;

➢ Measure participants' achievements in both versions;

➢ Identify the e-reading process; and

➢ Define what students like and dislike in both versions.

The target population comprised students aged between 9 and 13 who were attending Libyan public primary schools. The total sample comprised 80 respondents, distributed as follows: 20 participants from Level 4; 30 participates from Level 5; and 30 participants from Level 6. Participants carried out three different observations, which required dividing the participants into eight groups, each of which had 10 participants. Four groups used e-books (available at: http://skooollibya.com/), whilst the other four groups used paper versions. During the first observation, participants were asked to prepare a lesson for discussion in class. They were given an open time to complete the task. The next day, teachers discussed the lesson with students and provided explanations, which took 45 minutes. Finally, the students were asked to search the text, answer the questions, and take a small quiz. Figure (4) shows the steps comprising the follow-up study.
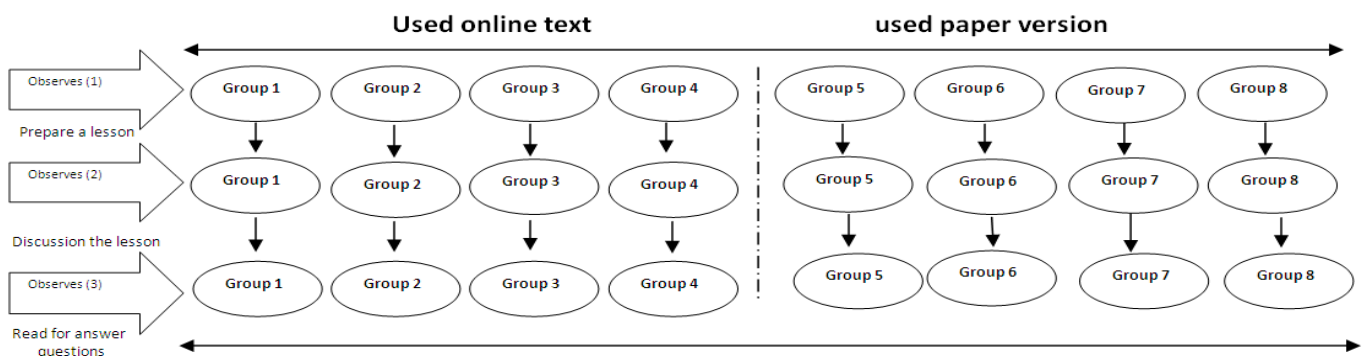

Figure 4. The follow-up survey stages.

The talk-aloud technique was used in order to identify users' cognitive and behavioural processes, and to collect quantitative data, which could not be obtained via any other method. It was also used to obtain more in-depth details from participants, such as describing their actions and reactions with the book interface.

A. Participants' Selection

The target population comprised students aged between 9 and 13, attending Libyan public primary schools. The total size of the participant sample was 80, distributed as follows:

- 36 males, thereby representing 45%; and 44 females, thereby representing 55%;
- The age of the participants was between 9 and 13;
- The sample was distributed across three studying stages: level 4 comprised 16 students; level 5 comprised 19 students; and level 6 comprised 35 students. These distributions are shown in Table 1.

Table 1.The sample by gender and education levels.

Education levels	Male	Female	Total
Level 4	13	7	20
Level 5	15	10	25
Level 6	15	17	35

B. Material Selection

The survey focused on primary school books within Libya, examined in order to recognize the main characteristics of such books and the overall structure of the text. This was done in order to obtain a clear picture from the analysis of the content of the books and to accordingly highlight the aim of the education system. Table 2 shows the distribution of school books at each level.

Table 2. Distribution of subjects studied at each level.

School levels	math	Science	reading	grammar	History	English	Geographic	Religion	Computer	Models
Level 1	/	/	/					/		4
Level 2	/	/	/					/		4
Level 3	/	/	/					/		4
Level 4	/	/	/	/	/	/	/	/	/	10
Level 5	/	/	/	/	/	/	/	/	/	10
Level 6	/	/	/	/	/	/	/	/	/	10
Total										42

School books differ from other types of resources in the way of presentation of information, the amount of information, and the structure of the content.

