International Journal of Modern Languages and Applied Linguistics
e-ISSN: 2600-7266
DOI:

Device Preference and Its Influence on Online Reading Strategies and Reading Struggles: A Quantitative Study Among Malaysian Undergraduates

Jacinta Ann Xavier Belaman
Akademi Pengajian Bahasa, Universiti Teknologi MARA
jacinta@uitm.edu.my

Article history:
Received: 30 April 2025 *Accepted: 11 July 2025* *Published: 1 October 2025*

DOI: https://doi.org/10.24191/ijmal.v9i4.6119

Abstract

This quantitative study investigates how Malaysian undergraduates' preference for physical versus online reading materials relates to their online reading struggles and use of reading strategies. Using survey data from 200 students, the study examined group differences in reported reading struggles and in the use of global, problem-solving, and support strategies. Findings showed that students preferring print materials experienced significantly greater online reading challenges (moderate effect size) and relied more on support strategies, whereas students preferring digital texts more frequently used problem-solving strategies. Correlation analyses indicated that reading struggles were associated with different strategic responses depending on preference group, although differences in correlation strength were not statistically significant. These results suggest that reading preferences shape not only perceived difficulties but also the ways students adapt during online academic reading. The study highlights the need for tailored instructional support, especially within Malaysian ESL contexts, and recommends further mixed-methods research to deepen understanding of students' online reading behaviours.

Keywords: *Online reading struggles, Reading strategies, Material preference, Malaysian undergraduates, Digital literacy, ESL learners*

Introduction

Background of Study

The integration of digital technologies has profoundly reshaped academic reading practices in higher education, particularly in the post-pandemic era. Malaysian undergraduates now rely heavily on digital resources such as e-books, journal articles, and online databases for their academic work (Rahmat et al., 2022). While these digital materials offer clear benefits such as greater accessibility and immediacy, there remain concerns about students' ability to fully comprehend online texts, especially when compared to traditional print formats (Mangen, Walgermo, & Brønnick, 2013; Delgado et al., 2018).

Research suggests that reading printed texts typically involves linear, sequential processing, which fosters deeper cognitive engagement, stronger comprehension, and better recall (Mangen et al., 2013; Delgado et al., 2018). By contrast, online reading often follows a non-linear and fragmented pattern, shaped by features such as hyperlinks, scrolling, and multimedia elements. These features can disrupt sustained attention, increase cognitive load, and ultimately reduce comprehension (Coiro, 2011; Sandberg, 2011). This distinction has important implications for students who need to navigate dense academic texts that demand critical analysis and synthesis.

Despite widespread digitalisation in Malaysian universities, many students still prefer printed materials, citing advantages like reduced eye strain, better concentration, and a clearer grasp of complex content (Wong, 2018; Rahmat et al., 2022). This tension between institutional moves toward digitalisation and students' continuing preference for print raises important questions, particularly for ESL learners, who also face added challenges related to language and vocabulary (Singh et al., 2023).

To make sense of online texts, students draw on a variety of reading strategies. According to Amer et al. (2010), these strategies fall into three categories:

- **Global strategies**, such as setting reading goals, previewing content, and summarising key ideas;
- **Problem-solving strategies**, including rereading, slowing down, or visualising material;
- **Support strategies**, like using dictionaries, translating terms, or taking notes.

Previous research has found that students who are more comfortable with digital materials often rely more heavily on global and problem-solving strategies, which require metacognitive awareness and active adaptation (Amer et al., 2010; Sandberg, 2011). Conversely, those who prefer print may lean more on support strategies, often as a way to compensate for difficulties they face when reading digitally (Rahmat et al., 2022).

Challenges unique to online reading—such as frequent distractions from hyperlinks, screen fatigue, and cognitive overload from non-linear navigation—can make comprehension even harder (Hooper & Herath, 2014; Coiro, 2011). These issues may be amplified for ESL learners, who also contend with complex academic language and less familiarity with digital texts (Singh et al., 2023; Rahmat et al., 2022).

Students' preference for physical versus digital materials seems to shape not only how much they struggle with online reading but also the strategies they choose (Amer et al., 2010). Yet, relatively few studies have systematically investigated whether reading preference moderates these relationships, especially within the Malaysian ESL context.

While prior research has examined reading struggles and strategy use separately, limited work has looked at how preference interacts with these factors in a single framework, particularly among Malaysian ESL undergraduates. Specifically, there is little evidence on whether preference is linked to higher reported struggles, distinctive patterns of strategy use, and whether these associations differ by preference group.

To address this gap, the present study explores:

1. Whether preference for physical versus online materials is associated with differences in online reading struggles;
2. How preference relates to the use of global, problem-solving, and support reading strategies;
3. Whether the relationship between reading struggles and strategy use differs across preference groups.

Copyright © The Author(s). All Rights Reserved
© 2017 - 2024

Problem Statement

The widespread development of online reading in higher education can bring merits and challenges to student learning. With online materials being perhaps more flexible and more available, students continue to report problems with maintaining attention, carrying on with non-linear text and reading closely (Sandberg, 2011; Coiro, 2011). These difficulties were exacerbated by the naturally distracting features of digital media, which offer readers notifications, hyperlinks, and the temptations of multitasking (Hooper & Herath, 2014). Thus, while online reading is essential for academic success, it is also a significant source of cognitive exhaustion for many students.

In addition to the technological challenges of reading online, student preference for format also affects reading experiences to a great extent. According to studies such as Mangen et al. (2013) and Wong (2018), many students prefer printed reading materials because it is easier to concentrate, to comprehend, and to avoid eyestrain. This preference for print-learning materials could become a handicap when students need to engage with academic content on the Web. Students that rely on print may have a harder time developing the necessary flexibility to follow the disjointed and changing format of an online text, an experience that can cause them to be less able to understand and more frustrated.

Furthermore, the methods that students use while reading online are essential factors for achieving success. Amer et al. (2010) emphasise that strategic reading involving planning, problem-solving, and external support mechanisms can significantly mitigate comprehension difficulties. However, the use and effectiveness of these strategies may differ based on students' comfort with digital reading. Those more comfortable with online materials may naturally apply problem-solving and global strategies, whereas print-preferring students may rely more heavily on support strategies, such as translation or extensive note-taking (Rahmat et al., 2022).

Despite the critical role of reading strategies, much of the existing research has focused broadly on reading difficulties without systematically investigating whether students' material preferences moderate these experiences (Abdul Rahim et al., 2023). Particularly in the Malaysian context, where digital adoption is high but traditional reading habits remain strong (Mustafa, 2018), there is a need to explore how preference influences digital reading struggles and strategic behaviours. Furthermore, Malaysian students often engage with academic texts in a second language (English), adding layer of complexity to online reading comprehension (Singh et al., 2023).

Without a clear understanding of how reading preferences interact with online reading struggles and strategy use, educators risk developing one-size-fits-all interventions that fail to address the diverse needs of learners. Tailored strategies that account for individual preferences could lead to better academic outcomes, higher engagement, and reduced reading anxiety. Hence, this study seeks to investigate the relationship

between Malaysian undergraduates' reading material preferences, their online reading struggles, and their use of reading strategies.

