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Understanding College Students' Engagement in Mobile Reading for Sustainability in Education: A Case Study from China

Tingting Liu, Yingjie Li *, Mengqin Feng, Yan Chen and Tianyi Zhang

College of International Education, Shanghai University, Shanghai 200444, China
* Correspondence: liyj@shu.edu.cn

Abstract: Mobile reading is viewed as a promising pathway to reading with sustainable education goals. At present, there have been many studies on the mobile reading of young readers and their reading comprehension by testing their task-based comprehension, but not much attention has been paid to the mobile reading of college students in China and the factors of reading engagement from readers' perspectives. With the aim to investigate the factors that affect college students' engagement in mobile reading, this study used interviews with open-ended questions and followed a qualitative content analysis design with an inductive and exploratory approach. The participants of this study were thirty college students with diverse majors out of three universities in Shanghai, China. They were selected from a pre-questionnaire, and these students (N = 30) were chosen from those who read on mobile devices for less than 2 h on average per day (N = 276). The results revealed that the college students perceived a variety of factors affecting their engagement in mobile reading, including the following: four motivational needs (information needs, academic needs, social needs, emotional needs), reading experience, reading efficacy, and reading strategies. It has been assumed that the most common factor that leads to the engagement of college students in mobile reading is the intention to be entertained. The investigation of this study has different results. Even the students who spent the minimum average time mobile reading used it with diverse needs in mind. Nevertheless, students' reading experience, reading self-efficacy, and reading strategies indicated that sometimes they had difficulties engaging in mobile reading. These difficulties resulted from an imbalance between their needs and their engagement: whether they obtained what they needed. Considering that mobile reading could be an effective way to assist college students' independent learning and sustainable development in future, it is necessary to understand the factors of mobile reading and rethink how to avoid difficulties to improve the mobile reading engagement of college students.

Keywords: mobile reading; factors of reading engagement; content analysis study; Chinese college students

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1. Introduction

With the rapid development of information and communication technology (ICT), the widespread use of mobile devices has changed reading as a practice, which can now take place anytime and anywhere. Mobile reading, which has been inevitably taking over the mainstream existing reading methods [1] is viewed as a promising pathway to reading with sustainable education goals [2]. The use of mobile devices for reading refers to the use of mobile terminals (e.g., tablet computers, e-book readers, smartphones, etc.) to read novels, magazines and newspapers, blogs, web essays, and other electronic forms of reading materials via websites, bookstore clients, and other online platforms [3].

Mobiles and smartphones are transforming the reading habits of the general public, especially those of the young generation, at a faster pace [4]. It is said that young people's dedication to digital reading has changed because of their interest in social networking, gaming, and music in the process of reading on their mobile phones [5]. Dedication to

digital reading reflects one's reading engagement when reading online [6]. The importance of reading engagement, which benefits students' reading comprehension, also has been demonstrated in a variety of quantitative studies [7,8]. The significance of reading engagement necessitates further analyses of the factors that influence reading engagement in the process of mobile reading. Unlike previous studies, which were based on experiments and measurements [7,8], the present study applies a qualitative content analysis with an inductive approach that specifically focuses on college students' reading engagement on mobile devices and the factors that influence students' engagement.

Additionally, this study concentrates on the reading engagement of college students when they read with portable devices, considering that little research specifically focuses on this group, even though college students actually account for a large part of mobile users in China. According to "The 48th Statistical Report on China's Internet Development" published by the China Internet Network Information Centre (CNNIC), the number of mobile Internet users in June 2021 was 1.007 billion, and the proportion of Internet users accessing the Internet via mobile phones was 99.6%. Among them, 17.4% were netizens aged 20–29, and college students played a key role [9].

The current study may provide a perspective with which college students can reflect on mobile reading as a potential access to inclusion, equity, quality, and sustainability in education. As a prospective path to ensure SDG4/Target4.6 "all youth and a substantial proportion of adults, both men and women achieve literacy", mobile reading has been suggested for further utilization as a new way to literacy for marginalized groups who may not have access to paper books [2]. According to a comprehensive survey of over 4000 people in seven developing countries conducted by UNESCO in 2014, mobile reading was encouraged as a promising pathway for assisting people of various ages in developing countries to access long-form reading materials, even while using the least expensive mobile phones [2]. It was found that people read more when they read on mobile devices, and young mobile readers tend to complete more schooling than before. In 2016, a five-year project of mobile learning was launched, demonstrating how it can facilitate an inclusive and equitable learning environment in a primary school in China [10]. This successful demonstration illuminates the potential of mobile reading to facilitate e-learning and enable e-school models to achieve the targets of SDG4: to "ensure inclusive and equitable quality education." The potential of ICT in education—to strengthen knowledge dissemination, information access, quality, and effective learning [11]—has already been acknowledged and highlighted for sustainable education in the Education 2030 Framework for Action [11] and Target 4.4/SDG4: to "substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills". The issue of mobile reading that we deal with in this paper can be understood as a perspective through which college students may understand the factors that affect their engagement in mobile reading and recognize the significance of using mobile reading for their sustainable and lifelong learning with ICT.

