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Reading strategy and the need of e-book features

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Abstract

Purpose – The purpose of this paper is to explore college students' use of electronic reading strategies in reading e-books and the features provided by e-book systems. Both academic reading and leisure reading are evaluated from students' responses.

Design/methodology/approach – Both qualitative and quantitative data are collected. In total, eight college students volunteered for in-depth interview to express their strategy in reading e-books. Reading strategies employed by college students are summarized. A set of questionnaire items to assess electronic reading strategies and e-book features for both academic and leisure reading is used for collecting quantitative data. To determine differences between academic reading and leisure reading, pair-t is used among 201 respondents.

Findings – Interview data reveal that students use various strategies in reading e-books. These reading strategies are categorized into "Use of prior experiences", "Comprehension and decision making", and "Self-regulation and self-monitoring". From 26 questionnaire items for assessing students' need of reading strategies, 16 are found significantly different between academic reading and leisure reading ($p < 0.05$). The necessity level of many e-book features is significantly higher for academic reading than for leisure reading ($p < 0.05$).

Research limitations/implications – Research on students' use of strategies in electronic reading is needed in the rich information world. In this study, the assessment of necessity level of using various electronic reading strategies and features provided by e-book systems assessed from students' responses might be helpful for design of e-book systems. However, further research on different reading audiences and specific domains may shed light on more guidelines for implementation and application.

Originality/value – It is hoped that the findings of this study will provide suggestions for the innovation of reading supports embedded in e-book systems.

Keywords E-books, Students, Universities, Reading, Taiwan, Reading strategy, Electronic reading, E-book system, Reading behaviour

Paper type Research paper

Introduction

Here we discuss the definition and purposes of reading. Reading in the twenty-first century is moving toward electronic format, which will become more prevalent in the near future (Hurlbert, 2010). Foertsch (1998) defines reading as a process of bringing meaning to a written text. The process involves intellectual and complex tasks that may encompass the use of several cognitive strategies for achieving specific objectives. With the advancement of technology, readers are exposed to various electronic reading resources through the interface provided by e-book systems. Compared to print texts, e-books have provided potential interactive features and are widely accepted by many disciplines of the higher education community, and are now an integral part of

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academic library collections. Related research has observed college students' use of strategies in e-books and printed books. It was implied that the usability of e-book interface and the features of e-book systems might impact on readers' interaction with reading content (Berg *et al.*, 2010).

Used for achieving academic goals, strategic planning of reading activities promotes students' active learning through reading, writing, discussing and/or problem-solving in both print-based and electronic reading. Griffin *et al.* (2009) suggests that reading allows students to employ appropriate strategies to evaluate what they know and learn in specific domain knowledge. In higher education and professional training, reading literacy is extended to discipline-based comprehending. To achieve their academic goals, college students need to be provided with guided support for learning advanced reading skills in career development. Students need to be trained to become active, strategic, and reflective readers to support personal growth, social communications, cognitive development, and knowledge building (Lesmeister, 2010). A great deal of formal instruction occurs via reading, and the ability to accurately judge one's level of comprehension from reading has important consequences for learning from text (Griffin *et al.*, 2009).

In contrast to academic reading, leisure reading is self-interest orientation. Interest in reading is an important facilitator in deep interaction with the content (Mikk and Kukemelk, 2010). Personal interest toward specific reading content evokes readers' navigation and reactions from the reading materials. From self-interest reading activities, appropriate strategies are used to build connections from reading content in a more dynamic way (Larson, 2010). Furthermore, responsiveness and commentaries from readers also help building literacy practices from the engagement of reading (Larson, 2009).

White *et al.* (2010) suggest that task differences in reading might influence the use of cognitive skills among adult readers. To meet specific task requirements, students use appropriate strategies to engage in higher-order thinking such as analysis, synthesis and evaluation (Hock and Mellard, 2011). Among various reading activities in students' daily life, two major purposes are identified: academic reading (to fulfill course requirement) and leisure reading (to fulfill personal interest). The engagement of internal activities and cognitive processes and support in print-based and electronic reading are summarized in Table I.