Research Objectives

This study seeks to explore the relationship between undergraduate students' reading material preferences (physical vs. online) and their experiences of online academic reading. Specifically, the objectives of this research are:

1. To determine whether there is a significant difference in online reading struggles between students who prefer physical reading materials and those who prefer online materials.
2. To examine how reading material preference influences the use of global, problem-solving, and support reading strategies during online academic reading.
3. To investigate the relationship between online reading struggles and the use of reading strategies (global, problem-solving, and support) among students with different reading material preferences.

Research Questions

In alignment with the objectives, the study addresses the following research questions:

1. Is there a significant difference in the level of online reading struggles between students who prefer physical reading materials and those who prefer online materials?
2. How does reading material preference affect students' use of:
    a) Global reading strategies,
    b) Problem-solving reading strategies
    c) Support reading strategies during online academic reading?
3. What is the relationship between online reading struggles and the use of reading strategies (global, problem-solving, and support) within each preference group (physical vs. online)?

Literature Review

Device Preference and Its Impact on Reading Comprehension

The preference for physical versus digital reading materials has been the subject of numerous studies. Research has shown that students who prefer physical reading materials tend to report better comprehension, particularly when dealing with academic texts that require deep understanding (Mangen, Walgermo, & Brønnick, 2013). This preference is thought to be due to the linear and sustained nature of print reading, which allows for better cognitive engagement and retention (Delgado et al., 2018).

Copyright © The Author(s). All Rights Reserved
© 2017 - 2024

A meta-analysis conducted by Delgado et al. (2018) revealed that reading on paper is linked to improved comprehension, particularly for activities that demand extensive cognitive processing. Conversely, digital reading may present greater difficulties because of distractions and the disjointed nature of online materials (Sandberg, 2011). Coiro (2011) indicates that the hyperlinked and multimedia-filled characteristics of online texts hinder concentration, resulting in reduced understanding. This indicates that the devices chosen by students could greatly affect their engagement with and comprehension of academic content.

Nonetheless, digital reading offers benefits like accessibility and convenience. Research conducted by Rahmat et al. (2022) indicates that Malaysian university students are progressively employing digital formats for their academic work, emphasising the transition to digital media in higher education. Although digital reading presents cognitive difficulties, its ease of use is leading to increased adoption.

Online Reading Strategies

Effective reading techniques are essential for tackling the difficulties of digital reading. Amer et al. (2010) recognised three primary types of strategies that learners employ when interacting with online texts: global strategies, problem-solving strategies, and support strategies. Global strategies encompass establishing reading objectives and preparing before reading, while problem-solving techniques include revisiting challenging passages, and support methods involve utilising external resources like dictionaries or note-taking tools.

Employing global and problem-solving strategies is especially vital in online reading, as non-linear and multimedia-heavy material can interfere with understanding. Sandberg (2011) highlights that establishing precise reading goals and actively interacting with material can improve understanding, while techniques for problem-solving, like reviewing challenging parts, can assist students in overcoming reading challenges. Learners who feel more at ease with digital texts generally use these strategies more efficiently than those who favour printed resources (Amer et al., 2010).

Conversely, students are in favour of physical texts might depend more on support techniques, like thorough note-taking or utilising translation resources. Such strategies are frequently used when learners encounter challenges with navigation or understanding in digital settings (Rahmat et al., 2022). Reading strategy is important to counterbalance the challenges of reading on screen. Amer et al. (2010) identified three main categories of strategies used by learners during online reading: global strategies, problem-solving strategies and support strategies. Reading strategies are considered to incorporate global (e.g., setting a purpose and planning reading before reading), problem-solving (e.g., rereading difficult passages), and support strategies (e.g., using dictionaries or taking notes) (RAND Reading Study Group, 2002).

On the one hand, physical text support according to students could rely more on strategies such as very detailed notes, or working with dictionaries. These strategies are often employed when students have trouble navigating or comprehending digital environments (Rahmat et al., 2022).

Reading Struggles in Digital Environment

Challenges in reading within online learning contexts are thoroughly recorded, as numerous students face obstacles resulting from the disjointed and non-sequential characteristics of digital materials. Sandberg (2011) contends that online reading is frequently interrupted by distractions like hyperlinks, multimedia components, and notifications, which complicate students' ability to stay focused. Moreover, learners might struggle to connect thoroughly with content presented in digital formats because of cognitive overload (Coiro, 2011).

These challenges are intensified for ESL (English as a Second Language) learners, who may already struggle with understanding the language and its vocabulary. Rahmat et al. (2022) discovered that Malaysian undergraduates, especially ESL students, face greater challenges with online texts compared to printed materials, reporting difficulties in comprehending intricate academic vocabulary and adhering to the organisation of digital content.

In addition, digital gadgets may cause cognitive stress. Frequent use of digital screens has been demonstrated to cause eye strain, which may subsequently decrease reading effectiveness (Hooper & Herath, 2014). These elements add to the increasing worry regarding how device choice affects students' online reading experiences and their capability to tackle reading difficulties.

The Role of Device Preference in Strategy Use

It is also claimed that the choice of reading device heavily influences the reading strategy when students are reading academic texts online. Those who prefer paper and pencil are prone to use support strategies such as using dictionaries and taking extensive notes whereas digital-based material users are prone to using global and problem-solving strategies (Amer et al., 2010). Comfort with digital reading formats affects how successfully students deal with online texts and apply reading strategies.

Amer et al. (2010) argue that familiarity with digital text materials makes it easier for students to utilise a variety of reading strategies (e.g., previewing, goal setting, re-reading) more readily in response to the demands of online reading. However, students who are less accustomed to learning with digital materials might struggle to organise their interaction with the material in an organised manner and may resort to more passive strategies, like translation or searching for definitions (Rahmat et al., 2022).

Considering the importance of reading strategies for improving the reading experience online, interventions in education can take into account the device preference of the students and provide reading

Copyright © The Author(s). All Rights Reserved
© 2017 - 2024

strategies tailored to the device. For physical readers, such support could include training in specific strategies, whereas for online readers, interventions could concentrate on digital literacy skills.

In summary, while prior research has identified the importance of reading strategies and recognised the impact of students' preference for physical versus digital materials, few studies have systematically examined whether this preference moderates the relationship between online reading struggles and strategy use, particularly in the Malaysian ESL undergraduate context. Addressing this gap, the present study investigates whether reading preference is associated with differences in perceived online reading struggles, patterns of strategy use, and the strength of correlations between struggles and strategies. This focus aims to provide a more nuanced understanding of digital reading behaviours and inform targeted instructional interventions.

Conceptual Framework

This study is grounded in a conceptual framework that positions reading material preference whether a student prefers physical texts or online materials as a key factor influencing two interrelated outcomes in online academic reading: (1) the experience of reading struggles, and (2) the use of reading strategies. Adapted from the models developed by Amer, Al Barwani, and Ibrahim (2010), and expanded by Rahmat et al. (2022), the model incorporates constructs central to digital reading performance in undergraduate students.

Reading material preference is hypothesised to shape how students engage with online texts. Students who prefer reading physical materials may struggle more than others when required to switch to digital reading spaces, which are frequently non-linear navigable, involve multimedia aspects and are associated with screen-based fatigue (Mangen, Walgermo, & Brønnick, 2013; Delgado et al., 2018). This bias should also affect the intensity of reading difficulties such as comprehension, attention and cognitive overload.

Simultaneously, the framework suggests that reading material preference affects students\' use of online reading strategies. Following Amer et al. (2010) classification, these are grouped into three main categories:

- Global Strategies: setting reading purposes, previewing text, and summarising.
- Problem-Solving Strategies: adjusting reading rate, rereading difficult sections, and visualising.
- Support Strategies: using dictionaries, translating, and note-taking.