1.1. Multidimensions of Reading Engagement

Studies of reading engagement have developed for a long time. Many previous studies initially linked reading engagement to cognitive engagement [12,13], because in the process of reading, readers are cognitively engaged when they regulate their attention and effort, make sense of the texts, monitor their comprehension, and gain new knowledge [14]. Despite the key effect of cognitive aspects in reading engagement, there are other aspects that together are responsible for reading engagement. Fredricksd et al. [15] first defined reading engagement as a multidimensional metaconstruct that includes cognitive, behavioral, and emotional aspects [15,16]. The construct of engagement, which has long been followed by many scholars, has been further developed. Many studies followed the comprehensive theoretical framework of reading engagement built on these three aspects [15–17]. It is important to anchor these three dimensions of reading engagement in specific reading activities. Fredricks and McColskey [16] suggested that engaged readers actively engage

in academic (i.e., reading tasks), social, or extracurricular reading activities (behavioral engagement); respond positively to teachers, classmates, or schools; express interest in and appreciation for reading (emotional engagement); and use high-level strategies for comprehension and reading skills (cognitive engagement).

Numerous studies from the fields of culture, sociology, anthropology, and sociolinguistics have conceptualized reading as a social activity [18], and the availability of social media and online reading platforms is changing the way we read [18]. Reading is increasingly becoming a socialized behavior that involves interacting with information, sharing knowledge, and maintaining relationships [19]. Online readers can read a larger number of texts and connect with other readers and writers by asynchronously reading, liking, reposting, sharing, and interactively commenting through mobile terminals [20]. In contemporary times, social reading engagement is increasingly coming to the fore, while most studies prefer to examine three aspects (i.e., behavioral, emotional, and cognitive) of reading engagement and assume that the social aspects are difficult to measure [17]. Research has shown that the social interaction function of mobile reading (e.g., the WeChat reading app) encourages college students to read socially and promotes the cognitive development of online readers [21]. Among university students, their social reading engagement with digital media has a positive impact on their digital reading skills [22].

Naumann [6] proposed a model of engagement in online reading based on Guthrie et al.'s [23] framework for reading engagement. This model was supported by findings from studies of information engagement, social engagement, and their associations with task-adaptive navigation in digital reading. These hypotheses were tested using OECD PIAS 2009 Digital Reading Assessment data from 17 countries and economies [6]. The present study concerns reading engagement on mobile devices without assigning specific types of platforms or specific tasks. Instead, we opted for an exploratory study using a qualitative inductive approach [24], which does not limit itself to a specific framework but focuses on having our informants report on their feelings about and experiences of using mobile reading for learning or other needs.

Overall, the empirical research methods and conclusions of previous studies have a certain degree of similarity and overlap. The majority of recent studies have captured reading engagement based on various quantitative analysis methods [6,8,17]. Among them, many proposed a framework and some assumptions were tested [6,16]. Some applied questionnaires and measurements [8], and many others used latent profile analyses to identify groups or subgroups with distinct profiles of engagement behaviors [25–27]. In contrast to many studies focusing on reading engagement, qualitative studies have rarely been applied in identifying and exploring profiles with a smaller scale. These previous studies can be characterized as the following: (1) Most of them have been conducted among secondary or high school students [17], while few have been carried out among college students. (2) Reading engagement, both online and offline, has been largely related to task-based reading comprehension or academic reading activities, even tests of online reading [28]. However, reading, especially digital reading, with portable devices is not only connected to the academic activities in class, but also the social activities outside of class, occurring whenever and wherever possible. (3) The characteristics of the engagement profiles in the samples from China are unclear, since most studies on students' reading engagement were conducted in the contexts of Europe and North America. In light of the issues arising from these previous studies, the current study incorporated a multidimensional and exploratory approach to capture the complexity of Chinese college students with different majors.

1.2. Factors Affecting Mobile Reading

There have been many previous studies on the factors of reading from a reader's perspective [29–32]. A key concept of reading is the reading experience, which has been understudied over the years [30]. Regarding reading experience, there are many commonplace notions. Usually, a good reading experience is considered a happy, exciting, and entertaining experience [30]. In this study, reading experiences that were obtained during

the process of mobile reading might include students' feelings about reading platforms, content, environment, and the use of mobile devices. Motivation is also an important factor to students' performance in reading [29]. The first theory of motivation was put forward by Maslow, who understood needs as components of motivation [33]. People's actions are stimulated by motivations which can be transferred from needs. Accordingly, reading needs strengthen the individual motivation of a reader to engage in reading activities [34].

Research shows that readers can persist in reading tasks if they have confidence in their ability to read and comprehend effectively [31]. This confidence about one's own ability to finish tasks is named self-efficacy, which refers to one's belief in their own ability to take action to achieve specific goals [35]. Accordingly, reading self-efficacy can be defined as the students' confidence about their reading abilities and comprehension [36] in their specific reading activities, which in this study was reading on mobile devices. Reading self-efficacy has been positively correlated with reading comprehension in many studies [36–38]. Reading strategies also have positive contribution towards reading comprehension [32]. These can be defined as a series of specific, goal-oriented cognitive actions that control readers' efforts to understand words and construct the meaning of the text [32]. This study considers reading strategies as one potential factor that might facilitate readers' engagement in mobile reading.

As for mobile reading, there has been a great deal of research on the factors that influence reading behaviour, habits, and performance with varying perspectives [4,28]. Little research has been conducted on mobile reading engagement and the factors that influence mobile reading engagement. Scholars have tried to look for the factors of mobile reading. Texts online are displayed differently than on paper, which contributes to the text factor of mobile reading—front size, image format, e-book format, and text displayed types [39]. The marginalia function and screen size of the platforms as well as the reading environment, time, and situation are all considered as contextual factors that affect mobile reading comprehension [40].