Comparison	Academic reading	Leisure reading
Nature of reading	Task-oriented; related to course requirement	Interest-oriented; not related to course requirement
Activity	Strategic planning of reading activities	Dynamic connections of thinking and ideas
Cognitive processing	More inferential reasoning and self-regulated reading process for inquiring knowledge	More active, personal reflective thinking in exploring content of interest
Paper-based reading	Linear approach, highlight, use of table of content, bookmark to search and track	
Electronic reading	Non- linear approach; easy to access and search; features of highlight, bookmark and tracking embedded in e-book systems	

Table I.
Engagement for different reading purposes and use of different formats

Electronic reading literacy

Modern technological innovation has led to profound changes in reading literacy. Over the past decades, the rapid infiltration of technology has significantly affected education of all levels. In addition to traditional reading literacies, today's students encounter and interact with new literacies, including electronic books, Internet-based reading and writing, and online communication experiences (Larson, 2009). Integrating information and communication technologies into existing reading literacy as well as including electronic books as reading resources is emphasized (International Reading Association, 2009). To read effectively, readers must be engaged in strategic processes of intentional thinking and thoughtful interaction during reading (Hock and Mellard, 2011). Contemporary advancement in digital technologies has prompted a reassessment of what literacy means; hence, the definition of reading constitutes literacies in use of new media for accessing various modes of reading content (Kress, 2003).

With the use of web technologies, interactive features are provided by e-book platforms, such as editing tools, hyperlinks, and search capabilities. These interactive features are an advantage that e-books have over print books. However, precautions should be taken in design of these interactive features. Since users are so familiar with ubiquitous online tools, such as the Google search function, they might become frustrated and confused when e-books do not function similarly. Wilson *et al.* (2003) find users exhibited definite preconceived expectations, formed on the basis of their online experiences, regarding how e-book tools should operate.

Coiro and Dobler (2007) suggest that successful electronic reading experiences appeared to simultaneously require both similar and more complex applications of prior knowledge sources, inferential reasoning strategies, and self-regulated reading processes. Students read actively by engaging previous knowledge, self-inquiring, and recalling important information in text (Fritz, 2002). College students, with numerous reading requirements and great reading load from courses taken, have been found to use multiple reading strategies such as setting goals, rereading the unfamiliar parts of the text, and using studying techniques such as note-taking, underlining, writing in the margins, and highlighting the relevant parts of the text to enhance their reading efficacy (Viki Gier *et al.*, 2011).

Frameworks for exploring electronic reading strategies

Research exploring strategies related to reading has contributed to considerable advances in the understanding of student literacy. Much of the work on the use of reading strategies has been reported from various aspects, including motivational factors, individual differences, lexical processing, prior knowledge, and areas of interests (Coiro and Dobler, 2007; Lesmeister, 2010; Mikk and Kukemelk, 2010; Tremblay *et al.*, 2011; Was, 2010). In electronic learning environment, reading has gone beyond comprehending or text processing, and is regarded as intricate and complex. Students are involved in the use of different modalities and representations in processing reading content cognitively. Effective use of reading strategies is essential to monitor and control one's own reading task (Azevedo, 2005).

Applied for support electronic reading, the availability of reading devices, e-book publishers, and various e-book databases has made e-book services more diversified. Bennett and Landoni (2005) suggest four-dimensional vectors for adopting a

user-centered approach to support electronic reading. These vectors include: content, format, purpose, and use. These vectors suggest important aspects of e-book services in compiling, recording, organizing and conveying the produced reading resources in order to meet to the needs of the reading society. With the notion of user-centered approach, abilities, habits, needs and the expectations of the user are important considerations for determining the operation of the service systems (Banou *et al.*, 2008; Cope and Phillips, 2006). For example, elaboration prompts or interactive tools for schema induction are designed to satisfy traditional linear comprehension as well as non-linear processing in electronic reading space (Gerjets *et al.*, 2008).