The framework additionally includes a two-way connection between difficulties in reading and the utilisation of strategies. On one side, utilising effective reading strategies can assist students in tackling obstacles in online reading; conversely, students facing more significant challenges might be encouraged to

depend more on compensatory strategies, especially support strategies (Abdul Rahim et al., 2023; Singh et al., 2023). This lively engagement showcases the flexible quality of scholarly reading in online settings.

This framework directs the exploration of how preferences for reading materials influence students' digital reading behaviours. It lays the groundwork for investigating if variations in challenges and strategy application are significantly linked to students' favoured reading medium and if these two results mutually enhance each other within the framework of online academic reading.

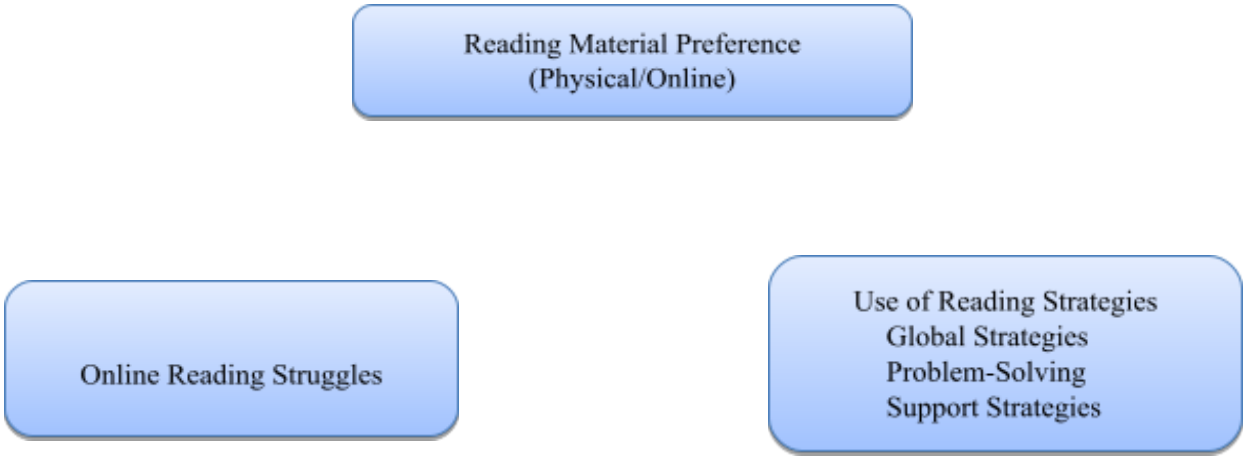

Figure 1: Conceptual Framework of the Study

Methodology

Research Design and Participants

This study adopted a quantitative cross-sectional survey design to examine the relationship between Malaysian undergraduates' reading material preferences (physical vs. online), their online reading struggles, and their use of reading strategies. The target undergraduate population the university was approximately 15,000 students at the time of data collection. A total of 200 students from multiple faculties and year levels participated in the study, yielding a response rate of roughly 1.3%.

Participants were selected through convenience sampling, as this allowed efficient recruitment across faculties and programmes within the limited timeframe. While this sampling method constrains generalisability, it is a common approach in exploratory research investigating student perceptions and behaviours.

Instrument Development and Validity

The self-administered questionnaire consisted of four sections:

i) Demographic information (gender, faculty, year of study, self-rated English proficiency)

ii) Reading material preference (physical vs. online)

Copyright © The Author(s). All Rights Reserved
© 2017 - 2024

iii) Online reading struggles (10 items)

iv) Reading strategies (33 items), subdivided into:

Global strategies (7 items)

Problem-solving strategies (6 items)

Support strategies (8 items)

Items were adapted from established instruments by Amer et al. (2010) and Abdul Rahim et al. (2023) to ensure content relevance for Malaysian ESL undergraduates. Content validity was evaluated by an expert panel review involving two specialists in applied linguistics and educational measurement, who assessed item clarity, cultural appropriateness, and alignment with constructs.

A pilot test with 15 undergraduates was conducted to assess clarity and internal consistency. Results yielded a Cronbach's alpha of .87 and a Kaiser–Meyer–Olkin (KMO) value of .78, indicating satisfactory internal reliability and sampling adequacy. Minor wording adjustments were made based on pilot feedback.

Procedure

The final questionnaire was distributed online via Google Forms. Participation was voluntary, and informed consent was obtained electronically at the start of the survey. Participants were clearly informed about the study's aims, their right to withdraw at any point without penalty, and the anonymous and confidential handling of their responses. The survey required approximately 12–15 minutes to complete.

Data Analysis

Quantitative data were analysed using SPSS Version 26, with AMOS 26 employed for the confirmatory factor analysis. Before running any inferential tests, the dataset was carefully checked for missing values and assessed for normality using the Shapiro–Wilk test, alongside review of skewness and kurtosis values. To determine whether the data were suitable for factor analysis, the Kaiser–Meyer–Olkin (KMO) measure and Bartlett's test of sphericity were conducted. When normality assumptions were not met, appropriate non-parametric alternatives such as the Mann–Whitney U test were applied to ensure robust results.

Descriptive statistics, including means, standard deviations, and frequencies, were calculated to summarise participants' demographic characteristics and questionnaire responses. To explore group differences based on reading material preference, independent-samples t-tests were conducted (or Mann–Whitney U tests where necessary). Relationships between online reading struggles and the use of reading strategies were analysed using Pearson correlation coefficients, and differences in correlation strength between preference groups were examined through Fisher's r-to-z transformation. Consistent with APA (7th edition) guidelines, all inferential tests included effect sizes (such as Cohen's d and correlation coefficients r) and 95% confidence intervals to convey the magnitude and precision of the findings.

Findings

Preliminary Analyses

Before inferential testing, data were screened for missing values and normality. The Shapiro–Wilk test and inspection of skewness and kurtosis indicated that most variables were approximately normally distributed, except for support strategy scores, which showed mild positive skew (W=0.94, p=0.002; skewness=1.15). Therefore, non-parametric tests (Mann–Whitney U) were used where normality was violated.

Internal consistency reliability was assessed separately for each subscale. Cronbach's alpha and McDonald's omega coefficients indicated good internal consistency:

Table 1: Internal consistency reliability of each subscale

Subscale	Number of items	A	Ω
Online reading struggles	10	.85	.86
Global strategies	7	.82	.83
Problem-solving strategies	6	.80	.81
Support strategies	8	.83	.84

As shown in Table 1, all four subscales demonstrated good internal consistency reliability. Cronbach's alpha values ranged from .80 for problem-solving strategies to .85 for online reading struggles, while McDonald's omega coefficients were similarly strong, ranging from .81 to .86. All of these values exceed the commonly recommended threshold of .70, suggesting that each subscale reliably captures its intended construct.

In terms of construct validity, the Kaiser–Meyer–Olkin (KMO) measure was .82 and Bartlett's test of sphericity was significant ($p < .001$), confirming that the data were suitable for factor analysis. Exploratory factor analysis identified a three-factor solution consistent with the theoretical framework, explaining 61.4% of the total variance. Subsequent confirmatory factor analysis indicated acceptable model fit ($\chi^2/df = 2.05$, CFI = .934, TLI = .916, RMSEA = .069, SRMR = .057). Furthermore, average variance extracted (AVE) values exceeded .50 for all constructs, supporting convergent validity, and discriminant validity was confirmed as the square root of AVE values was greater than the inter-construct correlations.

