Studies in English Language Teaching
ISSN 2372-9740 (Print) ISSN 2329-311X (Online)
Vol. 13, No. 2, 2025
www.scholink.org/ojs/index.php/selt

Original Paper

A Study on the Correlation between the Reading Proficiency and the Digital Reading Strategy Use of English Majors in Local Normal Universities in China

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Abstract

Based on Gagné's Information Processing Theory (IPT), which stresses staged processing and the transfer of learning to real-world tasks, this study takes 677 English majors as participants from a local Chinese normal university, who were administered two digital reading tests and a Survey of Digital Reading Strategies (SODRS), with a view to explore the profile of the digital reading strategies, the correlation between reading proficiency and digital strategy use as well as the differences in the application of digital reading strategies between the high proficiency learners and the low proficiency learners. The research results show that: (1) The majority of students use digital reading strategies at a moderate level, with global strategies being the least frequently used, then support strategies and problem-solving strategies. (2) Significant positive correlations are observed between digital reading proficiency and global strategy, problem-solving strategy as well as support strategy, respectively, with correlation coefficients being 0.591, 0.543 and 0.522. (3) Independent samples t-tests reveal significant differences in strategy use between high and low proficiency learners. This study not only provides insights into the further study on targeted interventions to enhance the reading proficiency of students but also contributes to promoting students' digital literacy within underdeveloped areas in China.

Keywords

IPT, digital reading proficiency, digital reading strategy use, independent samples t-test, correlation coefficient, significant application difference

Introduction

In the era of the 21st century, digital and online tools have become important resources for language acquisition and educational achievement, and digital text is ever more prevalent (Reiber-Kuijpers, Kral, & Meijer, 2021), which creates a new generation of "digital" readers, who prefer to navigate the Internet via mobile phones, laptops, computers, by means of which their reading behaviors and habits are constantly shaped. To adapt to this change, the future educators and instructors need to deeply understand

the changing learning environments and modes, innovating their teaching concepts and approaches. Accordingly, governments worldwide have invested in reformulating the education system to align it with the global information society discourse in the digital age. *The Ministry of Education of the People's Republic of China (2018)* issued *the Education Informatization 2.0 Action Plan* in 2018, actively promoting "Internet +Education," adhering to the core concept of the deep integration of information technology and education, maintaining the basic principles of application-driven and mechanism innovation, establishing and improving the sustainable development mechanism for educational informatization, constructing an education system that is networked, digitized, intelligent, personalized and lifelong, and building a learning society where everyone can learn anytime and anywhere. And in May, 2023, *the Action Plan for Deepening the Reform of Curriculum and Teaching in Basic Education* was issued with an aim to promote the integration of new technologies such as artificial intelligence, big data, and fifth-generation mobile communication technology (5G) with teacher development, and accelerate the formation of new paths and models for new technologies to boost the construction of teacher contingent (The Ministry of Education of the People's Republic of China, 2023). With the development of e-publishing technologies and standards, more and more traditional textbooks are being replaced with digital ones (Yin, Yau, Uosaki, Hirokawa, & Kumamoto, 2016), and the format of digital reading has arisen as a new trend (do Amaral, Torres, & Tomitch, 2018). It is asserted that digital reading or online reading has become a crucial source for readers in line with the importance of computers and the Internet for users worldwide (Anderson, 2003). Accordingly, digital literacy is considered one of the key competencies as well as an essential factor in students' learning (Knutsson, Blåsjö, Hållsten, & Karlström, 2012) and a key component in educators' professional development. In this context, educators play an essential role in familiarizing students with reading on the Internet, exploring its features so students are able to make the most of these online resources (Gilbert, 2017). Therefore, digital reading strategies have become essentially crucial for students to possess in grasping the meaning of online texts so as to improve their digital reading literacy (Lebedeva, 2022). And it is especially essential for the English majors, who are studying in local normal universities and quite likely to serve as English teachers in the poverty-stricken areas in China where the students' digital reading proficiency and reading literacy are in great need of improvement, to apply digital reading strategies to boost their own reading literacy.

Based on the hypothesis that students' digital reading strategy use helps to improve their reading proficiency, this study aims to investigate the correlation between the digital reading strategy use and the reading proficiency of English majors in local normal universities in China and tends to find out the differences of the digital reading strategy use between the high-proficiency group students and the low-proficiency group students so as to offer some constructive instructional suggestions on augmenting the digital reading proficiency of the struggling English majors.