The use of mobile devices for reading by college students has been investigated by analyzing the differences between reading e-books and paper books in classroom learning [41]. College students mostly read through mobile devices because of the convenience, portability, easily acquisition of information, and powerful entertainment of reading platforms [22], as well as the reliability, usefulness, interactivity, security, and compatibility of apps [1]. There have been studies that have analyzed the influencing factors of college students' mobile reading. These factors from the reader's perspective, including mobile terminals, economic purchasing power, reading ability, and traditional reading habits, affect the mobile reading behavior of college students in China [42]. There are also other latent factors, such as gender, grade, subject, region, educational level, academic background, student's origin, and consumption level, which affect the mobile reading behavior of college students to varying degrees [43].

The above studies mostly describe the factors that influence mobile reading from external contexts. However, the reader's reading experience and motivational factors are not easy to observe at a given time, as mobile reading occurs not only in class but also at any fragmented time. It can take place freely at any time and in any place. The current study on mobile reading engagement is not specified to some classrooms or based on task-based learning. The factors that influence mobile reading engagement from the reader's perspective may inform a rethinking of the impact of mobile reading on university students' reading habits.

1.3. The Aim and Research Question of Current Study

We aim to understand the factors that influence reading engagement of college students (including undergraduate and postgraduate students) based on their experiences of mobile reading.

The research question that we explore is: What are the factors that affect college readers (undergraduate and postgraduate students) in China engaging in mobile reading?

2. Materials and Methods

2.1. Design: Qualitative Content Analysis with an Inductive Approach

The current study applied qualitative research method that underlies important information in terms of participants' behaviors, thoughts, feelings, and experiences [44] by describing and interpreting them. Specifically, we used qualitative content analysis with an inductive approach, which is characterized by a search for patterns of some phenomena [45]. Qualitative content analysis is a method to analyze a large number of qualitative data, such as texts or pictures [46] qualitatively and at the same time "quantify" the data [47]. This method seems to combine qualitative and quantitative approaches when coding and analyzing data. The inductive approach that is also called data-driven [45]; it looks for the similarities and differences in the data through coding of the data. By counting these codes quantitatively, this approach also seeks the most frequent phenomena and interprets these codes and phenomena [48,49]. These similarities or differences are displayed and described in categories and/or themes on various levels of abstraction and interpretation. The process of analysis is the move from the data to a theoretical understanding, or from the concrete and specific to the abstract and general [50]. The use of qualitative content analysis with an inductive approach allows us to conduct an exploratory work without using a theoretical framework. Instead, we explored the latent meaning (subthemes/themes) behind the content, by coding the manifest content (subcategories/categories) with emergent flexibility and reflexivity [45]. Each concept of the qualitative content analysis is explained in a later section.

2.2. Participants and Data Collection

The participants consisted of 30 students from different universities in Shanghai, China, including 13 male and 17 female students (Table 1). Before interviewing them, we sent out a general questionnaire to college students (N = 624) in different universities in Shanghai, to learn about the content and frequency of mobile reading. Among the students who read on mobile devices less than 2 h on average per day (N = 276) (more than other three groups—2 to 3 h, 3 to 4 h, and more than 4 h on average per day), we recruited 30 students to participate in the interview to investigate the factors that affect their engagement in mobile reading. These interviewed students were recruited from different majors mainly out of three universities in Shanghai, China. Three universities are all comprehensive universities and offer diverse majors. When selecting them, we also tried to make sure the difference in samples was maximized. In order to generalize the results to students with diverse backgrounds in universities, the educational background of participants was broadly balanced, including 18 undergraduates (60%) and 12 graduate students (Master's and PhD candidates). To ensure the diversity of academic backgrounds of participants, we selected participants from different majors—Chinese language and literature, linguistics and applied linguistics in foreign languages, vocational and technical education, innovative design, tourism management, networks and new media, mathematics and applied mathematics, chemical materials, and medical laboratory technology. Although the students were from diverse academic majors, they were divided into two groups—undergraduates and postgraduates—when being described in the results.

Open-ended questions in interviews were used to conduct this qualitative study. Open-ended questions for data collection are regarded as suitable when seeking people's perceptions [51]. To ensure a smooth flow and comprehensive content of the interview, the interviewer conducted a pre-interview with 4 students in advance and adjusted and modified the interview outline based on the pre-interview. The final outline was as follows: (1) What content do you usually read about on your mobile? (2) For what purpose do you generally read? (3) What do you think are the effects of reading on a mobile? (4) Please describe your experience and feelings when you engage in reading on portable devices, in terms how mobile reading affects the way you read.

Table 1. Composition Table of Participants.

Items	Categories	Number of Samples	Proportion
Gender	Male	13	43%
	Female	17	57%
Educational background	Bachelor	18	60%
	Master's and PhD	12	40%
Major	Literature, History, Philosophy, and Art	10	33%
	Science Technology	7	24%
	Education Science and Social Science	13	43%

Before the formal interview, the interviewer informed the interviewees in detail about the research background, research aims, interview procedure, and relevant concepts of mobile reading to ensure that the interviewees fully understood the purpose of the interview and the relevant terms used in the interview, in order to create a natural, conversational atmosphere. During the interviews, interviewees were encouraged to speak freely around the outline of the interview and describe their answers in detail. They were guided to gradually reflect their experiences and feelings throughout the mobile reading process. At the same time, interviewers checked the relevance of the topics and lightly adjusted the questions according to their answers. The interviews were organized in the form of face-to-face conversations or voice calls. The interviews that lasted for at least 40 min were digitally recorded, with the consent of the interviewees. Then, all the interviews were transcribed verbatim and subjected to a qualitative content analysis.