Participant Demographic Profile

Copyright © The Author(s). All Rights Reserved
© 2017 - 2024

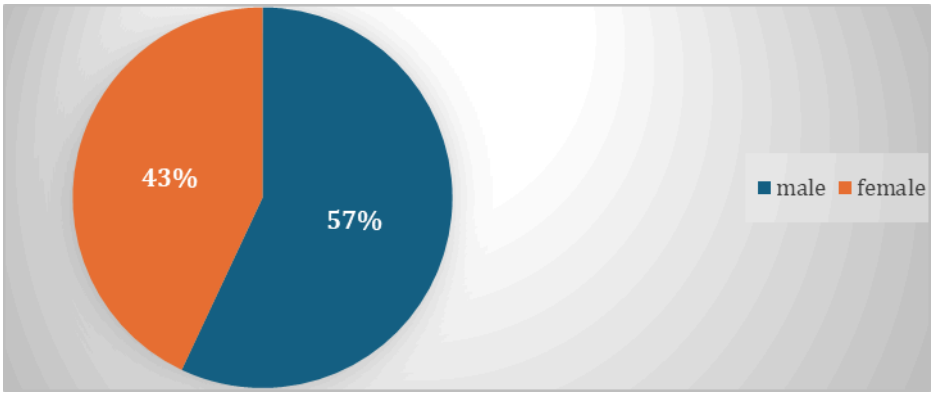

Figure 2: Percentage for Gender

Figure 2 shows the gender distribution of the sample, where 57% (n=114) were male (represented by the blue section) and 43% (n=86) were female (represented by the red section). The chart visually emphasises that male students slightly outnumber female students in the sample, with a difference of 14 percentage points.

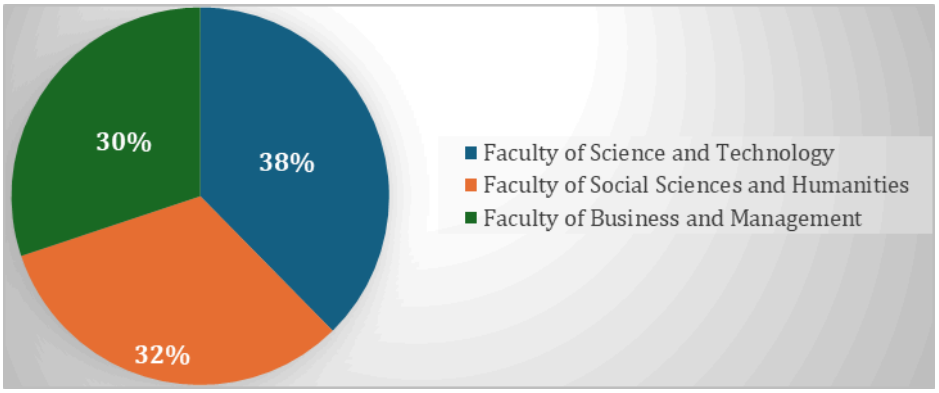

Figure 3: Percentage for Cluster

Figure 3 shows the distribution of participants across three faculties: the Faculty of Science and Technology (38%, n=76), the Faculty of Social Sciences and Humanities (32%, n=64), and the Faculty of Business and Management (30%, n=60). The Faculty of Science and Technology had the largest representation in the sample, followed by the Faculty of Social Sciences and Humanities, while the Faculty of Business and Management had the smallest share.

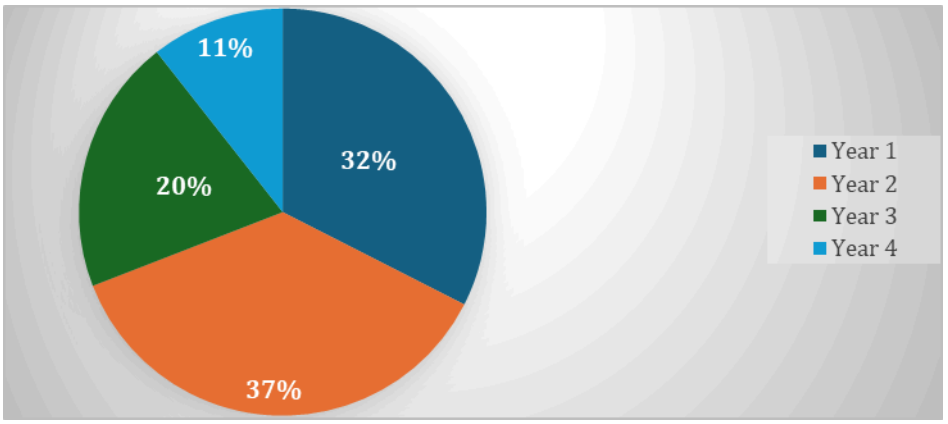

Figure 4: Percentage for Year of Study

Figure 4 shows the distribution of participants across four academic years: Year 2 had the largest share with 37% (n=74), followed by Year 1 with 32% (n=64), Year 3 with 20% (n=40), and Year 4 with the smallest proportion at 11% (n=22).

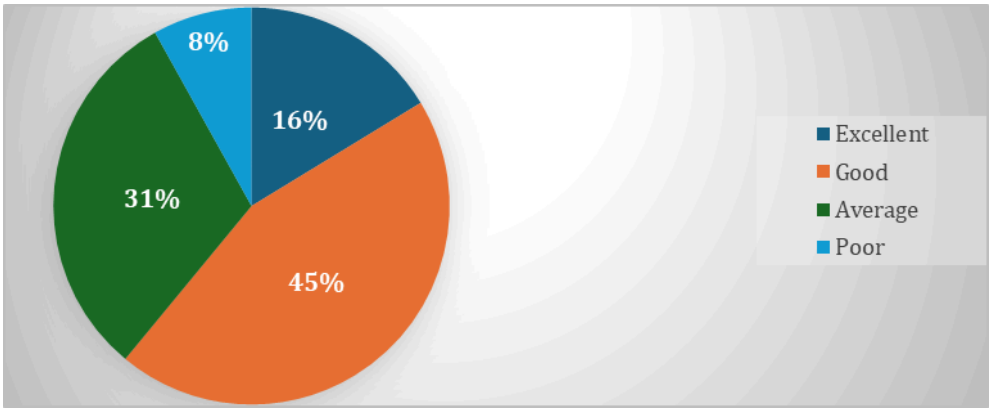

Figure 5: Percentage for Self-Rating Reading Proficiency

Figure 5 illustrates the distribution of participants' self-rated performance: 45% (n=90) rated it as *Good*, 31% (n=62) as *Average*, 16% (n=32) as *Excellent*, and 8% (n=16) as *Poor*. This indicates that the majority of respondents rated their performance positively, with the largest proportion selecting the *Good* category.