Reading strategies

Reading strategies have been one of the most heated research focuses for scholars since 1960s and a corpus of relevant research achievements have been obtained, which can be classified into the following

categories: the comparative studies of reading strategy use between students of different reading proficiency or genders, the empirical study on the improvement of the students' reading proficiency through reading strategy training, and the study on the correlation between reading strategies and reading proficiency (L. Chen, 2021; Hong-Nam, Leavell, & Maher, 2014). Of all the studies, no universal consensus has been reached on the definitions of reading strategy.

Goodman (1967) defines reading strategy from the perspectives of psycholinguistics and regards it as a psycholinguistic guessing game. Similarly, Nunan (2001) asserts it a mental process and operation used by learners to learn and then communicate.

In contrast, Langer (1982) and McNamara (2007) focus on the functional aspect of reading strategies. The former regards it as a static, passive technique while the latter views it a means for readers to overcome difficulties and obstacles to successful text comprehension. These distinctions stimulate a heated debate in the literature: whether reading strategies should be viewed as passive techniques or active, problem-solving processes.

Block (1986) and Johnson & Johnson (1998) adopt a more interactive view, regarding reading strategy as a process, in which readers consciously interact with the reading content so as to resolve their reading difficulties. This view conforms to the broader recognition that reading strategies involve conscious decision-making and reflection during the reading process.

Other scholars view reading strategy as a kind of methods adopted by readers while reading. Wallace (1992) and He Yanli (2003), identify reading strategies as methods that readers use to adapt their approach based on the text type and their reading goals. This adaptability is a key feature of effective reading strategies, as it allows readers to tailor their approach to different contexts. Expanding on this concept, Villanueva (2022) highlights the diverse approaches readers might adopt to engage with a given text. These perspectives illustrate that reading strategies are not just techniques but a comprehensive approach to reading, which includes both cognitive and metacognitive processes. This view allows for a further exploration of the role of reading strategies in reading comprehension and proficiency.

The majority of scholars define reading strategies as cognitive and behavioral activities. Stern (1983) points out reading strategies include all observable language learning behaviors adopted by learners in a language learning activity, such as inferring grammatical rules from the text and consulting dictionary. Carrell (1984) describes reading strategies as the readers' use of rapid decoding, a lot of vocabularies, phonemic awareness, and different techniques to understand a text. Garner (1987) and Barnett (1988) further highlight the deliberate, planned nature of reading strategies. In Garner's view, reading strategies are conscious activities that readers undertake to address cognitive failures during reading. Barnett's definition of reading strategies focuses on the specific actions readers use to derive meaning from unclear texts. Oxford and Crokall (1989), as well as Paris, Wasik, and Turner (1991) further support these cognitive perspectives and describe reading strategies as goal-oriented actions chosen to enhance understanding, such as skimming, scanning, and inferring. Brown (2014) strengthens the importance of strategic control, viewing reading strategies as deliberate actions to improve comprehension. Aarnoutse

& Schellings (2003) add that these strategies involve cognitive behaviors aimed at extracting deeper meaning from texts. Oganov & Kornev (2017) and Chen (2021) emphasize the voluntary and interactive nature of reading strategies, which readers employ to effectively engage with the text and grasp its underlying meanings. Lebedeva M.Yu (2022) defines reading strategies as deliberate, goal-directed actions that readers take to effectively accomplish their reading goals. This view encloses the evolution of the concept, integrating both cognitive and behavioral aspects of reading strategies.

It can be seen that reading strategy has been defined by different scholars from different perspective as a process, techniques, methods, or behaviors in the course of reading, all of which highlight the importance of reading strategies. Despite the diverse definitions, the essential role of reading strategies in enhancing reading proficiency is universally acknowledged by scholars. According to Israel & Duffy (2017), reading strategies are indispensable for mastering complex cognitive tasks like reading comprehension. Without them, individuals fail to achieve competence or proficiency

Classification of reading strategies

In line with the definitions of reading strategies, the classification has been fully explored and the typologies proposed by scholars are typically built on the broader frameworks of language learning strategies (Bialystok, 1978; R. L. Oxford, 1990, 2011).

The earliest theoretical framework of reading strategies is introduced by Olshavsky (1976) Influenced by Goodman's psycholinguistic views, Olshavsky classifies reading strategies into problem identification strategies and problem solving strategies, which lays the foundation for subsequent studies on how readers address challenges during comprehension (Msaddek, 2023).

Based on Olshavsky's framework, Francoise (1988) categorizes reading strategies into sensitizing, improving reading speed, and skimming to scanning. Francoise highlights the use of activities such as summarizing and note-taking to enhance classroom instruction, setting the stage for classroom-oriented applications of reading strategies. On the basis of Francoise's work, Phillips (1987) introduces ten specific strategies, such as questioning interpretations and transforming information, emphasizing readers' ability to shift focus and evaluate information critically. These frameworks give prominence to the importance of identifying problems and applying active strategies to resolve them.