2.3. Data Analysis

There are several concepts related to qualitative content analysis—meaning unit, code, category, sub-theme, and theme [52]. A meaning unit refers to words, sentences, or paragraphs containing manifest meaning related to the focus and research question of the study. A meaning unit is coded as a code. The heading of a category in inductive content analysis describes a group of codes that share a commonality on a manifest level. A theme as a meaningful "essence" that runs through the codes and categories is referred as a recurrent thread of underlying meaning and an expression of the latent meaning of a text. It can be divided into subthemes on different levels [53]. The analysis process mainly shortens the meaning unit and abstracts the shortened meaning units at a higher logical level for each step of the analysis, through code, category, sub-theme, and theme.

The specific procedures of data analysis are shown as follows. First, the text was read repeatedly in order to obtain a sense of the whole. The next step was to identify content areas related to the research question and divide the text into meaning units, i.e., words, sentences, and paragraphs, that were relevant to the study's aim. The meaning units were condensed in order to develop descriptions of the content and meaning of the text. These were labelled with codes that were compared for similarities and differences. Similar codes were abstracted into categories without excluding data related to the aim or sorting them into more than one category. When the categories held nuances, subcategories were formulated. The findings account not only for what is common in participants' experiences, but also for individual variations in order to let all voices be heard.

Results are often presented on a descriptive level, in which the content of categories and subcategories closely reflects data. Graneheim and Lundman [52] also describe a further analytic step, in which focus is put on identifying a theme, which is "a thread of an underlying meaning through condensed meaning units, codes or categories, on an interpretive level" (p. 107). While categories are more descriptive of the manifest content,

themes are interpretive, highlighting the latent content. Synthesizing categories and theme enabled us to take the interpretation one step further.

On the basis of inductive qualitative content analysis concepts, we followed the following steps: (a) deciding on research questions, (b) selecting participants, (c) interviewing the participants, (d) transcribing the interviews, (e) dividing the transcribed texts into meaning units, (f) opening coding of the meaning units, (g) interpreting the codes, comparing them for differences and similarities, and sorting the coded manifest content into categories, and (h) formulating these categories as subthemes and then themes based on the latent content. Table 2 provides an example of data analysis.

Table 2. An Example of Qualitative Content Analysis.

Meaning Unit	Condensed Meaning Unit	Codes	Sub-Categories	Main Categories	Theme
I (major in Art and Design) think mobile reading is helpful for my academic learning. For example, I can easily find art paintings and the essays about these paintings, which improves my aesthetics. I can also find more works of some famous painters. In a word, the impact of mobile reading on improving the ability to acquire and integrate information is subtle . . . . . However, I think mobile reading is like a very thin sheet. It covers diverse aspects of learning, but has only a thin layer. If you're going to dig deep, you have to turn to paper reading. So, for me, mobile reading is a kind of shallow and simple reading. I know this, but sometimes there's no better option, because I can't carry a book at all times.	Mobile reading is helpful in finding works of art and painters that are necessary for academic learning. Mobile reading gradually improves my ability to search and integrate information. Mobile reading produces shallow understanding.	Helpful for academic learning. Improves one's ability for information retrieval and integration. Difficult to read in depth on one's mobile.	Broadening academic knowledge. Information retrieval Low reading efficiency	Academic needs Information needs Reading self-efficacy	Imbalance between needs and engagement effect

3. Results

The results describe the factors of the university students' engagement in mobile reading as an imbalance between their needs and the effect on engagement. The students' needs are distributed between academic needs, emotional needs, social needs, and information needs with 176 subcategories. The engagement factors are distributed between students' reading experience, reading self-efficacy, and reading strategies with 171 subcategories (Table 3; the number shown in the subcategories). Table 3 provides the frequencies of their need (N = 30) for mobile reading engagement. On average, each university student identified 5.87 kinds of needs and 5.7 kinds of factors affecting their engagement.

Table 3. Description of factors of university students' (N = 30) engagement in mobile reading.

Theme	**Imbalance between Needs and Engagement Effect**						
Sub-Theme	**Factors to Motivate Mobile Reading**				**Factors Affecting Reading Engagement Effect**		
Main categories	Academic needs	Emotional needs	Social needs	Information needs	Reading experience	Reading self-efficacy	Strategies for comprehension
Sub-categories	Finish learning tasks and review academic knowledge learnt in class; broaden academic knowledge; prepare for research paper and thesis. (49)	To be relaxed, happy, and at ease; to help one sleep; it depends on what is being read. (14)	Sharing reading experience; expectation of making friends; group identification; exchanging opinions with peers. (45)	Acquire updated and comprehensive information; information retrieval ability; information integration ability. (68)	As a means of entertainment; rich and easy-to-obtain information; diverse platforms and content; affected by the reading content and the platform, e.g., the screen size, the font, and the layout; whether the screen is harmful for one's eyes. (55)	Disturbed reading because of social or news apps; low reading efficiency; fast reading with low retention; difficulty reading in depth. (77)	Comments, tags, highlights, making notes, skimming and skipping, reading back. (39)

In order to show the difference in the two groups (undergraduate and postgraduate students), the numbers of subcategories of the two groups are described, respectively, in Table 4. These numbers indicate the frequencies of the subcategories mentioned by the students when they described their experience with mobile reading.

As for the factors that motivate students' mobile reading, information needs are the most mentioned motivation for students' mobile reading (N = 30); this is the same for each group (undergraduate and postgraduate) of students. Social needs are the second most mentioned motivation for both of the groups, followed by academic needs. Academic needs motivated more of the postgraduate students. On average, each of postgraduate students mentioned academic needs twice, whereas each of undergraduate students mentioned academic needs 1.4 times.