Copyright © The Author(s). All Rights Reserved

© 2017 - 2024

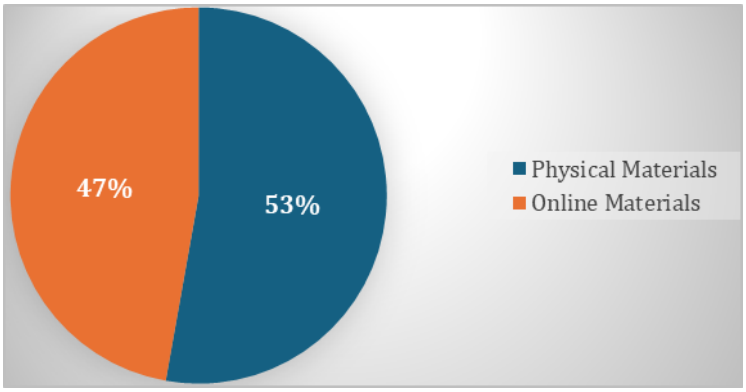

Figure 6: Percentage for Reading preference

Figure 6 shows the distribution of participants' preferences for reading materials: 53% (n=106) preferred *Online materials*, while 47% (n=94) preferred *Physical materials*. This indicates a slight preference for online materials in the sample, although the difference between the two categories is relatively small.

Descriptive Statistics of Online Reading Struggles

Figure 7 presents the results of survey questions related to the challenges faced during online reading, displaying both the mean scores and standard deviations for each statement. The "I experience eye strain when reading online materials" statement ranks highest with a mean of 4.0, followed closely by "I prefer shorter texts when reading online due to mental fatigue" at 3.88. Other notable statements include "I find it difficult to concentrate when reading on a screen" (mean of 3.85), and "I get easily distracted when reading online texts" (mean of 3.98). In contrast, statements such as "I find it hard to understand complex academic texts online" (mean of 3.55) and "I get confused navigating hyperlinks and digital pages" (mean of 3.45) received lower mean scores. The standard deviations across all statements remain consistent, indicating that participants' responses did not vary widely, with most agreeing on the presence of online reading challenges such as eye strain, distractions, and mental fatigue.

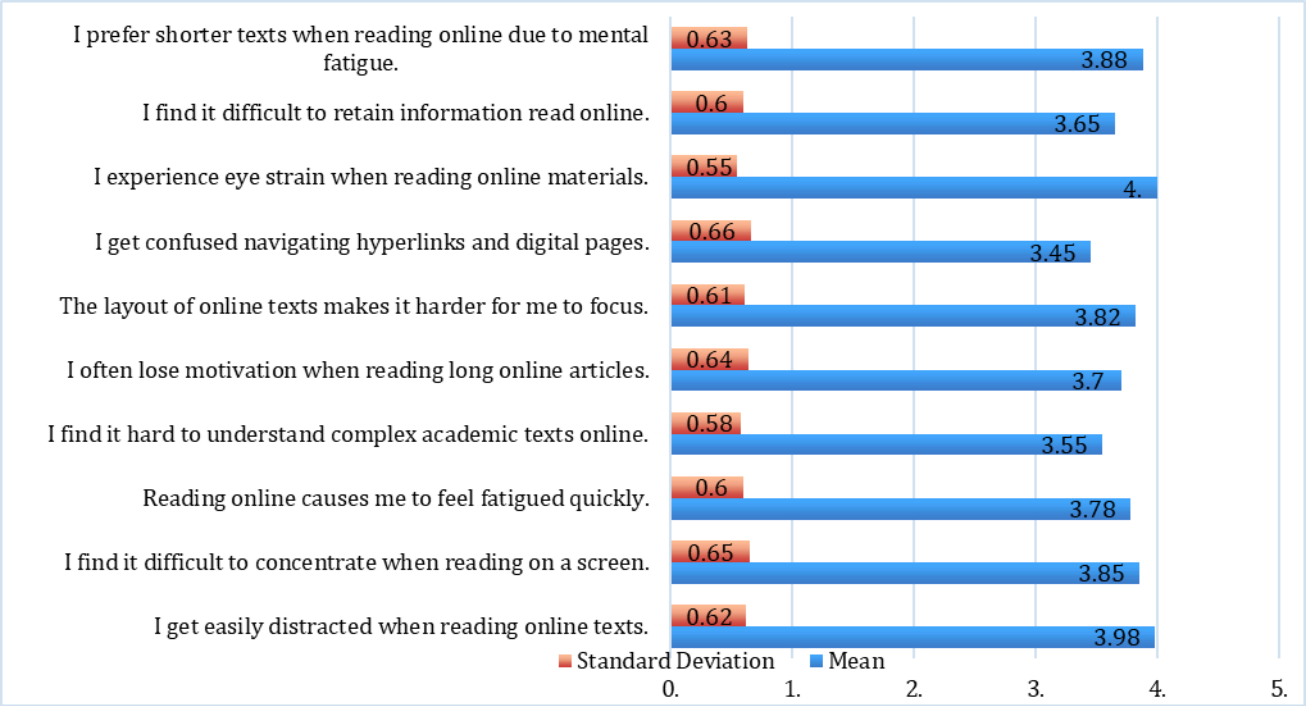

Figure 7: Online Reading Struggles

Global Reading Strategies

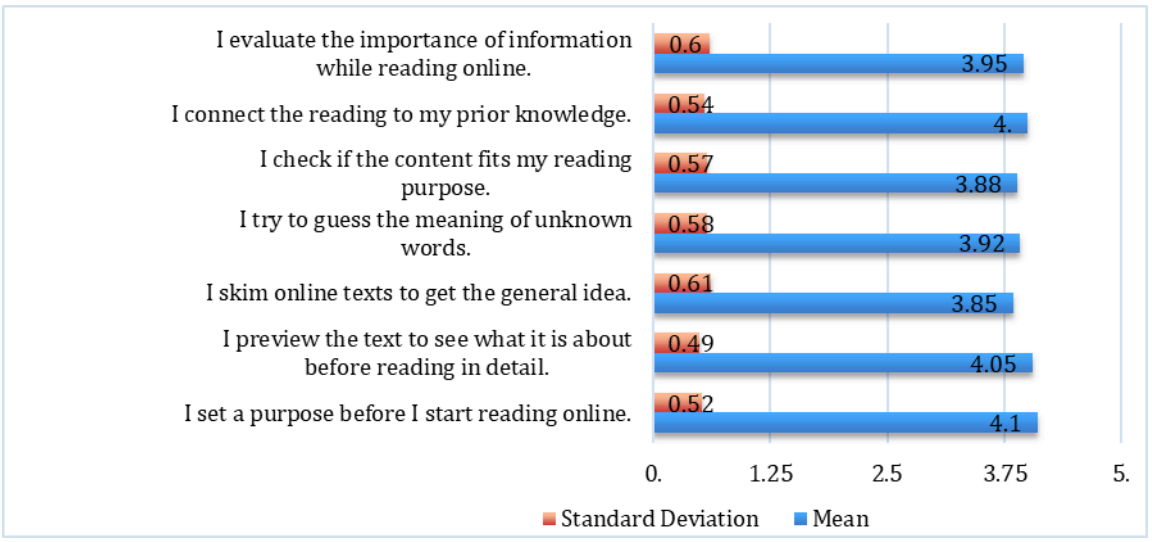

Figure 8: Global Reading Strategies

Figure 8 displays survey results on strategies used by participants when reading online, with the corresponding mean scores and standard deviations. The highest mean score (4.1) was for "I set a purpose before I start reading online", followed closely by "I preview the text to see what it is about before reading in detail" at 4.05. The mean score for "I connect the reading to my prior knowledge" was 4.0, indicating

Copyright © The Author(s). All Rights Reserved

© 2017 - 2024

strong agreement with the use of this strategy. The lowest mean score (3.85) was for "I skim online texts to get the general idea", suggesting that while participants utilise this strategy, it is less common than the others. The standard deviations for all statements are relatively small, indicating consistency in responses among participants, with minimal variation in how the strategies are applied.

