

دراسة تأثير تعدد المهام الرقمية على الفهم القرائي لمتعلمي اللغة الإنجليزية كلغة أجنبية: الميول، الدوافع، والقدرات الذاتية المدركة لأدائها

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المستخلص: يُعتقد أنَّ العديد من متعلمي اللغة الإنجليزية بصفتها لغة أجنبية ينخرطون بشكل مكثف في أداء مهام متعددة أثناء قراءتهم نصوصًا باللغة الإنجليزية على الأجهزة الرقمية المختلفة. هدفت هذه الدراسة إلى بحث تأثير أداء المهام المتعددة على الفهم القرائي للنصوص الرقمية بشكل عام، وكذلك على مستويات الفهم الحرفي المباشر، والاستنتاجي العميق. كما تستطلع الدراسة تصورات متعلمي اللغة الإنجليزية حول تأثير أداء المهام المتعددة على القراءة الرقمية باللغة الثانية، واتجاهاتهم نحو هذا السلوك، والدوافع الكامنة وراءه، ومدى إدراكهم لقدراتهم الذاتية على تنفيذ مهام متعددة أثناء قراءة النصوص الرقمية باللغة الإنجليزية. وشارك في الدراسة 50 من متعلمي اللغة الإنجليزية السعوديين. وجمعت بيانات الدراسة باستخدام أدوات متعددة، اشتملت على اختبار الفهم القرائي واستبانة. وقد استخدمت عدة أساليب إحصائية تمثلت في المتوسطات الحسابية، والانحرافات المعيارية، واختبار *t* للمجموعتين المرتبطتين، وتحليل التباين المتعدد لقياس واحد. وأظهرت نتائج الدراسة أن الفهم القرائي كان أفضل بشكل ملحوظ عند أداء مهام متعددة رقمية مقارنةً بالفهم دون أداء تلك المهام أثناء قراءة النصوص الرقمية. كما أشار المشاركون إلى أن أداء المهام المتعددة أثناء قراءة النصوص الرقمية له تأثير سلبي معتدل على الفهم، والتركيز، والتفاعل، والقدرات الإدراكية. كذلك كشفت نتائج الدراسة عن وجود ميل واضح لدى المشاركين لأداء مهام متعددة، مع دافعية معتدلة المستوى، وقدرة ذاتية متوسطة على تنفيذ هذه المهام خلال القراءة الرقمية. قدّم البحث مجموعة من التوصيات والاقتراحات التعليمية اللغوية والتي منها على سبيل المثال ضرورة تعليم الاستخدام الفعال والمسؤول للأدوات القرائية الرقمية، وتنمية مهارات تعدد المهام أثناء القراءة الرقمية، وإيجاد بيئات، أو منصات رقمية قرائية خالية من المشتتات، وكذلك تم تقديم مجموعة من المقترحات البحثية المستقبلية.

الكلمات المفتاحية: تعدد المهام الرقمية، متعلمو اللغة الإنجليزية كلغة أجنبية، الفهم القرائي باللغة الثانية، ميول تعدد المهام، دوافع تعدد المهام، كفاءة تعدد المهام.

Exploring the Effects of Digital Multitasking on EFL Learners' Reading: Tendencies, Motivation, and Self-Perceived Abilities

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ABSTRACT: It is believed that many learners of English as a foreign language (EFL) engage in prolific use of digital multitasking using digital multifunction devices while they are reading digital English texts within a short span of time. The present study aimed to investigate the effects of digital multitasking on both general second language (L2) reading comprehension, along with comprehension at surface and in-depth levels. Additionally, it explores the perceived impacts of digital multitasking on L2 reading, multitasking tendencies, motives guiding multitasking behaviors, and self-perception of multitasking ability. The participants of this mixed quasi-experimental study were 50 Saudi EFL learners. Data collection utilized a triangulation of multidimensional methods, including reading comprehension assessments and a cross-sectional survey. Data analysis encompassed descriptive statistics (means and standard deviations), and inferential statistics (paired *t*-tests and one-way repeated-measures analysis of variances). The results revealed that reading comprehension was significantly better when multitasking while reading digital texts, compared to comprehension without multitasking. Participants perceived multitasking while reading digital texts to be moderately detrimental to reading comprehension, concentration, engagement, and cognitive ability. The study also unveiled frequent multitasking tendencies among participants, coupled with moderate motivation and self-assessed ability to multitask while reading digitally. Pedagogical implications (e.g., teaching effective and responsible use of digital tools, developing robust multitasking skills, and creating distraction-free digital reading environments) are thoroughly explored, and promising avenues for further research in this area are identified.

Key Words: Digital multitasking, EFL learners, L2 reading, Multitasking behaviors, Multitasking efficacy

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Introduction

In today's rapidly evolving digital era, the ubiquity of electronic devices and the growing tendency towards multitasking have fundamentally altered how people engage with information and educational resources. This shift is particularly evident in English as a Foreign Language (EFL) learning, in which learners increasingly face digital distractions and the cultural norm of multitasking while reading. Digital multitasking, defined as simultaneously managing multiple tasks or information streams, has become a routine behavior for EFL learners, especially during digital-based reading experiences.

Previous research has highlighted the profound influence of digital technology on reading behaviors and habits. For instance, Al-Seghayer (2023) underscored that the increasing accessibility of digital texts and the burgeoning expansion of the digital readership environment have transformed language learners' engagement with English texts in the digital sphere. These changes have led to an increase in novel reading behaviors and patterns. Echoing similar views, Chevet et al. (2022) emphasized digital technology's substantial impact on students' reading habits. They argued that this influence reoriented reading into a digitally driven activity that required juggling various tasks concurrently.

This exploration of the effects of digital multitasking on EFL learners' reading delves into the intricate interplay between the digital world and pursuit of language mastery through reading. To navigate this multifaceted terrain, it is crucial to examine the potential consequences of digital multitasking on the L2 (second language) reading skills. Several compelling factors underscore the importance of conducting a thorough empirical study of this issue, including understanding its impact on comprehension, exploring cognitive processes, investigating self-regulation, informing pedagogical practices, addressing distractions, and enhancing digital literacy. By examining EFL learners' multitasking tendencies, cognitive demands, and perceived abilities, this study aims to illuminate how digital multitasking influences reading comprehension at both the surface and in-depth levels. Ultimately, these insights can help language practitioners design more effective reading experiences and support learners in maintaining their focus and engagement during digital reading tasks.