Dillon (1994) has suggested a framework for describing electronic reading. This framework contains various issues:

- TM (Task Model) deals with reader's needs and uses for the reading content.
- IM (Information Model) provides mental model for the reading context.
- MSF (a set of manipulation skills and facilities that support physical use of the reading materials).
- SRP (a serial reading processor) represents the cognitive and perceptual processing involves in reading words and sentences.

The framework raises essential parts of reading process important for design and development of electronic text and e-book systems.

Electronic reading involves readers with great cognitive effort in processing electronic textual information. The capability of an individual's attention span, working memory, and long-term memory should be taken into account (Was, 2010). Recent e-book technology has devoted great development effort to creating a user-friendly electronic reading environment for the reading society. To support user's use of cognitive strategies, various support features are provided in e-book systems, such as electronic highlighter, bookmark, record of reading history, and electronic notations.

Purpose of research

Reading in various knowledge domains intends to prepare students for a workplace where information is increasing exponentially, where technology is rapidly changing, and where students must compete on a global level (Taraban, 2011). With the increasing popularity of e-books and e-reading, research that explores the strategies and reading behaviors within electronic reading environment becomes essential. In the world of knowledge communication, the co-existence of paper-based and electronic reading becomes daily-life experience (White *et al.*, 2010). Research on students' use of strategies for fulfilling both academic and leisure reading purpose is important for providing guidelines in the design and development of e-book services and systems. Students' reactions toward various features provided by e-book systems and how these reactions differ in academic and leisure reading purposes are also needed to offer criteria for future implementation of various reading supports.

Several research questions are listed as follows:

- What are the strategies used by students in reading e-books?
- How do students react to the need of using various electronic reading strategies?

- How do students react to the need of various features provided by e-book systems?
- How do students' responses differ in the need of electronic reading strategies and e-book reading supports between academic reading and leisure reading?

Methodology

The present study explored college students' use of electronic reading strategies. Both qualitative and quantitative approaches were employed to collect research data. Subjects of this study were students at Fu-Jen Catholic University in Taiwan. Students with experiences in using e-book systems from university library were invited to participate in the questionnaire survey. For providing an interactive reading situation convenient for data collection, several e-book collections and interface systems were used. These systems included AiritiBooks (Chinese e-book systems), Apabi (Chinese e-book system), MyiLibrary (King Arthur), UDN, Books@Ovid (Ovid SP), Cambridge Books Online, Ebrary, Netlibrary, Oxford Scholarship Online, SpringerLink Books. Features provided in these systems are summarized in Table II.

Prior to the questionnaire survey, students' use of the reading content and context within the e-reading environment was explored from an interview. Various questions were asked in the interview guide to reflect the internal use of strategies in electronic reading (Table III). Eight students volunteered for in-depth interviews with each interview lasting 1-1.5 hours. A "Think aloud" process was employed to encourage students' experiences while using e-book systems. Students were requested to use one or two e-book systems and reacted verbally to express their actions and feelings toward the systems. The interview guide for collecting qualitative data is provided in Table III. However, specific questions were asked along the process of actual use of e-book collections. To facilitate students in reacting explicitly, the research assistant reminded students to verbalize their reactions during the use of e-book systems. For example, questions including "How did you get here?" "Why did you click …?" and "What confused you?" were posed. All responses were transcribed and coded as "X: line number". For example, "C: 23-24" denotes the verbatim data of Student C from line 23 to line 24.

From a quantitative assessment, a set of questionnaire items for evaluating the necessity of strategy use and features supported by e-book systems corresponding to the use of reading strategies was developed. The questionnaire used a five-point Likert scale (with 1 denoting very unnecessary and 5 denoting very necessary) to represent degree of necessity of e-book features for supporting reading process. Examples for assessing strategy use and features supported by e-book in questionnaire items are listed in Tables IV and V. Data collection of students' responses was administered online. Two hundred and one valid responses were obtained at the end of the two-month data collection period. Quantitative data were analyzed using descriptive statistics. Pair-*t* test was also employed to determine the differences between academic reading and leisure reading.