The author has examined a random sample from books in order to identify the main combination of school books, from which a document model is provided, as shown in Figure 5, which illustrates the document in a top-down method, complete with independent descriptions for the document elements. The document content is expressed as a set of parts. The document's contents are divided into many parts such as the text part, which is divided into many regions, such as the Table of Contents and Lessons. Each lesson component is made up of several sections, and each section breaks down into paragraphs, with each paragraph combining sentences, which are further broken down into words. In addition, each document then comprises a hierarchical structure of abstraction levels, with each level representing elements in the document. However, the analysis of the school books shows the following:

➢ The majority of the contents of books at the three first levels comprise images and limited exercises, which means we need to focus on colour dynamics and flexibility.

➢ The books of levels 4, 5 and 6 are completely different to those of other levels in many respects, such as the technique in which information is offered and organised, the structure, and the amount and type of information—all of which require the use of different formats, such as HTML and PDF
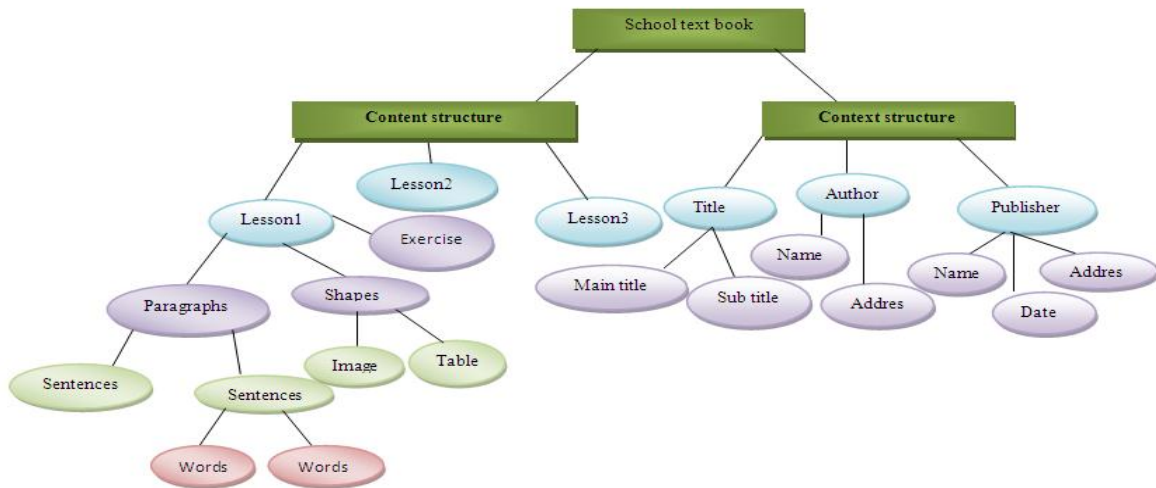
Figure 5.Structure of school text book.

IV. DATASET ANALYSIS

A. Using E-book and Paper Books in Primary Education

The use of paper version of books is still the first option to most readers. For instance, Perry reports that 84% of participants preferred using a paper version. Alternatively, students in primary schools in Libya are also more confident when using paper school books, as can be seen in Table (3). Furthermore, 75% of participants have found using the e-version to be very difficult, whilst 88% of participants could not deal with the paper version easily. Navigation is another challenge which participants face in e-versions. In addition, 91% of respondents found that transition from one page to another is difficult, which in turn influences the communication between students and teachers. On the other hand, 67% of participants found browsing the lessons easier in the paper version. Moreover, identifying the location of information in both versions was not easy, but was more difficult in the case of the e-book (74%) compared to the paper book (45%).

Table 3. Participants' opinions about e-version of school book compared to paper version.

	e- version		Paper version	
	yes	No	yes	no
➢ Easy to used.	25%	75%	88%	12%
➢ Can use without any help.	44%	66%	93%	7%
➢ Easy to search.	9%	91%	67%	43%
➢ Easy to find answer.	12%	88%	67%	33%
➢ Sound help to learn	19%	81%	-	-
➢ Easy to identify the location of information.	26%	74%	55%	45%

Moreover, there are several factors contributing to students' performance when reading electronic versions of school books, some of which relate to technical aspects, such as cohesion of content, linking, navigation, screen layout, segmentation of data, interface design and location of data. On the other hand, there are personal or human aspects which affect reading on-screen, such as previous knowledge on the topic, age, and memory structure and stages.