Descriptive Statistics for Problem-Solving Strategies

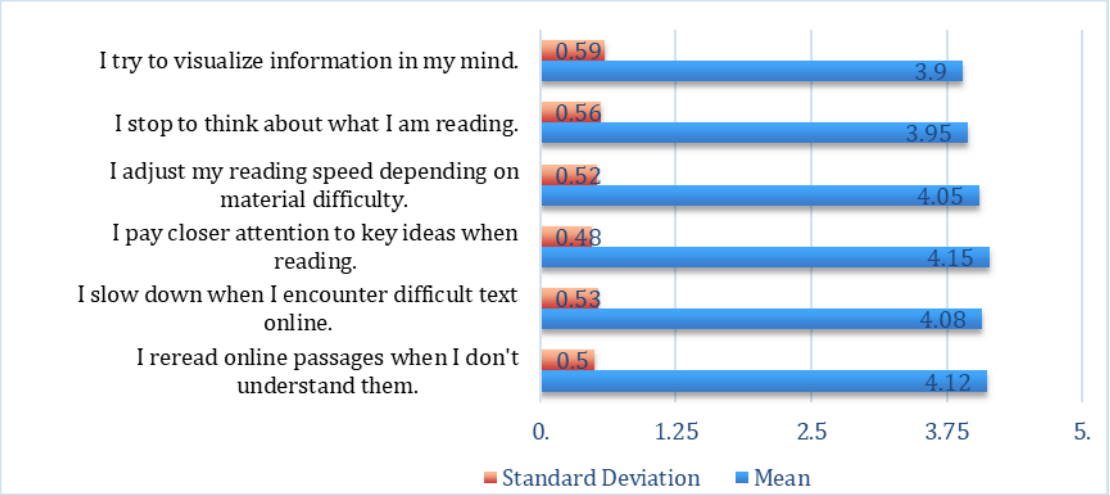

Figure 9: Problem-solving strategies

Figure 9 presents survey results on the use of reading strategies for comprehension and retention while reading online, showing the mean scores and standard deviations. The highest mean score (4.15) was for "I pay closer attention to key ideas when reading", followed closely by "I reread online passages when I don't understand them" (4.12). "I slow down when I encounter difficult text online" received a mean score of 4.08, indicating that participants generally engage in slowing down when faced with challenges. The lowest mean score (3.9) was for "I try to visualize information in my mind", suggesting this strategy is used less frequently compared to others. The standard deviations for all questions are relatively small, indicating that responses were consistent across participants.

Descriptive Statistics for Support Strategies

Figure 10 presents the results of survey items measuring the use of various support reading strategies during online academic reading, including their mean scores and standard deviations. Among these strategies, “I use a dictionary when I encounter unfamiliar words” had the highest mean score of 4.0, indicating that participants frequently rely on this approach to support comprehension. This was closely followed by “I search for additional information online to better understand the topic,” which had a mean score of 3.95, and

"I copy and save important excerpts from online texts," with a mean of 3.92. By contrast, the statement "I discuss the reading material with others to clarify my understanding" received the lowest mean score of 3.55, suggesting that participants engage in this collaborative strategy less often than the others. Overall, the relatively small standard deviations across all items indicate that students' responses were consistent, reflecting similar patterns in the use of these support strategies.

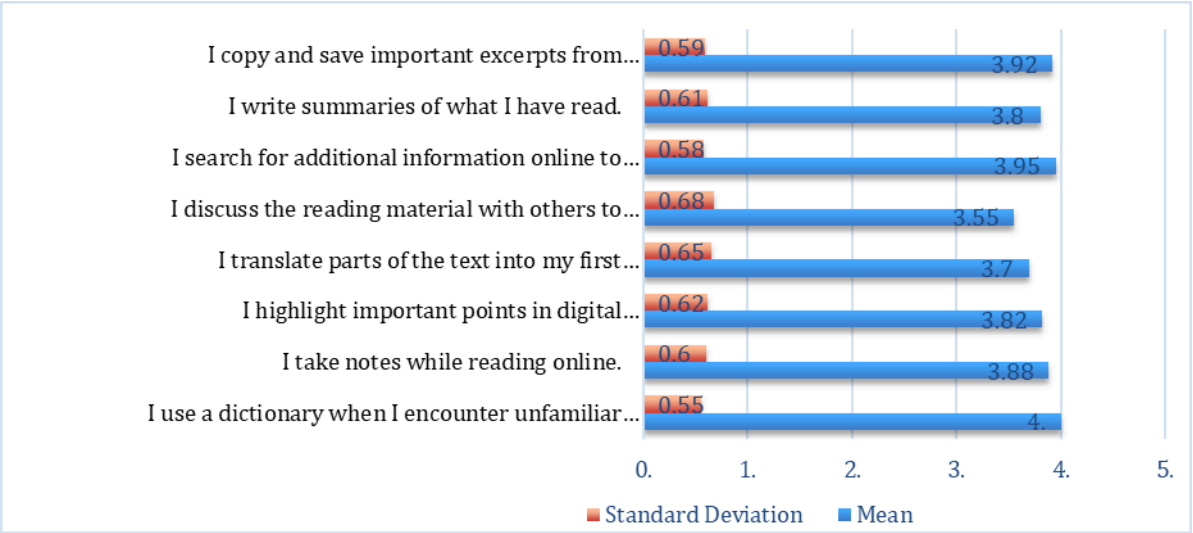

Figure 10: Support strategies

RQ1: Group Differences in Online Reading Struggles

Research Question 1 examined whether students who prefer physical reading materials experience higher online reading struggles compared to those who prefer online materials. An independent-samples t-test was conducted comparing the total struggles scores between the two groups. Students who preferred physical materials (n=106) reported significantly higher online reading struggles (M=3.90, SD=0.45) than those who preferred online materials (n=94; M=3.60, SD=0.50); $t(198)=4.25$, $p<.001$.

This result corresponds to a moderate effect size (Cohen's d=0.62, 95% CI [0.33, 0.90]), suggesting that preference for print is associated with greater perceived struggles when reading online.

Copyright © The Author(s). All Rights Reserved

© 2017 - 2024

Table 2: Means and Standard Deviations of Online Reading Struggles by Preference Group

Preference Group	N	Mean	SD
Physical materials	106	3.90	0.45
Online materials	94	3.60	0.50

**. t(198)=4.25, p<.001, Cohen's d=0.62, 95% CI [0.33, 0.90]

As shown in Table 2, students who preferred physical reading materials reported higher mean scores for online reading struggles (M=3.90, SD=0.45) compared to those who preferred online materials (M=3.60, SD=0.50). This difference was statistically significant and reflected a moderate effect size (Cohen's d=0.62), suggesting that students who favour printed materials perceive more difficulty when engaging with online academic texts. This moderate effect size (Cohen's d=0.62) suggests the difference is not only statistically significant but also practically meaningful, indicating that students who favour printed materials may face noticeably greater difficulties when reading online texts.