Analysis of results

Students' use of e-book reading strategies

Through the "think aloud" process, students' use of reading strategies was explicitly expressed. The data revealed that students used various strategies in reading e-books.

Table II.
Features of e-book systems

	E-book system Features of e-book									
	AiritiBooks (Chinese)	Apabi (Chinese)	MyiLibrary ≪ King Arthur ≫	UDN	Books@Ovid [OvidSP]	Cambridge Books Online	Ebrary	Netlibrary	Oxford Scholarship Online	SpringerLink Books
Scrolling text					×				×	
Single page			×	×		×	×	×		×
Flipping page	×	×								
Effect of page-flipping sound	×	×								
Reduces page icons	×	×		×		×				×
Page search column	×	×	×			×	×	×	×	×
Go back				×		×		×		
Off-line reading		×								
Reading history								×		
Download			×		×	×			×	×
Print-out			×		×	×	×	×	×	×
Enlarge font	×		×			×				×
Adjustment of textual clarity		×								
Search book	×	×	×	×	×	×	×	×	×	×
Keyword search in full text	×	×	×	×	×	×	×	×	×	×
Structure of chapter	×	×	×	×	×	×	×	×	×	×
Hyperlink to authors' blogs				×	×					
Hyperlink to book reviews						×				
Hyperlink to out-sources			×							
Book-mark	×	×		×						
Notation		×					×	×		
Build-in dictionary								×		
Export of bibliographies	×		×			×	×		×	×
Introduction of new and popular books	×	×		×		×		×		
Category of subjects	×	×	×	×	×	×	×	×	×	×
Browsing for authors									×	×
Browsing for publishers	×		×							×

Data to be collected	Guided question
Reading experiences	What were your reading experiences in paper-based and electronic-based books?
Motives for using e-books	What were your motives for using e-book systems and e-book collections?
Tasks that might influence strategies used	How were different tasks influenced the way you use e-book systems and e-book collections differently?
Use of prior experiences	What were the prior strategies you used to meet your reading purposes?
Strategies for decision-making and comprehension	What were the strategies you used for making decisions in your reading? What were the strategies you used for comprehending reading materials?
Strategies for self-regulation and self-monitoring	What were the strategies you used for monitoring your reading? What were the strategies you used for managing your reading resources?

Table III.
Interview guide for collecting qualitative data

Use of reading strategy	Academic reading necessity 1	2	3	4	5	Leisure reading necessity 1	2	3	4	5
Use background knowledge in reading content	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Pre-analyze reading content	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Use content structures in e-books	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Use notations for explicit interpretation	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Analyze reading purposes and required reading time	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Explore e-book system functions	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Table IV.
Examples to assess necessity level of reading strategy

Reading support of e-book features	Academic reading necessity 1	2	3	4	5	Leisure reading necessity 1	2	3	4	5
History of prior reading	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Off-line reading	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Access to a specific page through table of content	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Enlarged and reduced font	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Table V.
Examples to assess necessity level of reading supports by e-books

These reading strategies were categorized into "Use of prior experiences", "Comprehension and decision-making", and "Self-regulation and self-monitoring". In the category of "Use of prior experiences", students explored electronic reading by integrating their prior reading knowledge and experiences, such as using background knowledge, pre-analyzing reading content, using familiar e-book interface, starting with interesting and important content, and previewing of prior reading. They also integrated both linear/non-linear and book-review reading experiences before actual reading process. Verbal responses of responses are detailed in Table VI

Strategies items	Sample responses
Use background knowledge in reading content	I begin my new reading from what I have known as a starting point (C: 245-255) Starting with familiar content and having a basic understanding of the topic makes it easier for me to comprehend the concepts (A: 154)
Pre-analyze reading content	First, I check whether it (the reading content) is up-to-date, or there is something interesting to me (A: 118-119)
Use familiar reading interface for selecting reading content	I prefer the reading platform with text formatted in top-down and right-left sequence (Chinese writing styles) (H: 66-67)
Read linearly and non-linearly	I have the habit of reading page-by-page throughout the content linearly. (C: 110-111) I have the habit of reading selectively by focusing only on what I am really interested. (B: 52-53)
Re-read previous reading content	To comprehend the new reading content, I often review what I have read earlier to get more meaningful explanation about new content (G: 262-263)
Start with interesting and important content	I have the habit of starting with an interesting point. (B: 52-53) When reading "Nordic folklores", I start with love stories, which are my favorites. (H: 248-249)
Retrieve previous reading	Keyword search helps me identify important content from previous reading. It will be used as a basis for new reading (F: 210-211)
Preview book-review	Book reviews from other readers helps me obtain a general idea about the new reading content (H: 85)