However, paper books usually have a good structure and the same structure is used to design e-materials, which are not the most suitable method for several reasons. The printed method has a long history, and has improved over time to become more efficient for readers by ensuring understanding of many different aspects, such as reader behaviour, reading process, and types of reading.

In order to improve reading on-screen, student behaviours need to be studied at first in order to define the reading process. This requires clarification of the reading stages which students follow, and accordingly defining the reading strategy to be used.

In order to investigate the reading strategies used by students, two questions were asked: 'Do you read the lesson first, or, do you read the question first?' As seen in Table 4

which presents the reading strategy used by students, 65.8% of participants always read the lesson first and then answer the question, whereas 34.1% read the question first. Consequently, both strategies are used by students based on the purpose of reading. For instance, if the student is reading for an exam, s/he will read just the questions, whereas if reading for understanding, s/he would then read the lesson first. This confirms the correlation between the purpose of reading and the strategy that the reader will use to achieve his/her goal

Table 4. Strategy of reading used by students when reading school book.

Strategies	Read the lesson first						Read the question first					
levels	Always		usually		Sometime		Always		usually		Sometime	
	N	P	N	P	N	P	N	P	N	P	N	P
Level 4	92	18.2	22	4.3	20	3.9	16	3.1	32	6.3	44	8.7
Level 5	104	20.6	50	9.9	26	5.1	88	17.4	60	11.9	32	6.3
Level 6	136	26.9	36	7.1	18	3.5	68	13.4	48	9.5	64	12.6
total	332	65.8	108	21.4	64	12.6	172	34.1	140	27.7	140	27.7

B. Models of Reading Strategies

The survey reports that there are several possible scenarios when using a school book. These scenarios are built based upon the purpose of using the school book which is always used either at school or home. In each case, the purpose of use is different.

- **Use at school:** at school, the teacher directs students by telling them the number of the page, the lesson title, the number of questions, and so forth. Thus, all the stages in this case are controlled by the teacher.
- **Use at home:** at home, some students get support from their parents, while others do not. In both cases, students use the school book for two purposes: firstly, to memorise the lessons taught at school; or preparing for the next lesson. In the case of the latter, the teacher prefers comprehensive reading.