Given the prevalence of multitasking while engaging in digital reading materials, we can gain a deeper understanding of how multitasking influences L2 reading

comprehension. Such inquiries also enable the exploration of cognitive processes at play during digital reading, the cognitive demands imposed by multitasking, and the strategies employed by EFL learners to reconcile these competing demands. Furthermore, this exploration paves the way for investigating the role of self-regulation and metacognitive skills in mitigating the adverse effects of digital multitasking. Additionally, it empowers language practitioners to design more immersive and effective L2 reading experiences and instructs EFL learners to focus effectively on their reading task.

Multitasking often leads to distractions, which can have a detrimental effect on reading comprehension. By scrutinizing EFL learners' proclivity to multitask tasks and the motivations driving this behavior, researchers can unveil insights into the factors that divert EFL learners' attention from reading tasks. This knowledge can be leveraged to develop strategies that help learners maintain concentration and remain engaged. The ability to manage digital multitasking effectively is a crucial skill in today's technology-driven world. Research on EFL learners' perceived multitasking abilities can pinpoint areas in which students may require additional support and training, ultimately enhancing their efficiency in reading English digital texts.

Hence, the primary objectives of this study are to investigate the influence of digital multitasking on L2 reading comprehension, both overall and at surface and in-depth levels; explore EFL learners' propensity for multitasking and the motivations underlying their multitasking behaviors; and assess EFL learners' perceived competency in multitasking during L2 reading. By thoroughly exploring the complexities of digital multitasking and its effects, this study aims to deepen our understanding of the challenges and opportunities it presents in English language learning. Ultimately, the findings of this study will contribute to a deeper understanding of how digital multitasking shapes EFL learners' reading experiences and provide practical insights for language educators. These insights will support the development of teaching methods that address the challenges of multitasking by equipping learners with strategies to maintain focus and improve comprehension in a technology-driven world.

A literature review of the effects of digital multitasking on reading comprehension, perceived effects of digital multitasking on reading, multitasking ability, and multitasking tendencies and motives guiding multitasking behaviors is now presented, followed by a brief

summary that concludes the review of related literature.

Multitasking while reading digital texts in English remains an underexplored domain within the realm of English as a second/foreign language (ESL/EFL) research. Given the limited number of empirical studies dedicated to digital multitasking in the context of L2 reading, this literature review compiles relevant studies from first-language research context, despite their relative scarcity thereof.

Digital multitasking during reading entails concurrent engagement in various tasks or activities on digital devices, such as smartphones, tablets, or computers, while endeavoring to read and comprehend digital English texts. These additional tasks can encompass activities like Internet browsing, email checking, social media perusing, video clip watching, music listening, and any other digital forms of multitasking. According to Aagaard (2019), the notion of digital multitasking within scientific practice is not characterized by a mere tally of tasks; rather, it entails a qualitative differentiation between on-task and off-task activities. Both of these multitasks demand conscious attention, ultimately diminishing the cognitive processing capacity available for other tasks.

Effects of Digital Multitasks on Reading Comprehension

The overall effect of digital multitasking on reading comprehension presents a mix of convergent and divergent results. When Cho et al. (2015) examined the conditions under which multitasking could either impair or have no effect on reading comprehension, their findings demonstrated that multitasking requiring a high cognitive load had an adverse effect on reading comprehension, whereas other multitasks had no observable detrimental effects. In a similar vein, Tran et al. (2013) delved into the effects of multitasking while reading expository text and observed participants managing up to four additional activities without notable comprehension decline. Contrarily, Subrahmanyam et al. (2013) found minimal effects of multitasking on comprehension. However, Liu and Gu's (2020) study contradicted these results, revealing a significant negative impact of multitasking on comprehension. In their exploration of online multitasking's effect on comprehension, Altamura et al. (2022) noted a slight reduction in reading comprehension.

In complement to the aforementioned empirical investigations, an additional noteworthy contribution comes from Clinton-Lisell (2021), who conducted a comprehensive meta-analysis synthesizing empirical findings and insights

regarding the broader effects of multitasking. The results of this analysis underscored that engaging in multitasking while reading proved to be deleterious on reading comprehension, particularly when time was constrained. Moreover, this meta-analysis evidenced that multitasking while reading tends to be less effective, compared to directing undivided attention toward the primary task of reading.

Perceived Effects of Digital Multitasking on Reading

The examination of the perceived effects of digital multitasking on various reading aspects has been a focal point in the literature. In their study, Mokhtari et al. (2015) investigated the perceived effects of digital multitasking on reading and observed that participants struggled to maintain close focus on their reading material. Building on this research, Liu and Gu (2020) looked into the impact of multitasking on reading attention when reading digital texts and found that multitasking had a statistically significant deleterious effect on participants' reading attention. Similarly, Liu (2022) explored the potential ramifications of multitasking for reading; finding a significant impact on participants' reading experience, primarily due to the challenge of maintaining engagement with the text and frequent attention-switching, which prolonged the time required to complete reading tasks.

Multitasking Ability

The overall ability to manage multitasking, specifically while engaging in multiple tasks alongside reading digital English texts, has been measured in relatively few studies. Brown's (2013) study explored participants' self-perceived multitasking abilities, revealing a prevailing sense of confidence in their ability to manage multiple tasks adeptly. However, Liu's (2022) study suggested that participants encountered challenges when reading digital texts without engaging in multitasking activities.

Multitasking Tendencies and Motives Guiding Multitasking Behaviors

Multitasking tendencies and motivations play particularly conspicuous roles in influencing an individual's likelihood to engage in multitasking while reading digital texts and the underlying reasons for their actions. Mokhtari et al. (2015) investigated the prevalence of multitasking during digital reading, with participants frequently reporting engagement in multiple tasks simultaneously while reading. Along the same line, Baron (2017) observed a higher proclivity for multitasking among participants when reading digitally. In parallel, Liu (2022) emphasized the intensive engagement of participants in multitasking

during digital text reading sessions, indicating a recurring pattern.

Furthermore, studies have delved into the motives guiding or driving multitasking behaviors. Hwang et al. (2014), for example, investigated the primary motivations behind multitasking and identified various factors, including perceived efficiency, enjoyment, habit, information seeking, and social interaction, as significant contributors to this behavior.