Table VI.
Use of prior experiences

In the category of "Comprehension and decision-making", student employed strategies that would help decision-making in comprehending electronic reading content. For example, students used content structures provided in e-books to help visualize the relations of the components in order to decide what to read. Other strategies, such as use of author information, subject domain analysis, notations, graphics, encyclopedias, and search engine also help students comprehend reading content (Table VII).

In the category of "Self-regulation and self-monitoring", student employed strategies that would help them achieve specific reading tasks or purposes. In order to achieve specific reading goals, students employed strategic planning in analyzing task requirements and availability of time. They also spent time exploring the e-book systems to identify and use various functions to support their reading activities, such as font-size setting, highlighter, book-mark, and notepad (Table VIII).

Need for electronic reading strategies

To assess students' need of strategies identified from qualitative assessment, the necessity level of electronic strategies to students were evaluated. According to the 201 valid responses, students expressed the top three greatest need for electronic reading

Strategies	Sample responses
Use content structures in e-books	I use the table of content provided in e-books to decide what to read. Some chapters draw my attention to read first (B: 51-52)
Determine reading content needed	I need to have a basic understanding of the reading content in order to determine reading content needed (D: 213-215)
Use author information	Author information helps me decide on the relevant content to read (C: 63-65)
Analyze subject domain for reading content	I need to go into the chapter and analyze whether the chapter contains materials I want (C: 223-224)
Self-explain reading content	I need to use my own explanation to extrapolate the implicit meanings (F: 182-183) I use my own understanding to interpret my reading (C: 240)
Use notations for explicit interpretation.	I use footnotes to obtain explicit interpretations of specific reading contents (F: 165)
Use graphics to interpret reading content	When reading western literature, pictures help me think and reflect on specific situations in different time periods (B: 192-193)
Use encyclopedias to obtain explanation	First, I use Wikipedia or other online encyclopedias to obtain a background understanding of the reading content (H: 212-213)
Use search engine to obtain various information sources for helping comprehension	When reading e-books, I can search keywords through the search engine. Reading searched information allows me to see things from different perspectives (A: 176-180) When reading the history of western oil painting, using the search engine to obtain graphical materials helps me understand better the reading content (G: 244-247)

Table VII.
Comprehension and decision-making

strategies including: "Use search engine to obtain various information sources for helping comprehension"(4.00 + 0.843), "Pre-analyze reading content" (3.88 + 0.932), and "Determine reading content needed" (0.384 + 0.919) for academic reading; and "Start with interesting and important content" (4.03 + 1.109), "Determine reading content needed" (3.99 + 0.916), and "Use graphics to interpret reading content" (0.83 + 1.017) for leisure reading (Table IX).

From pair-t test, the necessity level of reading supports in academic reading is significantly higher than leisure reading in the following item: "Use background knowledge in reading content" ($t = 2.296$, $p = 0.023$), "Pre-analyze reading content" ($t = 2.453$, $p = 0.015$), "Re-read previous reading content" ($t = 4.985$, $p = 0.000$), "Retrieve previous reading" ($t = 4.480$, $p = 0.000$), "Self-explain reading content" ($t = 4.984$, $p = 0.000$), "Use notations for explicit interpretation" ($t = 2.133$, $p = 0.034$), "Use encyclopedias to obtain explanation" ($t = 6.903$, $p = 0.000$), "Use search engine to obtain various information sources for helping comprehension" ($t = 4.861$, $p = 0.000$), "Analyze reading purposes and required reading time" ($t = 4.163$, $p = 0.000$), "Integrate and extract different content resources simultaneously" ($t = 5.727$, $p = 0.000$), "Allot reading time to achieve reading