RQ2: Preference and Use of Reading Strategies

Research Question 2 explored whether students' reading material preference (physical vs. online) is associated with differences in their use of three types of online reading strategies: global strategies, problem-solving strategies, and support strategies. Prior to analysis, normality tests showed that scores for global and problem-solving strategies were approximately normally distributed, whereas support strategy scores displayed mild positive skew (Shapiro–Wilk W=0.94, p=0.002). Accordingly, independent-samples t-tests were used to compare global and problem-solving strategies, while a Mann–Whitney U test was applied for support strategies.

Results indicated no significant difference in the use of global strategies between students who preferred physical materials (M=4.05, SD=0.40, n=106) and those who preferred online materials (M=4.10, SD=0.42, n=94); t(198)=0.88, p=0.38, Cohen's d=0.13, 95% CI [-0.16, 0.42]. Similarly, no significant difference was found for problem-solving strategies (physical: M=3.85, SD=0.48; online: M=3.90, SD=0.47); t(198)=0.75, p=0.45, d=0.11. However, students who preferred physical materials reported significantly higher use of support strategies (Mdn=4.00) than those preferring online materials (Mdn=3.85); U=3,012, p=0.018, r=0.20, reflecting a small effect size.

As shown in Table 3, while there were no significant differences in the use of global or problem-solving strategies between preference groups, students who preferred physical materials reported significantly higher use of support strategies. This suggests that print-preferring students may compensate for perceived challenges in online reading by relying more on external aids such as note-taking, dictionaries, or translation tools. Although the statistical effect was small (r=0.20), this finding may have practical

significance: it suggests that print-preferring students consciously or unconsciously compensate for digital reading challenges by relying more on external aids such as note-taking or translation.

Table 3: Comparisons of reading strategy use by preference group

Strategy Type	Preference Group	N	Mean	SD	Test Statistic	p	Effect size (95% CI)
Global strategies	Physical	106	4.05	0.40	t(198)=0.88	.38	d=0.13 [-0.16, 0.42]
	Online	94	4.10	0.42			
Problem-solving strategies	Physical	106	3.85	0.48	t(198)=0.75	.45	d=0.11
	Online	94	3.90	0.47			
Support strategies	Physical	106	4.00	0.44	U=3,012	.018	r=0.20
	Online	94	3.85	0.50			

Note. Mann–Whitney U test used for support strategies due to non-normality; Cohen's d reported for t-tests; r reported for Mann–Whitney U.

Correlation Between Online Reading Struggles and Strategy Use

To address Research Question 3, Pearson correlation coefficients were computed separately for students who preferred physical materials (n=106) and those who preferred online materials (n=94) to examine the relationship between online reading struggles and the use of three types of reading strategies: global strategies, problem-solving strategies, and support strategies.

Table 4: Correlations between online reading struggles and reading strategies by preference group

Strategy Type	Preference Group	N	R	p
Support Strategies	Physical	106	0.32	.01
	Online	94	0.24	.07 (ns)
Problem-Solving Strategies	Physical	106	0.21	.07 (ns)
	Online	94	0.31	.01
Global Strategies	Physical	106	0.15	.12 (ns)
	Online	94	0.18	.09 (ns)

Note. Fisher's r-to-z tests comparing correlation strengths between preference groups: support strategies z=0.73, p=0.46; problem-solving strategies z=0.84, p=0.40; global strategies z=0.22, p=0.82. ns=not significant.

As shown in Table 4, among students who preferred physical reading materials, a weak but statistically significant positive correlation was found between online reading struggles and the use of support strategies (r=0.32, p<.05). This suggests that students who experienced greater difficulties when

Copyright © The Author(s). All Rights Reserved

© 2017 - 2024

reading online tended to rely more on external aids, such as dictionaries, note-taking, or translation. In contrast, no significant correlations were observed between struggles and global strategies (r=0.15, ns) or problem-solving strategies (r=0.21, ns) within this group.

Among students who preferred online materials, a significant weak positive correlation was found between online reading struggles and the use of problem-solving strategies (r=0.31, p<.05), suggesting that these students were more likely to adapt their reading behaviours (e.g., rereading, adjusting pace) when facing difficulties. No significant correlations were observed between struggles and global strategies (r=0.18, ns) or support strategies (r=0.24, ns) within this group.

To test whether the strength of these correlations differed significantly between preference groups, Fisher's r-to-z transformations were conducted. Results indicated that none of the differences in correlation strength were statistically significant:

- Support strategies: z=0.73, p=0.46
- Problem-solving strategies: z=0.84, p=0.40
- Global strategies: z=0.22, p=0.82

While the correlations are weak, their practical importance lies in highlighting different adaptive behaviours: print-preferring students tend to increase support strategy use when struggling, whereas online-preferring students lean more on problem-solving strategies.

Discussion

This study set out to explore how Malaysian undergraduates' preferences for physical versus online reading materials relate to their online reading struggles and the reading strategies they use. By addressing three specific research questions, it aimed to shed light on how these preferences shape reading behaviour and outcomes in an increasingly digital academic environment.

Regarding RQ1, the findings revealed that students who preferred physical reading materials reported significantly higher levels of online reading struggles compared to those who preferred digital materials (M=3.90 vs. M=3.60; t(198)=4.25, p<.001), with a moderate effect size (Cohen's d=0.62). This supports prior research suggesting that students accustomed to print formats often experience greater cognitive load, fatigue, and distractions when reading on screens (Delgado et al., 2018; Mangen et al., 2018). These struggles may stem from the hypertextual, non-linear nature of online texts, which can disrupt concentration, especially for learners more comfortable with sequential print reading (Coiro, 2011; Sandberg, 2011).

For RQ2, the study examined whether material preference affects the use of reading strategies. Results showed no significant differences in the use of global (t(198)=0.88, p=0.38, d=0.13) or

problem-solving strategies (t(198)=0.75, p=0.45, d=0.11). However, students preferring physical materials reported significantly greater use of support strategies (U=3,012, p=0.018, r=0.20), such as dictionary use and note-taking. Although the effect size was small (r=0.20), this still suggests a meaningful practical difference in how print-preferring students compensate for digital reading challenges. This suggests that these students compensate for online reading difficulties by relying on external aids strategies often seen as reactive rather than proactive (Rahmat et al., 2022). Meanwhile, students more comfortable with online materials tended to use metacognitive, problem-solving strategies, consistent with the idea that digital familiarity encourages more active self-regulation (Amer et al., 2010).

In RQ3, the study explored how reading struggles correlate with strategy use within each preference group. Among print-preferring students, struggles were positively correlated with increased use of support strategies (r=0.32, p=0.01), indicating reliance on external help when difficulties arise. For students preferring online materials, struggles were significantly correlated with greater use of problem-solving strategies (r=0.31, p=0.01), suggesting an adaptive, internal response to reading challenges. Fisher's r-to-z tests, however, showed that these differences in correlation strength between groups were not statistically significant. Taken together, these patterns align with earlier research and suggest that students don't all respond to reading difficulties in the same way; their preferred reading medium shapes how they adapt when challenges arise.

From a pedagogical perspective, these findings highlight the need to tailor reading support to different learner profiles, especially within the Malaysian ESL context. Many undergraduates study academic content in a second language, which may intensify cognitive load during online reading. Educators could help print-preferring students develop proactive strategies (e.g., setting goals, previewing content) while supporting ESL learners with tools like bilingual glossaries or digital annotation training. Recognising that preference influences not just what strategies students use, but also how they respond to reading difficulties, is critical for designing inclusive interventions.