The reviewed studies have provided valuable insights into the realm of digital multitasking while reading digital text. Nevertheless, it is worth noting that none of these studies have specifically addressed the overall impact of digital multitasking on L2 reading. Consequently, this review highlights an unexplored area of research: the ramifications of digital multitasking for EFL learners' overall reading comprehension and comprehension at surface and in-depth levels. Moreover, further investigation is warranted into EFL learners' perceived effects of digital multitasking on L2 reading, their propensity to multitask while reading digitally, the driving forces behind their multitasking behaviors, and their self-perceptions of multitasking efficacy. The current study has been crafted to address these gaps in the extant research and illuminate the relationship between digital multitasking and L2 technology-assisted reading, establishing a basis for future exploration in this domain.

Overview of the Study

Digital multitasking while reading digital English texts is an increasingly prevalent practice among EFL learners, driven by the proliferation of new digital media and technologies and the widespread use of digital devices. These learners often juggle multiple tasks simultaneously while reading on various digital platforms, such as desktop or laptop computers, tablets, and smartphones, which have gained popularity as reading tools. It is critical to understand the effects of multitasking on L2 reading as language learners are more prone to multitask when reading digital English texts. Specifically, the overall effect of multitasking on reading comprehension warrants particular attention, as do the perceived effects of digital multitasking on L2 reading, the tendency to multitask while reading digital texts, and the motives guiding multitasking behaviors and the perception of EFL learners' multitasking ability. Indeed, these areas remain under-reported in previous studies and have not been thoroughly explored in existing literature. Consequently, a substantial gap exists in the current body of research, which serves as a primary motivation for this study.

In response to this gap, this study is designed to lay the groundwork for future research on the effects of digital multitasking on L2 reading, given that digital reading has become an integral component of EFL learning. This study is guided by five central research questions:

1. Does reading comprehension performance differ when EFL learners engage in multitasking while reading digital texts?
2. What are the effects of digital multitasking on EFL learners' surface and in-depth reading comprehension?
3. What are the perceived effects of digital multitasking on second-language reading?
4. When reading digital texts, do EFL learners multitask more frequently? What motivates them to engage in such behaviors?
5. How do EFL learners perceive their ability to handle multitasking when reading digital texts?

Participants

A convenience sample of 50 Saudi EFL learners was randomly selected from the College of Languages and Translation at a Saudi university during the 2022–2023 academic year. The participants comprised 28 males and 22 females aged 19 to 21 years ($M = 19$). All participants were native Arabic speakers majoring in English, resulting in a fairly homogeneous sample.

Participants were selected based on their academic placement level, compatibility, English-language proficiency, and engagement with digital English texts. They were all in their seventh academic level (equivalent to the "junior year") of a 4-year English undergraduate degree program, ensuring they shared the same level of English proficiency. Their scores on the Test of English as a Foreign Language (TOEFL), along with evaluations from their instructors, validated this selection. These criteria ensured that all participants had reached an advanced proficiency level, with TOEFL scores falling between 530 and 600. Moreover, their instructors confirmed their proficiency in reading. In essence, all participants had achieved a functional level of English that enabled them to read digital English texts and engage in digital multitasking while reading.

All were expected to have attained intermediate proficiency TOEFL scores of 450–530 and to confirm reaching the intermediate proficiency level in reading by consulting with their instructors.

Table 1 (see Appendix A) provides an overview of the participants' background characteristics, including their experience reading digital English-language materials and multitasking

while reading digital texts. This data was collected from Section 1 of the survey developed specifically for this study.

Procedures

The study comprised two phases conducted over three sessions. In the initial phase, lasting 90 minutes, male participants met with the principal investigator, while female participants met with the research assistant. These meetings, which took place either individually or in small groups in a seminar room equipped with laptop computers, began with participants providing informed consent. All participants were given detailed information about the study's purpose, procedures, potential risks, and benefits. Written consent was obtained to ensure their voluntary participation, and they were informed of their right to withdraw from the study at any time without consequences. Following this, participants completed two tasks: (1) a pencil-and-paper background survey and (2) the TOEFL test, which contained multiple-choice questions in three categories: listening, grammar, and reading. To protect participant privacy, all data were anonymized, and identifying information was securely stored in encrypted files accessible only to the research team.

The second phase of the study consisted of two 60-minute experimental sessions. In each session, participants read two analogous digital expository texts on a computer screen or on any digital device under two distinct conditions: one involving multitasking while reading and the other not involving multitasking. To foster naturalistic reading behavior, participants were given unrestricted and self-paced reading times for each text. However, each text was read for varying lengths: the text that did not involve multitasking was read for 30 minutes, while the text that involved multitasking while reading was read for approximately 45 minutes. This extended time was primarily due to participants alternating between reading and performing the required multitasking tasks, which naturally prolonged the reading duration. After reading each text, each participant took 10-15 to complete a comprehension test, followed by a survey lasting 15-20 minutes. Notably, there were no missing data in the survey, as all participants completed it. Counting a 15-minute break between the study phases, all tasks were successfully concluded within a 4-h timeframe.

Design Overview

This mixed quasi-experimental study adopted a within-subjects design comprising two distinct conditions. In the first condition, participants engaged in reading a digital text and concurrently watched a video clip and sent a WhatsApp message to simulate a multitasking situation. In the second condition, participants

read a digital text without engaging in multitasking. The different texts (i.e., the independent variables) were experimentally manipulated by subjecting the participants to the same treatment conditions. In both conditions (multitasking and non-multitasking), we had equivalent groups or a single group alongside a non-pretest-post-test comparison group. Participants effectively served as their own controls in this design.

The study also incorporated standard survey methodologies to record the effects of digital multitasking on L2 reading. The survey primarily addressed the perceived effects of digital multitasking on L2 reading, multitasking tendency, motives guiding multitasking behaviors, and perceived multitasking ability. The principal investigator devised the survey after reviewing related literature and after conducting a preliminary survey with a convenience sample of participants. Data were collected from various sources to determine whether engaging in multitasking while reading short expository English-language digital texts affected EFL learners' reading comprehension and other related aspects as well. Subsequently, the data underwent descriptive and inferential statistical analyses, allowing for the potential corroboration of findings across different methods.

Materials and Instruments Reading passages.