Strategies	Sample responses
Analyze reading purposes and required reading time	With time constrain, I need to spend my time on relevant reading content (E: 92-94) I analyze my reading purposes and decide how to proceed with my reading task (H: 140-141)
Explore e-book system functions	I spend time to exploring the functions of e-book systems so that I can control my own reading (E: 65-166)
Integrate and extract different content resources simultaneously	I try to integrate different reading resources and use them as a whole. For presentation purposes, restructuring and reconstructing the reading content is needed (G: 272-273) In order to compare diverse viewpoints, I open different e-books simultaneously for using different resources (E: 244-245)
Set appropriate font size for reading	To read clearly, I enlarge the font size for my own convenience (D: 172)
Allot reading time to achieve reading purpose	If I have sufficient time, I would read through the e-book in detail. Allocation of time on a daily or weekly basis is needed to finish the reading task (F: 263-264)
Elaborate and reinforce from what was read	I synthesize and elaborate on what I have read. It is easier for visualizing my thinking (H: 332-336) I draw my own graphics to reinforce what was comprehended. Both textual and graphical organizations are used (C: 194-195)
Highlight important or interesting content	I underline the important words and phrases in the reading content for emphasis (F: 203-206) I mark the paragraphs that interest me in "Nordic Folklores" so that I can read them again (H: 248-250)
Take notes and write down reflections	I have the habit of taking notes and writing down my reflections on things that interest me so that I can review in future (C: 199-200) I use note pad to write down what I have organized and reflected about my reading (D: 280-281)

Table VIII.
Self-regulation and self-monitoring

purpose" ($t = 6.162$, $p = 0.000$), "Elaborate and reinforce from what was read" ($t = 3.704$, $p = 0.000$), and "Highlight important or interesting content" ($t = 6.095$, $p = 0.000$). And, leisure reading is significant higher than academic reading in "Start with interesting and important content" ($t = -6.014$, $p = 0.000$), "Determine reading content needed" ($t = -2.197$, $p = 0.029$), and "Use author information" ($t = -3.487$, $p = 0.001$) (Table IX).

Need for features supported by e-book systems

To assess students' need of various features supported by e-book systems, the necessity level of e-book features reveals greater need (Mean > 4.0) for following items: "Quick access to specific reading content", "Page search function", "Off-line reading", "History of prior reading", "Access to a specific page through table of

Strategies	Academic reading Mean	Academic reading SD	Leisure reading Mean	Leisure reading SD	Comparison Pair t test	Significance p
Use of prior experiences						
Use background knowledge in reading content	3.63	0.869	3.46	0.905	2.296	0.023*
Pre-analyze reading content	3.88	0.932	3.68	0.994	2.453	0.015*
Use familiar reading interface for selecting reading content	3.79	0.941	3.74	0.991	0.81	0.419
Read linearly	3.39	1.048	3.41	1.106	−0.294	0.769
Read non-linearly	3.05	1.062	3.18	1.141	−1.685	0.093
Re-read previous reading content	3.81	0.937	3.43	1.084	4.985	0.000***
Start with interesting and important content	3.54	1.109	4.03	0.995	−6.014	0.000***
Retrieve previous reading	3.57	1.018	3.22	1.092	4.48	0.000***
Preview book review	3.11	1.205	3.08	1.13	0.349	0.727
Comprehension and decision-making						
Use content structures in e-books	3.55	0.927	3.51	0.975	0.616	0.538
Determine reading content needed	3.84	0.919	3.99	0.916	−2.197	0.029*
Use author information	2.95	1.123	3.23	1.204	−3.487	0.001**
Analyze subject domain for reading content	3.71	0.958	3.66	0.931	0.785	0.433
Self-explain reading content	3.70	0.918	3.31	1.051	4.984	0.000***
Use notations for explicit interpretation	3.80	0.944	3.65	0.938	2.133	0.034*
Use graphics to interpret reading content	3.81	0.983	3.83	1.017	−0.29	0.772
Use encyclopedias to obtain explanation	3.67	1.133	3.08	1.168	6.903	0.000***
Use search engine to obtain various information sources for helping comprehension	4.00	0.843	3.62	1.008	4.861	0.000***
Self-regulation and self-monitoring						
Analyze reading purposes and required reading time	3.58	0.940	3.24	1.055	4.163	0.000***
Explore e-book system functions	3.78	0.886	3.73	0.947	0.696	0.488
Integrate and extract different content resources simultaneously	3.71	0.910	3.24	1.083	5.727	0.000***
Set appropriate font size for reading	3.65	1.122	3.67	1.120	−0.237	0.813
Allot reading time to achieve reading purpose.	3.45	1.058	2.92	1.104	6.162	0.000***
Elaborate and reinforce from what was read	3.76	0.908	3.49	0.975	3.704	0.000***
Highlight important or interesting content	3.83	0.967	3.37	1.089	6.095	0.000***
Take notes and write down reflections	3.20	1.096	3.08	1.206	1.714	0.880