As for the factors affecting one's reading, reading self-efficacy and reading experience were mostly mentioned by both groups of students. However, students with different levels of academic backgrounds applied strategies for reading comprehension and concentration differently. On average, each of the postgraduate students mentioned their strategies for engaging in mobile reading nearly twice, and the undergraduate students mentioned them once on average.

Table 4. Frequencies of subcategories, respectively, mentioned by two groups of students (N = 30).

Theme	Sub-Theme	Main Categories	Undergraduate (N = 18)	Postgraduate (N = 12)	In Total
Imbalance between needs and engagement effects	Factors to motivate mobile reading	Academic needs	25	24	49
		Emotional needs	22	12	34
		Social needs	30	25	45
		Information needs	42	26	68
	Factors affecting one's reading	Reading experience	35	20	55
		Reading self-efficacy	48	29	77
		Strategies for comprehension	18	21	39

3.1. Imbalance between Needs and Engagement Effect

University students' need for engaging mobile reading can, on a general, thematic level, be understood as an imbalance between their needs and the effects of engagement. Their needs for mobile reading, from a reader's perspective, include their needs for studying disciplinary knowledge and research in a field of study, obtaining an interest in and appreciation for mobile reading, facilitating social interaction through mobile reading, and getting information through mobile reading. Their reading engagement, as well as whether they obtained what they needed, was inevitably affected by their reading self-efficacy, reading experience, and reading strategies. Sometimes, when a student was motivated by strong needs, while at the same time, the effects of their reading engagement were dampened by other factors (e.g., low reading self-efficacy, negative reading experience, or improper strategies), an imbalance arose that interfered with the effect of mobile reading on them.

3.2. Information Needs

The college students' engagement in mobile reading was mostly motivated by their information needs. The choice of mobile reading content not only reflected the college students' preference, but also reflected the purpose of obtaining information. In addition to academic materials, contemporary college students also care about current affairs at home and abroad, contemporary news reports of society, culture, and recreation, job hunting information, and knowledge pertaining to their interests, in order to expand their knowledge and understand the world. The preference of college students for academic and informative mobile reading is a reflection of the rationality and practicality of reading. Some previous studies [22] focused too much on the negative effects of mobile reading by arguing that young students mainly read online for leisure and entertainment, while ignoring the practicality of mobile reading—a main media for contemporary students to obtain information whenever and wherever possible.

> *' . . . I usually read on mobile to acquire information of various aspects, because I think mobile apps provide latest news and essays, which keeps me up to date.' (P1)*

> *' . . . the apps or platforms I follow mainly push the news, current affairs at home and abroad, and information of interests to me when I open the phone.' (P4)*

> *' . . . mobile reading does expand my knowledge, because the information got from the mobile apps helps me understand the world and increase my knowledge on various aspects of life.' (P2)*

> *' . . . mobile reading is more convenient than paper book reading, and it is updated all the time, so that you can get the latest and comprehensive information. Further, it provides many channels of information with enrich the content I am looking for.' (P15)*

3.3. Academic Needs

Academic needs included the students' need to search academic articles and materials for learning tasks, get ready for their research thesis, broaden their academic knowledge, and push the frontier of research. Academic needs resulted from both the students' own demands and their tutors' demands and expectations. Although two groups (undergraduate and postgraduate) of students with different levels of academic backgrounds had different preferences in terms of their academic needs (on average, academic needs were mentioned more by postgraduate students), academic needs were often commonly mentioned as an indispensable factor for motivating mobile reading for university students.

The interviewees showed a positive tendency towards mobile reading, especially in terms of their academic needs, such as the accessibility of academic materials and articles, the mastery of the professional frontier, and the expansion of academic knowledge. The interviews showed that the students' top three interests for academic learning via mobile reading were learning materials, academic research, and online courses. Moreover, they were willing to pay for online learning materials, electronic versions of paper books, and online courses. In the large-scale questionnaire before the interviews (N = 624), it was found that 30% of the students spend an average of 2–4 h per week reading academic research-related content, 25% of the students spend more than 4 h per week reading academic materials, and some (9%) even spend more than 6 h.

> *' . . . if you use APP like CNKI or Web of Science Database, you can learn about some frontiers of my major, as well as the background history, the current situation, and the future trend in this field.' (P21)*

> *' . . . through mobile reading, I can learn more professional knowledge, and let me no longer receive academic knowledge information narrowly from the class. It is also very helpful for my career planning after I know more about this field.' (P25)*

3.4. Social Needs

As a combination of social media and reading media, portable devices (e.g., mobile phone, iPad) have initiated a new way of reading—mobile reading—which represents a social way of reading, instead of a private reading experience. Different from previous paper-based reading, readers have social reading behaviours in the process of searching, browsing, commenting, forwarding, and making mutual recommendations, which further strengthens the readers' experience in and identification with a certain community of readers.

A reading community refers to a social group composed of readers with similar reading purposes, reading interests, reader values, and appreciation levels [54]. Due to multiple identities, a college-aged reader may belong to different reading communities, such as a community of young readers, a community of male/female readers, a community of college students, a community of readers based on different majors, and a community of readers based on different interests. Within a certain community of reading, what the students read usually tends to be a cumulative agglomeration in some aspects through the constant sharing and mutual recommendations of other readers in the same community. In this way, a reading community influences the content of students' readings, and also their social contacts. By coding the transcripts of interviews, it was found that the social needs of the students to participate in mobile reading were relatively strong. In a reading community, in order to gain a shared reading experience with resonance, to make friends, and to build an identity that other readers in the same group can identify with, one participates in forwarding, recommending, and commenting.