Two passages were excerpted from the self-improvement book, *Atomic Habits: An Easy and Proven Way to Build Good Habits and Break Bad Ones* (Clear, 2018). Both passages, titled "The Ultimate Productivity Hack Is Saying No" ("UPHSN") and "What I Do When I Feel Like Giving Up" ("WDWFLGU"), were expository texts that would likely be unfamiliar to most high-intermediate EFL learners. However, the topics were chosen to resonate with participants, aligning with their aspirations for self-improvement and cognitive insights. Eight specific criteria were considered in selecting the passages: (1) shared subject matter, (2) consistent literary style, (3) equal length, (4) comparable difficulty level, (5) authenticity, (6) minimal prior knowledge, (7) logical rhetorical organization, and (8) cultural relevance. Arias (2007) and Ghahroudi and Sheikhzadeh (2017) have identified these criteria as crucial when selecting reading materials.

To simulate today's digital reading environment, in which participants engage in digital multitasking, the selected texts were converted into digital texts or web text formats using Google Sites. The texts were divided into smaller paragraph units that were displayed independently on computer screens or other

digital screen devices. Each passage was displayed on a total of five consecutive digital screens (pages). The paragraphs' content, length, and syntactic structure remained unchanged. Each page on which the text was displayed was divided into three frames: the top frame displayed the text's title, the middle frame presented the text itself, and the bottom right frame housed navigation buttons. Participants could navigate through the text by scrolling within each page. Clicking the "Read more" button allowed progression to the subsequent page, while the "Back" button facilitated a return to the preceding page. On the second page of the "UPHSN" text, participants were instructed to watch a video clip, respond to two related questions, and submit their answers via an embedded Google Form. Afterward, they were prompted to click on the "Continue reading" button to proceed. While progressing through the third page, participants were instructed to send a WhatsApp message briefly outlining their plans to a specified mobile number. Once again, they had to click the "Continue reading" button to move forward. Conversely, when reading the "WDWFLGU" text, the participants were not engaged in any multitasking activities.

Reading comprehension measures.

To assess the participants' reading comprehension, a one-dimensional multiple-choice test was administered, comprising six questions, each with four possible answers. The format and types of questions remained uniform across the tests. Both surface and in-depth levels of reading comprehension were assessed. Throughout their reading of the digital texts, participants could access the multiple-choice test by clicking a designated button, enabling them to seamlessly transition between the texts and the comprehension questions.

Scoring procedures.

Correct answers earned participants 1 point, while incorrect ones were awarded 0 points. Consequently, a maximum of 6 points could be awarded for each test, with a maximum of 3 points each for surface and in-depth reading comprehension. The answers were electronically stored in a MySQL database through tailored PHP code.

Validating the Research Instruments

Two EFL reading specialists, two test specialists, and four EFL learners who did not participate in the study provided valuable insights and suggestions on the tests. Utilizing a 5-point Likert scale, nine criteria were employed to evaluate the tests, encompassing (a) clarity of instructions, (b) alignment with the stated research objectives, (c) appropriateness of the test duration, (d) dependence on the text passages, (e) coverage breadth, (f) mitigation of

response bias, (g) plausibility of distractors, (h) appropriateness of wording, and (i) randomization of test items.

Revision suggestions were solicited through an open-ended question, and statistical analyses were performed on the responses to establish content validity. The final versions of the tests were then refined based on the feedback and suggestions provided by the experts.

Additionally, we conducted item-specific analyses to assess the difficulty and discrimination levels of the questions in the multiple-choice tests. The Kuder-Richardson formula-20 was employed to estimate the internal consistency reliability of the tests following a single administration. The internal consistency reliability was determined to be 0.75 for the multiple-choice test related to "UPHSN" and 0.76 for the test linked to "WDWFLGU".

Regarding the two multiple-choice tests, item analysis revealed a difficulty index ranging from 0.55 to 0.80 and 0.52 to 0.89, respectively. Furthermore, the item analyses indicated that, for both tests, discriminability ranged from 0.20 to 0.55 and .22 to 0.53, respectively.

Constructing the Effects of Digital Multitasking on L2 Reading Survey

EFL learners who took part in the study responded to a cross-sectional survey about the perceived effects of digital multitasking on L2 reading comprehension, multitasking tendency, multitasking behaviors, and perceived multitasking ability. Survey items were rated using a 4-point Likert scale, which ranged from 1 (*agree* or *strongly agree*) to 4 (*disagree* or *strongly disagree*), 1 (*always*) to 4 (*never*), or 1 (*completely able to do so*) to 4 (*unable to do so*). In Section 1 (Background information), participants provided demographic details, including their typical weekly usage of digital devices, the amount of time spent reading digital materials available in English each week, and whether they engaged in digital multitasking while reading digital texts. In Section 2 (i.e., Perceived Effects of Digital Multitasking on Second-Language Reading scale), 37 items gauged the participants' perceived views on digital multitasking's effects on various aspects of L2 reading. In Section 3 (i.e., Multitasking Tendency and Motives Guiding Multitasking Behaviors scale), 10 items inquired into participants' frequency of multitasking while reading digital texts and their motivations for engaging in this behavior. Last, in Section 4 (i.e., Perceived Multitasking Ability scale), eight items were presented to determine participants' perceptions of their digital multitasking abilities while reading digital texts.

Piloting the Instrument

To test the validity and reliability of the developed survey and to refine it at the piloting stage, we enlisted eight EFL learners from the same target population. Additionally, four EFL instructors with extensive experience in computer-aided language learning participated in the pilot test. The procedures for the pilot study closely mirrored those of the primary study. Both learners and instructors were tasked with thoroughly examining the survey items' wording, sequence, clarity, and overall comprehensibility. Their objective was to pinpoint any potential ambiguities or sources of confusion. Furthermore, any challenges encountered while completing the instrument were meticulously recorded.

Following the completion of the survey by the instructors and learners, we interviewed them to gather additional insights and feedback on these aspects. Drawing from the intended purpose of the research instrument and guided by input from a panel of experts and EFL learners, we proceeded to make necessary modifications to the instrument.

Instrument Reliability

We assessed the instrument's internal consistency using Cronbach's alpha correlation statistical procedure to ascertain its reliability. The alpha coefficient for the "Perceived Effects of Digital Multitasking on L2 Reading" scale was 0.931, while the "Multitasking Tendency and Motives Guide Multitasking Behaviors" scale yielded an alpha coefficient of 0.851. The "Perceived Multitasking Ability" scale also had an alpha coefficient of 0.749. The overall reliability coefficient, encompassing all scales, amounted to 0.803.