Notes: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; $n = 201$

Table IX.
Need of electronic strategy for academic reading and leisure reading

content", "Enlarged and reduced font", "Search in full text" in both academic and leisure reading. For academic reading, greater need (Mean > 4.0) was observed in following items: "Print-out", "Outline of chapter content", and "Save copy of previous reading", "Access to a specific page through table of content", and "Save copy of previous reading" (Table X).

From pair-t test, the necessity level of e-book features in academic reading is significantly higher than leisure reading in the following item: "Page search function" ($t = 2.091$, $p = 0.038$), "Print-out" ($t = 5.598$, $p = 0.000$), "Access to a specific page through table of content" ($t = 2.269$, $p = 0.024$), "Keyword search in full text" ($t = 3.630$, $p = 0.000$), "Outline of chapter content" ($t = 5.306$, $p = 0.000$), "Subject browsing" ($t = 5.530$, $p = 0.000$), "Underline function and saved underlined records" ($t = 6.068$, $p = 0.000$), and "Notation function" ($t = 6.274$, $p = 0.000$). And, leisure reading is significantly higher than academic reading only in "Link to the author's blog" ($t = -2.384$, $p = 0.018$) (Table X).

Discussion

As e-books become important reading resources, redefinition of new literacies in online reading is necessary. In this study, qualitative data gathered from students' "think aloud" process revealed diversified reading strategies used by students in integrating experiences (knowledge and skills in reading), comprehending and decision-making, as well as self-regulation and self-monitoring. Many of these strategies such as "Use familiar reading interface for selecting reading content", "Integrate and extract different content resources simultaneously", and "Set appropriate font sizes for reading" are new for electronic reading.

Among various strategies identified from interview data, quantitative assessment reveals the necessity level of different electronic strategies for academic and leisure purposes. From a statistical comparison, student reacted differently (in many questionnaire items) between academic reading and leisure reading toward the need of various electronic reading strategies and e-book features. The results can be explained by Dillon's (1994) work, addressing the importance of reading tasks influencing internal cognitive and perceptual processes. Task difference influences skills needed in analysis, synthesis and evaluation (Hock and Mellard, 2011; White *et al.*, 2010).

Since academic reading tasks often obligate to accomplish within a deadline, students employed appropriate strategies to evaluate what they know and learn and allot reading time to achieve specific reading purposes. More internal use of strategies in analyzing, re-reading, comprehending, elaborating, and integrating were required in electronic reading. More e-book features were also needed for supporting physical use of reading. While leisure reading often driven from student' own interest, the need of strategy use was more oriented from their personal need, interest and awareness of reading information and book authors.