Notably, there are differences in the steps followed by readers when reading an e-text. Such differences are highlighted in Figure 6 which summarizes the school book reading stages used by students. Firstly, students start by opening the book and skimming the Table of Contents (TOC). Worthy of note is the fact that 54.7% of participants always use the TOC to access the lesson, whereas 11% access the lesson using the page numbering. Accordingly, students usually check the lessons by identifying the subtitle, how long it is, and the number of questions before starting to read. This technique is also used when students read the lesson for the first time. In addition, when students decide to read the lesson, there are two ways to view the text, as the survey reports: either by viewing the text or viewing the questions. In each case, students use different reading methods. Finally, during the reading, students always take notes and save it for later use.
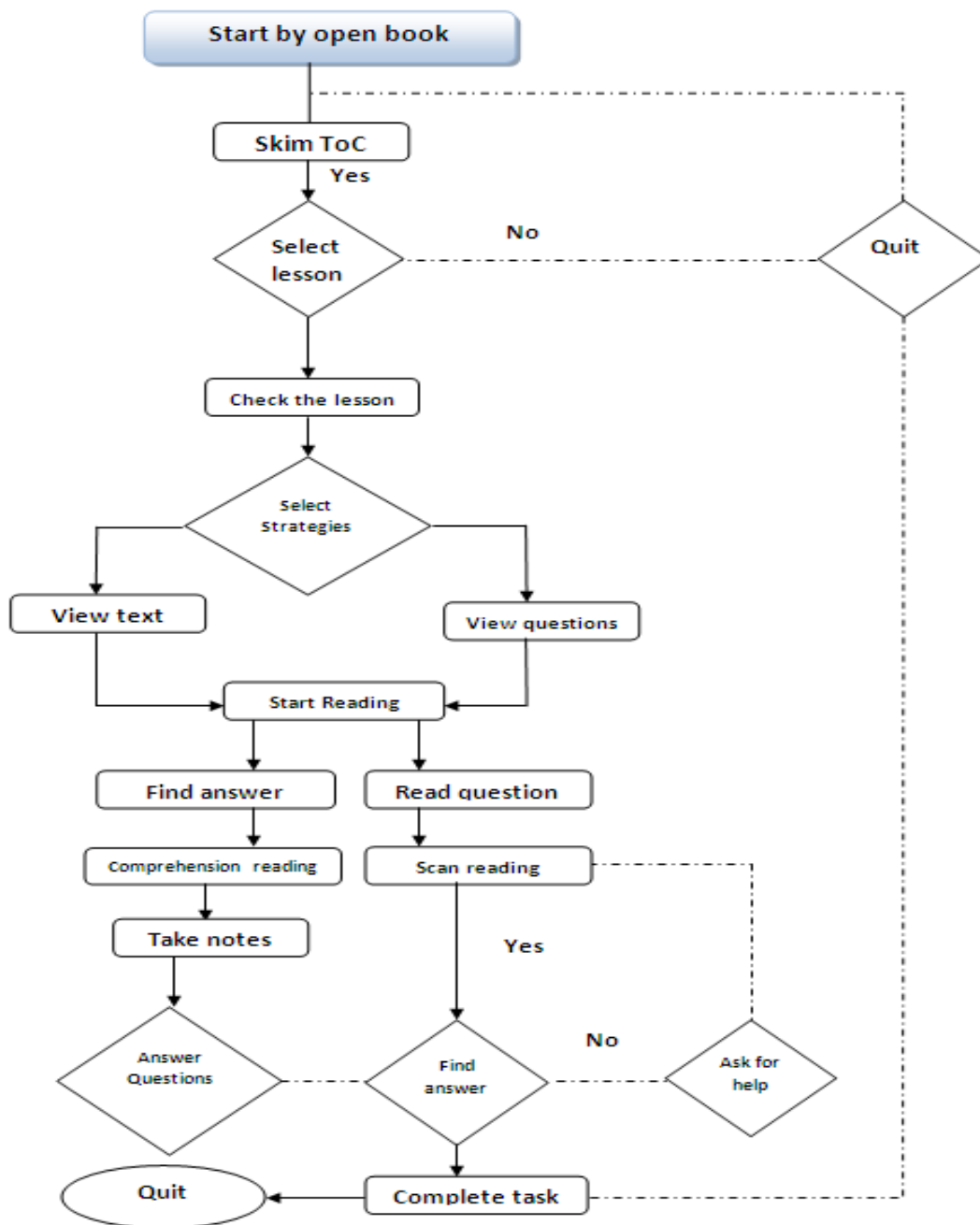
Figure 6. Reading strategies with paper school book.