Results

The results are presented in two parts. The first part details the results of EFL learners' overall reading comprehension of digital texts, along with their surface- and in-depth comprehension levels under two conditions: multitasking (reading digital text while simultaneously performing other tasks) and non-multitasking (reading digital text without additional tasks). In the second part, the effects of digital multitasking on L2 reading are presented.

Data Analysis Procedures for the First and Second Questions Sample Description and Normality Assessments

The data was drawn from two assessment samples. The first sample comprised 50 repeated assessments examining reading comprehension after perusing digital texts in both multitasking and non-multitasking text forms. This sample resulted in a total of 300 observations (i.e., 6×50). The second sample contained 50 repeated assessments aimed at

measuring two aspects of reading comprehension— surface and depth— after perusing digital texts in each of the two distinct formats. This is also corresponded to 300 observations (i.e., 6×50).

Paired *t*-tests were performed to ascertain any significant statistical difference in reading comprehension between multitasking and non-multitasking scenarios with digital text. The analysis also assessed if any such differences existed between the participants' surface and in-depth comprehension under both conditions.

In a paired *t*-test, the dependent variable is represented by differences between sets of values rather than the original data values. This test makes several assumptions that must be met, including the independent observations of a dependent variable, the continuity of the dependent variable, and the approximately normal distribution of the dependent variable.

The reading comprehension test scores were continuous, meaning that the paired *t*-test dependent variable (the difference between two sets of values) was also continuous. This fulfilled the first assumption of the paired *t*-test. Independence was also met, as each subject was distinct and independent, guaranteeing that the observations were mutually exclusive.

The assumption of normality was verified using *z*-scores for skewness and kurtosis. The skewness *z*-score is calculated by dividing skewness by its standard error, while the kurtosis *z*-score is obtained by dividing kurtosis by its standard error. For medium-sized samples, such as this study with $N = 50$, an absolute *z*-value exceeding 3.29 for either skewness or kurtosis might suggest non-normality in the data. If the data's normality was not confirmed, we utilized the Wilcoxon signed-rank test, a non-parametric counterpart to the paired *t*-test, to validate the results yielded by the paired *t*-tests.

Data Analysis Procedures for the Third, Fourth, and Fifth Questions

The survey data for all 55 of the 4-point Likert scale items were imported and analyzed in SPSS v. 25 (IBM Corp., Armonk, NY). Both inferential and descriptive statistics, specifically means and standard deviations were used to summarize the survey responses and the subscales' composite scores.

As indicated above, the survey comprised four scales, each of which was accompanied by the corresponding subscales. The total score for each scale, which could range from 1 to 4, was computed by averaging the responses of its corresponding items. Higher scores represented greater perceived negative impacts of digital multitasking on L2 reading regarding comprehension, attention, engagement, and

cognitive effects. Concurrently, higher scores suggested a higher propensity for multitasking and the motives steering such behaviors or superior multitasking capabilities while reading digital text.

One-way repeated-measures analyzes of variances (RM ANOVA) were performed to determine whether there was a statistically significant difference in (1) the perceived impact of digital multitasking on second-language reading, including comprehension, attention, engagement, and cognitive effects (2) the perceived multitasking abilities that involved utilizing cognitive resources for multitasking, regulating multitasking activities, and effective. multitasking during reading digital text.

The normality assumption was assessed via z-scores of skewness and kurtosis. In cases where the data deviated from the normal distribution, the Friedman test was used to validate the results of RM ANOVA. The sphericity assumption of the RM ANOVA was examined using the Mauchly test and if violated the Greenhouse-Geisser adjustment was applied. Post-hoc

pairwise comparisons using the Sidak method were carried out whenever the within-subjects main effect of the RM ANOVA was deemed significant. For all tests, a p -value less than 0.05 was considered indicative of significance.

Research Question (RQ)1 Results

RQ1 investigates if a disparity exists in the reading comprehension capabilities of EFL learners when multitasking versus not multitasking while consuming digital texts. As shown in Table 2, the mean comprehension score was 3.40 (SD) = 1.14) when multitasking and 3.04 (SD = 1.03) in the absence of multitasking during digital text reading.

The paired t -test results revealed a statistically significant difference in reading comprehension between the multitasking and non-multitasking conditions ($t(49) = 2.02, p = 0.048$). Participants demonstrated significantly better reading comprehension when multitasking during reading digital texts compared to not multitasking.

Table 2

The Mean Score for Reading Comprehension and the Results of the Paired t-test for RQ1

	Multitasking	Non-multitasking	M _{diff} (SD)	95% CI	Normality assessment				Paired t-test		
	M (SD)	M (SD)			Skewness	Z _{skewness}	Kurtosis	Z _{kurtosis}	t	df	p
Test score	3.40 (1.14)	3.04 (1.03)	0.36 (1.26)	[0.003, 0.72]	-0.79	2.32	0.55	0.83	2.024	49	048

RQ 2 Results

RQ2 explored the effects of digital multitasking on EFL learners' surface- and in-depth reading comprehension. Table 3 presents the mean surface-level reading comprehension score, which were 1.64 (SD = 0.90) for multitasking and 1.84 (SD = 0.74) for non-multitasking while reading digital text.

The results of the paired t -test showed no statistically significant difference in the surface level of reading comprehension between multitasking and non-multitasking conditions during digital text reading ($t(49) = -1.400, p = 0.168$).

The mean score for in-depth reading comprehension was 1.72 (SD = 0.76) when multitasking and 1.12 (SD = 0.80) when not multitasking while reading digital text. The paired t -test results indicated a statistically significant difference in in-depth reading comprehension between multitasking and non-multitasking while reading digital text ($t(49) = 4.287, p < 0.001$). Participants exhibited significantly better in-depth reading comprehension when they engaged in multitasking compared to when they did not.