> *'I will forward the interesting content that I read to my friends or classmates. Especially when the author wrote something that I agree with, I would like to forward it as a way to express my agreement to the author and my recommendation to the friends.' (P17)*

> *' . . . It has a great impact on social interaction. If you don't pay much attention to hot topics, news events, or popular online novels through your mobile phone, sometimes you*

may not be able to get in on the chat between your classmates, or you don't understand their discussions. There will also be a lack of channels to absorb fresh ideas.' (P22)

' . . . On Weibo(microblog), you can recognize online friends from different places who resonate with you . . . I like to read other readers' comments which contain the commenters' opinions or some information' (P30)

Among the interviewees, more than four-fifths of the students had discussed and recommended content they read on portable devices with their classmates or friends. In terms of the method of communication, the students tended to chat and discuss with their peers or comment on what they read, with some students choosing to write and share their feelings.

3.5. Emotional Needs

The university students' engagement in mobile reading was also motivated by their emotional needs. Their emotional needs included their need to be relaxed, happy, and at ease, to help them sleep, and to adjust their mood. Academic pressure as well as emotional and social problems produce nervousness in university students, who then resort to the literature of art, entertainment news, and other content of interest. For young users of portable devices, this is mostly easy-to-obtain, diverse information, online fiction, and short videos through internet and mobile apps. Accordingly, their emotions will be affected by the content they read. The convenience of portable devices makes it possible to read and obtain comfort anytime, anywhere.

'It will also help me in terms of emotional needs. When I feel frustrated, I will read some inspirational essays or blogs. Also, sometimes I read beautiful poetry and proses, which can relax my mood.' (P18)

'When I am bored, I like to read via mobile Apps to spend time. For example, when I am irritable, reading funny novels let me feel better and calm down. Sometimes, I read in the bed as it can aid sleep.' (P11)

'It also helps me to be relax when I feel stressful because of the studying.' (P8)

'There will be changes in my emotions. I may be affected by the content of news. Sometimes, I will be excited, and sometimes I feel angry. In general, if I read something I am interested in, I will read the content with joy.' (P30)

'If I read research articles, and then reread my own papers, I will feel depressed with pressure. But I feel relaxed when read on microblogs.' (P15)

On one hand, college students are motivated by the above four needs—academic, informative, social, and emotional needs, but on the other hand, their engagement in mobile reading is inevitably affected by other factors from a reader's perspective. How do these students read on mobile devices? What are the effects on their mobile reading? Do students use reading strategies to help them learn and understand academic materials? The interviewees mentioned three other factors from a reader's perspective when they described the effects on their engagement when mobile reading.

3.6. Reading Experience

The transcripts of the interviews displayed two sides of the reading experience of college students. On one side, the interviewees described their ease when they read for entertainment, enjoying the convenience of reading and obtaining information anytime, anywhere. On the other side, they expressed their anxiety about the negative effects that portable devices have—the authenticity of the content, eye strain after long periods of reading, side effects of screen size and font, low memory retention, and so on. When describing their content selection for mobile reading, the interviewees expressed their difficulties in identifying the authenticity of the content and allocating proper time for learning. Mobile platforms provide them with a lot of learning materials, but it is not easy to distinguish authentic content due to the large amount of information. For both

academic reading and entertainment reading, their reading efficiency was easily affected by their reading environment, the content's quality, as well as the features of their portable devices, such as screen size, font, layout, and interference of social apps (e.g., WeChat, QQ, Facebook, popups, etc.).

> *'It (mobile reading) is convenient because I can easily find what I want through searching online. Also, the content often updates with rich and comprehensive information . . . but mostly I use mobile reading for entertainment, such as reading microblog which may not include knowledgeable content. I usually forget what I read.' (P15)*

> *' . . . Sometimes in order to attract readers' attention, the title will be too exaggerated, then it has certain impact on us, such as how to treat on and how to think about it. I think we have to learn to distinguish and identify.' (P18)*

> *' . . . The quality of content maybe low. The information that we read on the mobile phone is actually filtered layer by layer, and so the original source of the news we read may be completely different. After all, we usually couldn't get the first-hand information through mobile reading. So, sometimes I am not sure about the authenticity of the content . . . .' (P1)*

> *'The screen of the mobile phone is small and a little reflective, so my eyes are uncomfortable and the reading experience is not very good because of the screen. (P13)*

> *' . . . Sometimes, if the layout of mobile reading is not good, I cannot remember what I read. Thus, the reading experience isn't good either.' (P1)*

3.7. Reading Self-Efficacy

Both groups of students mostly mentioned reading self-efficacy as the key factor that influenced the effects of reading. The data show that most of the college students interviewed did not have high confidence in their reading ability and comprehension when mobile reading, because of their reading habits change on mobile devices. During the process of mobile reading, students tend to browse quickly or focus on the content selected, instead of carefully reading or reading word-by-word. Usually, mobile readers are inclined to read simple and short texts in their spare time or fragmented time in order to relax, pass time, or socialize. Most students spend 2–3 h mobile reading every day, and they mainly read in their leisure or fragmented time. Most of the students read in three types of scenarios: when bored or in their leisure time, when taking public transportation, and before going to bed. Their reading time and sites indicate the characteristics of their mobile reading—fragmentation and liberalization. Adapted to these requirements, the content of mobile reading is usually short and simple, with a crossover among texts, pictures, and videos. Mobile reading presents a new reading style that integrates multiple senses—hearing, seeing, and touching.