On the other hand, based on qualitative feedback, the e-reading strategy for school books was built. Figure 7 shows a generic description of the e-school book reading strategy, which starts by viewing the home page of the system. Subsequently, the student can access the book by viewing the models and then selecting the level, or otherwise, by viewing the education levels and then selecting the model. The first action will be the opening of the book. At this point, the student has two options: to view the text or to view the questions. In the case of selecting the questions, the student will access the questions which link to the parts that include the answer rather than answering the questions, simply because the aim is to encourage students to read. Notably, if students select and view the text, s/he will then start with the introduction to the lesson before going through the lesson and learning the main bulk. Students can take notes and save them for later use.
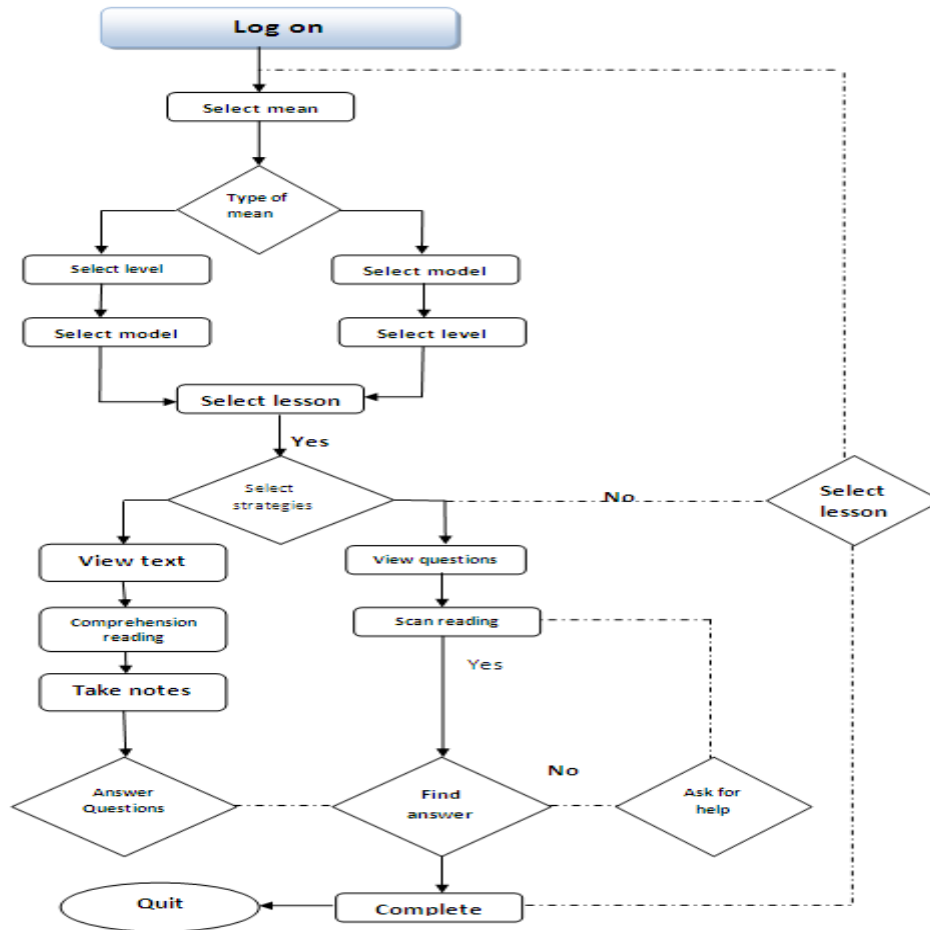
Figure 7. Reading strategy model of e-school book.

Finally, there are no changes required for user needs when students read the paper version or e-version of school books. However, the student's reading action changes in each version which makes a difference in the overall reading process. For example, the page number is the main tool used by students to access the book content in the paper version, while just 54% of participants use TOC. On the other hand, in the case of the e-version, students access the lesson by means of the lessons. Thus, defining the reading process can help define searching and reading stages. In the searching stage, students frequently search for a title or subtitle, or question and answer; this requires searching the content for concepts and titles. In the reading stage, students exploit two reading strategies: scanning and comprehension.

V. CONCLUSION

The general conclusion is that students preferred reading the paper version of the school book. This is due to a number of reasons. For example, dividing the text into a set of parts according to the paragraph for display on screen has led to a range of difficulties in browsing the text, making it difficult for the student to link and move between these parts. Moreover, the reading process changes according to the reading purpose. For instance, students usually use two strategies when reading school book: scanning and comprehension reading strategies. Each strategy requires specific tools and techniques, such as highlighting the sentence, taking notes, or using a finger when reading the text. In addition, the reading strategy is selected according to the aim of the reading. Therefore, determining the purpose of reading is necessary for designing readable e-learning material. However, these models will not only help define the interaction between users and e-books, but will also help designers understand user behaviour regarding e-books to establish the most appropriate functions when building the e-book interface.

VI. FURTHER WORK

In the next stage of the research, the following questions will be asked:

1. What are the most significant elements to consider when designing e-school books interface?
2. How should e-school books be designed to improve satisfaction, information recall, levels of confusion, and mental overload?
3. Measuring the factors that affect reading e- text such as font size, line length and color.

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