Table 3

The Mean Score for Reading Comprehension and the Results of the Paired t-test for RQ2

	Multitasking	Non-multitasking	M _{diff} (SD)	95% CI	Normality assessment				Paired t-test		
	M (SD)	M (SD)			Skewness	Z _{skewness}	Kurtosis	Z _{kurtosis}	t	df	p
Surface	1.64 (0.90)	1.84 (0.74)	-0.20 (1.01)	[-0.49, 0.09]	-0.45	-1.32	0.23	0.35	-1.400	49	.168

Continue/Table2

	Multitasking		Non-multitasking		[0.32, 0.24]	Normality assessment			Paired t-test		
	M	SD	M	SD		Skewness	Zskewness	Kurtosis	Zkurtosis	F	p
In-depth	1.72 (0.76)		1.12 (0.80)	0.60 (0.99)		0.71	-0.55	-0.83	4.287	49	<.001

RQ 3 Results

RQ 3 examined the perceived effects of digital multitasking on various aspects of L2 reading, including comprehension, attention, focus, engagement, and cognition. The results, shown in Table 4, indicate that multitasking is perceived to have a moderately negative impact on L2 reading comprehension, attention and focus, engagement, and cognition, with mean scores of 2.87 (SD = 0.60), 3.01 (SD = 0.58), 3.20 (SD = 0.54), and 2.93 (SD = 0.60), respectively. This suggests that the participating EFL learners perceive a detrimental effect on these areas when they multitask while reading digital English text.

Notably, engagement appears to be the most affected domain.

The RM ANOVA results (Table 5) reveal a statistically significant difference in the perceived effects of multitasking across these domains ($F(3, 147) = 8.216, p < 0.001$). Further pairwise comparisons (Table 6) show that multitasking has a more substantial adverse impact on engagement than on comprehension ($p = 0.001$), attention and focus ($p = 0.030$), or cognition ($p = 0.006$).

These findings highlight engagement as the most vulnerable aspect of L2 digital reading under multitasking conditions, which has critical implications for designing strategies to help learners maintain focus and improve reading performance.

Table 4

The Mean Scores of the Perceived Effects of Digital Multitasking on L2 Reading

Subscale	M	SD	Normality assessment			
			Skewness	Zskewness	Kurtosis	Zkurtosis
Comprehension effects	2.87	0.60	-0.08	-0.24	-0.83	-1.26
Attention and focus effects	3.01	0.58	-0.51	-1.50	-0.31	-0.47
Engagement effects	3.20	0.54	-0.70	-2.06	0.91	1.38
Cognitive effects	2.93	0.60	-0.16	-0.47	-0.82	-1.24

Table 5

Results of Mauchly's Test of Sphericity and Tests of Within-subjects Effects with Sphericity Assumed

Model	Mauchly's test				Tests of within-subjects effects				
	Mauchly's W	χ^2	Df	p	F	df1	df2	P	Partial η^2
RQ3	0.894	5.370	5	0.372	8.216	3	147	<0.001	0.144

Table 6

Pairwise Comparisons

Category i	Category j	Mean difference (i-j)	SE	p
Comprehension effects	Attention and focus effects	-0.139	0.061	0.161
Comprehension effects	Engagement effects	-0.328	0.078	0.001
Comprehension effects	Cognitive effects	-0.066	0.073	1.000
Attention and focus effects	Engagement effects	-0.189	0.064	0.030
Attention and focus effects	Cognitive effects	0.073	0.067	1.000
Engagement effects	Cognitive effects	0.262	0.074	0.006

RQ 4 Results

RQ4 aimed to assess the tendency of EFL learners to multitask while reading digital texts, along with the stimulating factors for such behaviors. As shown in Table 7, there was a moderate trend towards multitasking among EFL learners ($M = 2.70, SD = 0.71$). Specifically, the participants reported that they engaged in various types of multitasking while

reading digital texts quite often ($M = 2.72, SD = 0.95$), seldom read digital texts without multitasking ($M = 2.52, SD = 0.86$), and multitasked frequently due to elevated efficiency demands in today's world ($M = 2.86, SD = 0.97$).

In general, EFL learners displayed a moderate level of motivation towards multitasking ($M = 2.40, SD = 0.78$). Their primary motives for

multitasking included: a lack of interest when focusing on one task for a prolonged period without engaging in or contemplating other things (Q47, $M = 2.82$, $SD = 1.08$), an enhanced

ability to gather information (Q46, $M = 2.80$, $SD = 1.11$), and the ability to accomplish multiple tasks within a restricted time frame (Q41, $M = 2.62$, $SD = 1.10$).

Table 7

EFL Learners' Multitasking Tendencies and Motives that Guide their Multitasking Behaviors

	Item	M (SD)
Multitasking tendency (3 items)		
38	Over the course of reading digital texts, I often engage in several types of multitasking (e.g., text messaging).	2.72 (0.95)
39	I never read digital texts without multitasking.	2.52 (0.86)
40	While reading digital texts, I multitask constantly because of the increased pressure to be efficient in today's world.	2.86 (0.97)
Overall score of multitasking tendency		2.70 (0.71)
Motives guide multitasking behaviors (7 items)		
41	I tend to engage in digital multitasking while reading digital texts to complete more tasks within a short time.	2.62 (1.10)
42	In reading digital texts, I enjoy the digital multitasking experience because it allows me to engage in multiple stimuli or activities at once.	2.08 (1.07)
43	I switch between several tasks while reading digital texts because I feel more engaged in each task I am doing.	1.94 (1.02)
44	I undertake several tasks while reading digital texts on digital devices for the sheer enjoyment of it attributable to reading in a non-traditional way.	2.08 (1.18)
45	I multitask while reading digital texts because it makes the experience of reading digital texts more challenging and less boring than performing a singular task.	2.44 (1.15)
46	Whenever I read digital text, I multitask because digital multitasking facilitates my search for information.	2.80 (1.11)
47	While reading digital texts, I engage in several tasks because I lose interest if I have to focus on one task for a long time without thinking about or doing anything else.	2.82 (1.08)
Overall score of motives guiding multitasking behaviors		2.40 (0.78)

RQ 5 Results

RQ5 explored how EFL learners perceive their multitasking capabilities when reading digital texts. As shown in Table 8, participants' self-rated multitasking abilities were average overall, with (M) and (SD) values being 2.65 and 0.55, respectively. In particular, the respective mean scores for perceived multitasking skills such as using cognitive resources, regulating multitasking, and effectively multitasking during digital text reading were 2.51 ($SD = 0.88$), 2.98 ($SD = 0.61$), and 2.42 ($SD = 0.65$). These findings suggested that participants had a moderate ability to employ cognitive resources

to perform the above multitasking activities while engaged in reading digital texts.