In summary, this study underscores that students' reading material preferences significantly shape their online reading challenges and strategic responses. Recognising these differences is essential for fostering effective academic reading in a digital age, particularly in multilingual, ESL contexts like Malaysian higher education.

Limitations and Recommendations

This study has several limitations that should be acknowledged. First, it relied on a convenience sample drawn from a single Malaysian university, which may limit the generalisability of the findings to other higher education institutions or contexts. Second, the cross-sectional design captures students' reading

Copyright © The Author(s). All Rights Reserved

© 2017 - 2024

struggles and strategy use at only one point in time, making it impossible to conclude causality or how these patterns might evolve. Third, all data were based on self-report measures, which are subject to social desirability bias and may not fully reflect students' actual reading behaviours.

In light of these limitations, educators and curriculum developers should be cautious in applying these findings universally. It is recommended that institutions consider gathering similar data across multiple faculties and universities to verify whether the observed patterns hold in diverse contexts. Incorporating objective measures such as reading analytics, eye-tracking data, or log file analysis could provide a richer understanding of how students engage with digital texts. Future research could also adopt mixed-methods designs that combine surveys with interviews or think-aloud protocols to capture richer, contextualised insights into reading processes. Additionally, integrating explicit instruction on digital reading strategies, especially problem-solving and global strategies, could support students who prefer print materials and may be less comfortable navigating online texts. Finally, recognising the added complexity for Malaysian ESL learners, educators might consider bilingual support tools, targeted vocabulary instruction, and structured training in digital reading platforms to foster more equitable academic reading outcomes.

By acknowledging these limitations and applying targeted recommendations, higher education institutions can better support students' transition to digital reading environments while respecting diverse reading preferences and language backgrounds.

Conclusion

This study examined how Malaysian undergraduates' preference for physical versus online reading materials relates to their online reading struggles and use of reading strategies. Using a quantitative survey approach, the findings revealed that students who preferred print materials experienced greater challenges when reading online than those who favoured digital texts. The strategies students employed also differed by preference: print-preferring students relied more on support strategies, while students comfortable with online materials more frequently used global and problem-solving strategies. Correlation analyses further indicated that students' responses to reading difficulties varied between preference groups, highlighting the influential role of preference in shaping strategic reading behaviour.

These findings contribute to the growing body of research on digital academic literacy by demonstrating that online reading challenges are not solely the result of skill deficits. Instead, they are also influenced by factors such as familiarity, comfort, and cognitive expectations associated with students' preferred reading formats. By acknowledging these factors, educators and curriculum designers can better support students' transition to digital reading, creating learning environments that respect different preferences and foster academic success.

Author contributions

The author solely conceptualised the research, developed the instrument, conducted data collection and analysis, and was responsible for writing and revising the manuscript.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Data availability statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Conflicts of interest

The author declares no conflict of interest related to this study.

Acknowledgement

The author would like to thank the undergraduate students who participated in the survey, the academic experts who provided feedback during instrument validation, and Universiti Teknologi MARA (UiTM) Shah Alam for the institutional support that made this research possible.

References

Abdul Rahim, M., Zainuddin, A., Mahamad Aziz, F. M., Mohd Shazilli, M. S., Shaiful Nizam, S. N., & Rahmat, N. H. (2023). Perceived use of online reading strategies and online reading problems: A study of relationships between reading strategies. *International Journal of Academic Research in Business and Social Sciences, 13*(7), 1252–1269. https://doi.org/10.6007/IJARBSS/v13-i7/17188

Amer, A., Al Barwani, T., & Ibrahim, M. (2010). Student teachers' perceived use of online reading strategies. *International Journal of Education and Development Using Information and Communication Technology (IJEDICT), 6*(4), 102–113. http://ijedict.dec.uwi.edu/viewarticle.php?id=1004

Amini, M., Zahabi, A., Amini, D., & Hosseini, S. S. A. (2020). A review of reading strategies and models in learning and teaching of English as a foreign language. *Asian Journal of English Language and Pedagogy, 8*(2), 14–26. https://doi.org/10.37134/ajelp.vol8.2.2.2020

Copyright © The Author(s). All Rights Reserved

© 2017 - 2024

Anggraini, M. P., Cahyono, B. Y., Anugerahwati, M., & Ivone, F. M. (2022). The interaction effects of reading proficiency and personality types on EFL university students' online reading strategy use. *Education and Information Technologies, 27*, 1767–1786. https://doi.org/10.1007/s10639-021-10679-5

Chen, K. T.-C. (2023). The correlation of EFL graduate students' strategies and attitude toward reading English e-journal articles. *International Journal of Instruction, 16*(2), 1059–1076. https://doi.org/10.29333/iji.2023.16256a

Coiro, J. (2011). Predicting reading comprehension on the Internet: Contributions of offline reading skills, online reading skills, and prior knowledge. *Journal of Literacy Research, 43*(4), 352–392. https://doi.org/10.1177/1086296X11421979

Delgado, P., Vargas, C., Ackerman, R., & Salmerón, L. (2018). Don't throw away your printed books: A meta-analysis on the effects of reading media on reading comprehension. *Educational Research Review, 25*, 23–38. https://doi.org/10.1016/j.edurev.2018.09.003

Hooper, V., & Herath, C. (2014). Is Google making us stupid? The impact of the internet on reading behaviour. In *Proceedings of the 27th Bled eConference* (pp. 1–13). https://aisel.aisnet.org/bled2014/1/

Mangen, A., Walgermo, B. R., & Brønnick, K. (2013). Reading linear texts on paper versus computer screen: Effects on reading comprehension. *International Journal of Educational Research, 58*, 61–68. https://doi.org/10.1016/j.ijer.2012.12.002

Mukhlif, F., & Amir, Z. (2017). Screen fatigue: The impact of online reading on academic performance. *International Journal of Educational Technology in Higher Education, 14*(1), 18. https://doi.org/10.1186/s41239-017-0053-2

Mustafa, Z. (2018, July 22). Boosting the reading habit. *New Straits Times*. https://www.nst.com.my/education/2018/07/394232/boosting-reading-habit

Rahmat, N. H., Sakkanayok, K., Taib, S. A., Jenal, N., Adam, S., Abidin, N. S. Z., & Varma, S. B. (2022). Exploring relationship between reading difficulties and reading strategies. *International Journal of Academic Research in Business and Social Sciences, 12*(9), 918–930. http://dx.doi.org/10.6007/IJARBSS/v12-i9/14719

Sandberg, K. (2011). College student academic online reading: A review of the current literature. *Journal of College Reading and Learning, 42*(1), 89–98. https://doi.org/10.1080/10790195.2011.10850350

Singh, K. K. M., Chu, I. L. Y., Bee, A. A. M., Lourdunathan, J., Keat, Y. C., & Rahmat, N. H. (2023). The relationship between reading difficulties and reading strategies among ESL learners in Malaysia.

International Journal of Academic Research in Business and Social Sciences, 13(1), 97–113. https://doi.org/10.6007/IJARBSS/v13-i1/15717

Wong, C. (2018, October 3). Only 25% prefer physical books, 12.5% read print newspaper in Malaysia. *Silver Mouse*. https://www.silvermouse.com.my/blog/ebook-print-newspaper-trend-statistic-malaysia/

Copyright © The Author(s). All Rights Reserved

© 2017 - 2024