Multi-sensory reading inevitably shows readers more sensory information during the reading process. The interviewed students said that they were easily disturbed by external information, communication messages, advertisements, tweets, and other visual information in the process of reading, so their reading process was often interrupted. According to the transcripts, some students had low reading self-efficiency and effects during mobile reading because of inattention, poor memory retention, and low understanding.

> *' . . . WeChat and QQ message notifications on mobile phones, advertisements, links to some apps, and other essays recommendations on the page inevitably affect my concentration on mobile reading. So, I felt mobile reading always distract me from the reading texts. ' (P8)*

> *. . . 'Usually, I can't help reading other irrelevant things like blogs on my mobile phone, when I learning through mobile reading.' (P15)*

> *'I think it is possible that I can't remember some content very clearly after reading, so I have to look back for this. But mobile reading will affect my efficiency of looking for the specific content.' (P5)*

'It is possible to mark directly on the paper books, but not on the mobile terminal. I have to read several times when I have to remember something through mobile reading. For me, the influence of mobile reading is mainly on the memory.' (P4)

3.8. Strategies for Comprehension

Different students have different attitudes toward reading self-efficacy during mobile reading. Some students argued that reading self-efficacy was a problem for them when they read for informative and academic needs via mobile devices. Interviewee P23 stated he mostly utilized mobile reading as a way of entertainment, instead of a tool for learning and building knowledge. That was because the students who did not utilize reading strategies or used them improperly during mobile reading found it was difficult to concentrate on the content shown on the screen and had negative experiences with mobile reading. Still there were some students who tried to utilize the advantages of mobile reading for studying. They applied strategies to assist them to read and understand disciplinary materials, academic articles, frontier research, as well as other knowledgeable information they were interested in via mobile reading. By coding the transcripts, the following four most used strategies for academic learning were emphasized: summarizing the content of articles and taking notes, underlining and highlighting key sentences, excerpting key points of view and taking notes, as well as adding comments and tags.

'I didn't take notes during mobile reading; I didn't know how to do that; usually I read novels through mobile reading'. (P23)

'When I read articles, I usually extract useful information from them, and make electronic notes and saved in the computer. In that way, I have a bibliographic note almost every week.' (P14)

'I think it is easy to mark sentences on the mobile screen. When I download and read an article from the CNKI app (China National Knowledge Infrastructure), the content that I think is important or helpful to me will be highlighted or underlined in different colours.' (P15)

'Sometimes I take screenshots of the information that I want and save it; sometimes I copy and write a few sentences of some good articles down in my notebook.' (P12)

'I will take notes, and add comments and tags as well if the reading content is related to my major or it is helpful and informative . . . Sometimes, I will draw a mind mapping to help me clarify the author's views.' (P26)

The above findings help us understand the factors that affect students' engagement in mobile reading from a reader's perspective. The concept of needs in this study is related to the concept of reading engagement in previous studies. Academic needs refer to one's cognitive engagement in reading for studying; emotional needs refer to one's emotional engagement in reading for pleasure; social needs refer to one's social engagement in reading for socialization; and reading for information needs at fragmented time periods refers to one's extracurricular reading activities as a type of behavioral engagement [16].

Apart from students' needs, mobile reading engagement was simultaneously affected by readers' reading experience, reading self-efficacy, and the reading strategies they applied. Thus, an imbalance between their motivational needs and the effects of reading engagement was established.

4. Discussion

The study's results revealed that the college students perceived a variety of factors that influence their engagement in mobile reading: four motivational needs, reading experience, reading efficacy, and reading strategies (Table 3).

The results showed that college students had diverse and positive needs that motivated them to engage in mobile reading. However, a strong motivation does not necessarily lead to a good performance. Apart from their motivations, there were other factors that simultaneously affected the students' performance (reading engagement effects) in this

study. This assertion has been verified by some studies which have shown the links between one's motivation (or stimuli) and performance in learning or working [55,56]. This is in line with the Yerkes–Dodson law [57] which suggests that the association between motivation and outcomes is not linear. This study also found that though college students have strong information and academic needs for mobile reading, their performance in mobile reading (e.g., their satisfaction with their reading experience and reading self-efficacy) was not necessarily triggered by strong motivation. The effectiveness of an activity depends not only on the intensity of motivation processes, but also on the sustaining actions of people in the environment [56]. The reading strategies that students applied in this study can be understood as sustaining actions to meet their motivational needs.

One's reading experience on mobile devices not only refers to the experience of reading texts, but also to the experience of utilizing a device and platform. In the digital era, reading is not the main function of mobile devices; instead, communication, social networking, entertainment, and shopping might be more important than reading [58]. When people use mobile phones for leisure and entertainment for a long time, they may get used to thinking of mobile devices as a tool for entertainment instead of for reading or learning. This would then affect people's treatment and experience of mobile reading. Research has focused on the user's reading experience in order to promote mobile reading services [1]. However, research on the reading experience of college students as one factor of reading engagement should also be of interest. As the results show, on one hand, mobile devices have portability, accessibility, interactivity, and multifunctionality [40], which makes mobile readers happy and relaxed when mobile reading. On the other hand, readers' fatigue, disorientation, and low retention caused by mobile reading prevent them from having a good reading experience.

Studies have shown that self-efficacy affects people's effort and adherence to some tasks [59]. Reading on multifunctional mobile terminals is more challenging for students than paper reading. The findings of this study demonstrate the difficulties that influence students' reading self-efficacy and their persistence in mobile reading, especially long or academic texts, such as having a disturbed reading experience because of pop-up news or social messages, low reading efficiency because of distractions, and fast reading with low memory retention. Therefore, reading self-efficacy might be especially important in achieving abilities that require persistent practice, such as reading academic texts on mobile devices.