Table 9 denotes that the RM ANOVA results signify a significant statistical disparity in using cognitive resources for multitasking, multitasking regulation, and effective multitasking when reading digital texts ($F(1.784, 87.437) = 14.289$, $p < 0.001$). In particular, upon checking the pairwise comparisons' results reported in Table 10, it was found that participants had statistically significantly better ability to regulate multitasking than to use their cognitive resources for multitasking ($p = 0.002$) and to perform multitasking effectively ($p < 0.001$).

Table 8

The Mean scores of the Perceived Multitasking Ability when Reading Digital Text

Perceived multitasking ability	M	SD	Normality assessment			
			Skewness	Zskewness	Kurtosis	Zkurtosis
To use one's cognitive resources for multitasking	2.51	0.88	0.06	0.18	-0.96	-1.45
To regulate multitasking	2.98	0.61	-0.67	-1.97	-0.15	-0.23
To multitask effectively	2.42	0.65	0.31	0.91	0.46	0.70
Overall perceived multitasking ability	2.65	0.55	0.29	0.85	-0.40	-0.61

Table 9
Results of Mauchly's test of Sphericity and Tests of Within-subjects Effects using Greenhouse-Geisser Adjustment

Mauchly's test					Tests of within-subjects effects				
Model	Mauchly's W	χ^2	df	p	F	df1	df2	P	Partial η^2
RQ5	0.879	6.180	2	0.045	14.289	1.784	87.437	< 0.001	0.226

Table 10
Pairwise Comparisons

Category i	Category j	Mean difference (i-j)	SE	p
To use one's cognitive resources for multitasking	To regulate multitasking	-0.470	0.130	.002
To use one's cognitive resources for multitasking	To multitask effectively	0.090	0.105	1.000
To regulate multitasking	To multitask effectively	0.560	0.100	< .001

Discussion

The findings are discussed in relation to several key themes: multitasking's overall effects on L2 reading comprehension, EFL learners' perceived effects of digital multitasking on various aspects of L2 reading, the factors that influence EFL learners' multitasking behavior (e.g., tendencies and motives), and EFL learners' perceptions of their multitasking abilities. This discussion is intended to examine the findings in-depth, draw comparisons with previous research, and offer theoretical insights or justifications where relevant.

The results of reading comprehension tests indicated that the participants' reading comprehension was significantly better when they were multitasking while reading digital texts than when they were not multitasking. Furthermore, the findings revealed that the effects of multitasking versus non-multitasking on surface-level reading did not yield statistically significant differences. Conversely, participants showed significantly better depth of reading comprehension when reading digital texts while multitasking.

Several plausible explanations can be proposed to justify these results. First, the assigned multitasking activities, i.e., sending a WhatsApp message and watching a video clip, appear not to demand conscious effort to focus attention on the secondary task, thereby mitigating any noticeable impairment in reading comprehension. Clinton-Lisell (2021) argued that multitasking activities, which require conscious effort, may exert more pronounced negative effects on reading comprehension than tasks that do not necessitate such conscious effort. Second, self-paced reading and the absence of time constraints seemed to enable participants to reread digital texts to compensate for any forgotten or lost

information during reading digitally. Consequently, this may have helped mitigate multitasking's potential negative effects on reading comprehension. Third, EFL learners who are digital natives may possess enhanced abilities to multitask while reading digital texts, and they appear to be comfortable doing so. They can adeptly handle multiple tasks simultaneously without apparent negative impacts on reading comprehension. In other words, they are accustomed to dividing their attention between various stimuli. For digital natives, multitasking while reading digital text, as Tran et al. (2013) proposed, does not inherently increase load and consequential potential impairment of reading comprehension.

The findings of this study are consistent with those of Subrahmanyam et al. (2013), Tran et al. (2013), and Cho et al. (2015), all of whom found no significant harm reading comprehension from multitasking with digital texts. However, they contrast the conclusions of Liu and Gu's (2020) and Clinton-Lisell's (2021), who reported the detrimental effects of multitasking on reading comprehension.

The analysis of the survey revealed that participants perceived multitasking while reading digital texts as moderately detrimental to their reading comprehension, focus, engagement, and cognitive ability. In addition, they indicated that multitasking's negative impact on engagement was more pronounced when they read L2 digital texts than the effects on comprehension, attention, and focus.

The results also showed that the participants frequently multitask when reading digital texts, rarely engage in single-task reading, and often attribute multitasking to the increased demand for efficiency in today's society.

Moreover, the survey analysis indicated that EFL learners who participated in the study were moderately motivated to multitask while digital

platforms. They primarily multitasked because they become disinterested when they have to focus on one task for long durations without engaging with or thinking about anything else, they use digital multitasking to support their information-seeking endeavors, and it allows them to complete multiple tasks within a limited timeframe.

The participants rated themselves as moderately able to multitask when reading digital texts. Similarly, they showed a moderate ability to allocate cognitive resources to multitasking while reading digital texts. Moreover, they seemed able to regulate multitasking rather than efficiently utilizing their cognitive resources.

Several potential speculations can be proposed to elucidate these findings. Perceptions of multitasking and its effects on participants' reading comprehension, concentration, engagement, and cognition could be influenced by a mixture of personal experiences, social norms, and cognitive biases. They may prioritize surface-level understanding of digital text over deeper comprehension, potentially neglecting multitasking's cognitive consequences. Having grown up in a digital era, they might view multitasking as natural or a norm, failing to recognize its pitfalls. As Liu and Gu (2020) highlighted, digital native readers tend to prefer multitasking when reading digital text. They might also overestimate their multitasking abilities to perform tasks concurrently, prioritize speed over comprehension, and attribute difficulties to factors beyond multitasking.

Participants often multitask while reading digital texts for a variety of reasons. They may believe that multitasking increases efficiency because it allows them to perform multiple activities simultaneously. They may also find it difficult to sustain prolonged focus on a single task. The constant availability of digital stimuli provides a convenient way to escape the potential monotony of reading and interruptions to attention. In this light, Hwang et al. (2014) noted that readers often resort to multitasking to alleviate boredom and amplify stimulation, possibly satisfying their pleasure-related desires.

Several motivations can induce participants to multitask during digital reading. They may perceive themselves as proficient task-switchers and believe multitasking increases productivity. This perceived efficiency fuels their motivation to multitask while reading digital content.