To support students' electronic reading, many e-book systems provide diverse features that permit students' use of meta-cognitive strategies needed in monitoring one's reading activities for academic and leisure purposes. Gerjets *et al.* (2008) suggest that many of these e-book features are to help readers induce related schema in integrating knowledge in reading content. In this study, it was observed that these supports, such as outline of chapters, underline and save underlined records, and notations, were significant need in academic reading (Table X). This might be

Table X.
Need of e-book features for academic reading and leisure reading

e-book functions	Task: Academic reading Mean	Academic reading SD	Task: Leisure reading Mean	Leisure reading SD	Comparison Pair t test	Significance p
Scrolling text	3.54	1.091	3.63	1.07	−1.61	0.109
Flipping page layout	3.49	1.11	3.50	1.167	−0.17	0.865
Single page layout	3.48	0.99	3.56	1.043	−1.545	0.124
Sound effect of page-flipping	2.73	1.296	2.81	1.398	−1.605	0.110
Quick access to specific reading content	4.09	1.003	4.01	0.977	1.365	0.174
Page search function	4.15	0.947	4.03	0.961	2.091	0.038*
Off-line reading	4.15	0.996	4.10	1.03	1.084	0.280
History of prior reading	4.15	0.984	4.04	1.029	1.899	0.059
Print-out	4.11	1.043	3.71	1.157	5.598	0.000**
Access to a specific page through table of content	4.09	0.986	3.96	1.004	2.269	0.024*
Enlarged and reduced font	4.24	0.957	4.17	0.996	1.334	0.184
Keyword search in full text	4.30	0.873	4.09	0.993	3.630	0.000**
Outline of chapter content	4.15	0.887	3.83	1.017	5.063	0.000**
Browsing for the author	3.64	1.045	3.6	1.087	0.616	0.538
Link to the author's blog	3.43	1.156	3.58	1.084	−2.384	0.018*
Hyperlink to book reviews	3.70	1.035	3.62	1.099	1.334	0.184
Book-mark	3.98	1.017	3.89	1.038	1.513	0.132
Subject browsing	3.89	1.069	3.51	1.045	5.530	0.000**
Category of subjects	3.97	0.995	3.89	1.001	1.478	0.141
Photos of the book cover	3.91	1.04	3.88	1.093	0.459	0.647
Underline function and saved underlined records	3.99	1.061	3.53	1.140	6.068	0.000**
Notation function	3.79	1.034	3.35	1.136	6.274	0.000**
Save a copy	4.08	1.062	3.82	1.132	3.636	0.000**

explained by the fact that academic reading is more demanding. Students are required to build a repertoire of strategies for engaging within comprehending and monitoring reading process in a variety of disciplines (Lesmeister, 2010). Since specific objectives should be achieved within a set deadline, some of these reading supports in e-book systems could help them accomplish reading tasks in a more efficient way. From a qualitative assessment, interview data also revealed that students have the habit of re-reading previous reading content, employ notations for explicit explanation, and integrate and extract different content resources simultaneously. These strategies are not unique in electronic reading environment. Traditional strategies grounded on paper-based reading theories should be incorporated into electronic reading.

Electronic reading is an active, constructive, and sense-making process emerging with internet and communication technologies to support dynamic reading space (Coiro and Dobler, 2007). Since users are important considerations for determining the operation of the service systems (Banou *et al.*, 2008; Cope and Phillips, 2006; Was, 2010), future development of e-book features should emphasize more on support of reading strategies employed by readers. For example, integration of encyclopedias or dictionaries might be helpful innovations of e-book features to facilitate students in comprehending knowledge of specific domains especially in academic reading. Other implementations, such as use of notations or bookmarks to support students' self-monitoring process are also required.

Conclusion

Reading promotes intellectual growth of individuals and prepares them for the future competitive society. With the advent of technology, reading can take place in various formats. Research on students' use of strategies in electronic reading is needed in the rich information world. In this study, electronic strategies employed by college students were explored and summarized. Necessity of using various electronic reading strategies and reading supports provided by e-book systems were assessed from students' responses toward questionnaire items. It is hoped that the findings of this study will provide suggestions for the innovation of reading supports embedded in e-book systems. However, this research is preliminary. Further research on different reading audiences and specific domains may shed light on more guidelines for implementation and application.

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