There is one kind of view that considers mobile reading as superficial, which has a greater impact on students' reading comprehension [22]. Once students are accustomed to and immersed in fragmented and discontinuous reading experiences, they may gradually lose patience and their ability to read long texts. However, some scholars hold the opposite view; that is, mobile reading can cultivate readers' skills of multi-task processing and quick understanding [60]. This study indicates that college students have a strong need for information and academic learning, but meanwhile they use reading strategies to read on mobile devices. In this study, 26 students (N = 30) utilized strategies to engage in mobile reading with academic or information needs in order to reduce the negative impacts on their reading experience and self-efficacy. Obviously, reading strategies, especially integrating fragmented information and knowledge, are increasingly important with the development of ICT and mobile terminals. The usage of reading strategies can be regarded as one predictor of one's online reading skills, which is of great significance when employing ICTs in their daily and work lives in 21st century societies [6,61]. Research studies have considered skimming as an efficient reading strategy for screen reading [40]. In this study on mobile reading, reading strategies can be also applied in terms of the improvement in information retrieval and reading effects, storage of useful information and knowledge, and the enhancement of memory retention and attention.

In this sense, college students' engagement effects can be motivated by their needs and also might be prevented if they lack self-efficacy (their persistence in mobile reading

and utilization of goal-oriented strategies of meaning-making). This could explain why there was an imbalance between the students' needs and reading engagement effects.

Limitations

The limitation of the study might be the limited numbers of participants and the limited data collection time. This study was based on a qualitative design. Each interview lasted for 40 min at least to make sure that students' experiences and feelings were described in as much detail as possible. They could speak freely around the topic. Although the number was limited, the focus of the interviews was on the perception of the interviewees. In this study, the appropriate length of the interviews let the interviewees speak as much as possible. Thus, finally, there was a large amount of textual content that was transcribed from the interviews and used as data for the qualitative analysis. The participants (interviewees) were chosen at random from a large-scale questionnaire, and these participants were those who read on mobile devices for not very long per day, so the results might be applied to or reflected in different situations, and thus useful for guiding college students' mobile reading.

5. Conclusions and Implications

To summarise the results of the present study, college students' difficulties in engaging in mobile reading result from an imbalance between their needs and engagement effects.

It has been posited that college students' engagement in mobile reading is due to their intention to be entertained [22,62]. The investigation of this study differs. Compared with traditional paper reading, students, even those who spent the minimum average time mobile reading, pursued mobile reading with diverse needs, indicating the academic, social, emotional factors that motivate students' engagement in mobile reading. The main function of reading—to obtain information and knowledge—is still the core need of college students when mobile reading. These college students (both undergraduate and postgraduate students) had strong information needs and moderate academic needs (Table 4). Among them, 26 students (N = 30), including 15 undergraduate students and 11 postgraduate students, tried to read, understand, and bear information in mind by using reading strategies. Nevertheless, the students' reading experience and reading self-efficacy indicated that sometimes they had difficulties in engaging in mobile reading. According to the interviewees' reading experience and reading self-efficacy, they suffer from poor retention/memory, which might impact their cognitive engagement in an in-depth reading of academic materials and reduce their efficiency when reading informative materials. Their anxiety about the quality of platform and the authenticity of content might also impede their social and emotional engagement.

To avoid mobile reading difficulties, college students must understand the factors of mobile reading and address their difficulties. Mobile reading that supplies a method of mobile learning for college students as digital natives may facilitate their autonomous studying anytime and anywhere. Sustainable and lifelong learning has become a new trend of learning in the era of the knowledge economy. How to effectively cultivate college students' autonomous ability in reading and learning has become a topic of the times in the field of higher education [63]. As a new learning method, college students' mobile reading could be one of the effective ways to assist students' independent learning and sustainable development in the future. In order to improve the effects of mobile reading on college students, there are some suggestions that could be considered.

Firstly, we must improve college students' awareness of copyright and payment for high-quality mobile reading resources. There is still some vulgar, shoddy, one-sided, and/or distorted content displayed in various apps. So, students need to learn how to judge and select official apps and channels to ensure access to high-quality content from legitimate resources. it is necessary to build students' awareness of the copyright of content read in apps to protect high-quality reading content. Additionally, through publicity and guidance,

students must be encouraged to pay for high-quality platforms, resources, and content, having a broader awareness of paying for knowledge.

Secondly, college students need to be trained to improve their information literacy, which is particularly important in the era of mobile information bombardment. According to the results, the libraries in colleges should issue high-quality content that meets students' diverse needs. With the help of university library platforms, technical courses, such as information retrieval and information processing, could be opened for students to train their capabilities to collect, judge, and process information. At the same time, participating in mobile reading clubs organized by the library or departments may encourage students to engage in open discussions and a collision of ideas, enriching their reading experience and understanding. It is also necessary to care about the emotional needs of college students during supervision.

Last but not the least, based on university–enterprise partnerships, we must design and develop apps and platforms that focus on auxiliary reading and the interactive thinking functions of mobile devices. In order to avoid the phenomenon of information homogenization caused by the automatic filtering of information, apps must have more autonomous functions from a diversified perspective. At the same time, attention should be paid to the development of new technologies with traditional reading and paper reading functions, such as improving the functions of scribing, highlighting, and annotating words and sentences, as well as designing new functions, such as "export notes", "query notes", "mark information query", "make mind maps based on notes", and so on. Combined with the characteristics of social and open mobile reading, improving the interactive functions of sharing and commenting after reading is also necessary to meet young readers' personal and social needs simultaneously.

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