Participants may believe that they can regulate multitasking due to cognitive distortions and misconceptions. They may inflate their abilities, believing they excel at multitasking because

they have not experienced or have overlooked the negative impact of dividing attention. In addition, they might also underestimate how much multitasking harms reading comprehension. Instead, they may focus on tasks they deem manageable while ignoring deterioration elsewhere. In their belief of becoming better multitaskers due to exposure to technology, they fail to acknowledge that successful multitasking is more contingent on cognitive capabilities than mere technological interaction.

Overall, the current study's results might be best interpreted in line with Jeong and Hwang's (2016) argument that multitasking may negatively affect cognitive outcomes, such as attention, comprehension, and recall during reading, while simultaneously positively affecting outcomes related to attitude and preference.

This study's findings contradict those of Mokhtari et al. (2015), Liu and Gu (2020), and Liu (2022), who all reported challenges in participants' ability to maintain focus while reading digital text. Conversely, they coincide with Brown's (2013) study, in which participants expressed confidence in their ability to multitask while reading digitally. Additionally, the results align with those of Mokhtari et al. (2015), Baron (2017), and Liu (2022), demonstrating the prevalence of multitasking in digital reading. Similarly, the motivations underlying multitasking behaviors correspond with Hwang et al.'s (2014) findings.

Implications

The pedagogical implications of multitasking during digital reading are wide-ranging. One of the key pedagogical implications of multitasking is to underscore to EFL learners the cognitive toll of multitasking while reading digitally and suggest ways to lessen it. EFL teachers should instruct EFL learners on the effective and responsible utilization of digital tools, including when and how to multitask efficiently if deemed necessary. Furthermore, they can actively support learners in developing robust multitasking skills. These strategies include task chunking, capitalizing on downtime, employing multiple devices, setting aside specific blocks of time for different activities, ensuring uninterrupted reading time, and eliminating distractions. Wang et al. (2022) posit that using self-regulated learning strategies could offer a potent method to prevent digital readers from getting caught up in multitasking.

Another pedagogical implication of multitasking while reading English digital texts is that EFL teachers should establish and cultivate digital reading environments

conducive to focused attention. These digital reading environments should be designed to minimize distractions and promote single-task reading. Encouraging the use of active reading strategies and leveraging the diverse tools and features offered by modern digital devices, which facilitate text manipulation and comprehension—such as note-taking, checking definitions and meanings of terms, and summarization—can be instrumental in maintaining engagement with digital texts and effectively regulating EFL learners' multitasking behaviors.

To mitigate the negative effects of digital multitasking on L2 reading, EFL teachers are encouraged to promote mindful reading practices that foster better reading habits and ultimately optimize the reading experience for EFL learners in the digital multitasking landscape. This can be done by developing various informed strategies, such as helping EFL learners manage multitasking and sustain their focus effectively. Moreover, it may include facilitating the roles of self-regulation and metacognitive skills in mitigating the adverse effects of digital multitasking. Additionally, promoting mindful reading could involve teaching readers to discern the most crucial task, such as reading a digital text, and giving it precedence over less significant activities. Moreover, it is advisable to periodically promote "digital detox" sessions during which EFL learners disconnect from distracting digital devices or platforms entirely to concentrate solely on their reading. In addition, EFL teachers should advise learners to create dedicated, clutter-free study spaces, which may entail disabling notifications, closing irrelevant browser tabs, and utilizing website blockers. Lebedeva (2021) asserted that successful digital reading largely depends on readers' self-control: their ability to stay focused on the reading task and overcome any distractions that impede the reading process. Liu (2022) echoed this sentiment by highlighting the necessity of teaching students to harness self-control effectively to manage multitasking and sustain focus while reading digitally. This can be achieved by disabling social media applications and minimizing or deactivating alert notifications during interaction with digital texts.

Limitations and Considerations for Future Research

The current study carries several limitations. It focuses only on two specific forms of digital multitasking activities; the findings might not be universally applicable. The reliance on self-reporting or cross-sectional data, as well as the assessment of reading comprehension through

multiple-choice tests, may not fully capture all instances or nuances of potential multitasking effects on L2 reading. The study did not explore the long-term effects or consequences of multitasking on L2 reading. Lastly, expository texts were used exclusively to examine the effects of digital multitasking on L2 reading, leaving out the investigating effects on other textual forms, such as narratives or descriptive texts.

The following recommendations are intended to guide future research endeavors on digital multitasking while reading English digital texts. One promising avenue for exploration involves scrutinizing how various forms of multitasking affect EFL learners' reading comprehension. Subsequent investigations could explore the effectiveness of interventions and strategy training programs in aiding EFL learners to maintain focus during digital reading experiences. Another valuable line of inquiry is identifying features that can be integrated into digital platforms to foster concentrated reading. Researchers may wish to explore whether multitasking induces changes in L2 reading habits, attention spans, or cognitive abilities over time. Finally, a compelling direction for future research is to investigate whether certain individual traits or reading preferences among EFL learners correlate with a greater likelihood of digital multitasking when reading digitally.

Conclusion

This study has explored the impact of digital multitasking on general L2 reading comprehension, as well as on comprehension at surface and in-depth levels. Additionally, it offers valuable insights into the perceived effects of digital multitasking on L2 reading, multitasking tendencies, motives guiding multitasking behaviors, and self-perception of multitasking ability. The findings of the study serve as a valuable starting point for L2 practitioners, especially those interested in devising practical and efficient digital reading strategies to support language learners in navigating English digital texts within the constantly evolving digital reading landscape. As such, this study lays the groundwork for further exploration of uncharted avenues and future research on L2 digital reading practices.

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Appendix A

Table 1
Participants Information

Gender	Male	Female				Total
	28	22				50
	56%	44%				
Age	17--19	20--22	23-25	26-28	29-31	
	2	17	29	2		
	4%	34%	58%	4%		
How often do you multitask when reading digital texts?	Always	Sometimes	Never			
	7	41	2			
	14%	821%	4%			
Are you able to handle digital multitasking while reading digitally?	Yes	No				
	32	18				
	64%	34%				
Which digital multitasks do you often engage with when reading digitally?	texting	emailing	communication via social media	watching video clips	browsing the internet	others
	20	6	31	18	21	1
	40%	12%	62%	36%	42%	2%