From the cognitive perspectives, Van Dijk and Kintsch (1983) propose general reading strategies (e.g., comprehension monitoring, recognizing text structures) and local strategies (e.g., paraphrasing, rereading), which become the foundation for Block's (1986) categorization of general strategies and local strategies, which underscores the interplay between cognitive tasks and reading comprehension. Oxford (1990) elaborates these strategies into direct strategies (memory, cognitive, and compensation strategies) and indirect strategies (metacognitive, affective, and social strategies). Guthrie et. al. (1996) expand on Oxford's work by stressing on self-monitoring, inference generation, and problem identification as core reading strategies. The above cognitive models shape the subsequent classifications of reading strategies. He (2003) incorporates eight metacognitive strategies (e.g., planning, monitoring, self-evaluation) and ten cognitive strategies (e.g., deducting, summarizing). Similarly, Wang (2012) identifies cognitive

strategies (e.g., visualizing, paraphrasing) and metacognitive strategies (e.g., goal-setting, self-questioning). These categories emphasize the interaction between higher-order thinking and text processing.

Chen (2016) later proposes three categories of reading strategies, of which emotional and social strategies underscore the role of motivation, self-encouragement, and collaboration during reading. This shift toward the emotional and social aspects of reading highlights readers' adaptation of their strategies to the material and their interaction with others.

Building on Block's framework, Mokhtari and Sheorey (2002) introduce the Survey of Reading Strategies (SORS), categorizing strategies into global reading strategies, problem-solving strategies, and support strategies. Pu (2017) refines Mokhtari and Sheorey's typology, proposing four broad categories: metacognitive, cognitive, compensatory, and emotional strategies, with 26 subcategories. This expanded framework integrates educational psychology insights, recognizing that reading strategies are shaped by readers' emotional engagement, prior knowledge, and compensatory efforts. Based on Mokhtari and Sheorey's SORS, Anderson (2003) composes the Online Survey of Reading Strategies (OSORS), which reflects the evolving needs of digital readers and includes strategies for navigating online content, with sub-strategies focused on metacognitive, cognitive, and compensatory techniques.These typologies exert profound influence on later studies. Anderson's OSORS was widely emulated and applied by scholars of digital readings (Ahmadian & Pasand, 2017; Azman, Mirzaeifard, & Amir, 2017; L. W. C. Chen, 2015; Cheng, 2016; Li, 2020; Mesgar & Tafazoli, 2018; Taki, 2016; Tien & Talley, 2014). These developments highlight the growing focus on online reading strategies, emphasizing readers' ability to adapt strategies across different digital platforms.

Digital reading strategies

With digital texts becoming increasingly prevalent (Reiber-Kuijpers et al., 2021), readers(especially students) are exposed more to digital texts and facing new challenges in adapting to digital reading environments. More and more scholars realize the growing importance of digital reading strategies to enhance reading proficiency and literacy in digital contexts (Azmuddin, Nor, & Hamat, 2017; L. W. C. Chen, 2015; do Amaral et al., 2018). And the present studies on digital reading strategy mainly focus on the comparison between print and digital reading strategies, the use of digital strategies by second/foreign language learners, and the impact of digital environments on reading comprehension.

Digital reading is often seen as an extension of paper reading rather than a replacement (Reiber-Kuijpers et al., 2021). While the pre-service teachers are reported to use similar strategies across both reading formats (Yamaç & Öztürk, 2019), digital reading requires new techniques, such as navigating multiple digital sources and integrating inter-textual content (Cho & Afflerbach, 2017). Readers are expected to employ strategies for locating information and managing non-linear reading unique to digital environments (Coiro & Dobler, 2007). Shen (2014) stresses that online reading involves multimedia features like sound effects, digital highlights, and animations, all of which are different from those in the print media. Lebedeva (2022) highlights metacognitive strategies, such as controlling scrolling and

managing attention distribution across digital components, which are unique to digital reading. These strategies help readers to adapt to the multi-modal nature of digital messages and polish their digital reading comprehension.

Digital reading strategies for EFL/ESL learners attain scholars' research interest, and the correlation between digital reading comprehension and strategy use has become the research focus for scholars (Reiber-Kuijpers et al., 2021). Anderson's (2003) Online Survey of Reading Strategies (OSORS) have been most frequently employed by later scholars who study the digital reading strategies for EFL/ESL learners. Mukhlif and Amir (2017) investigates the metacognitive online reading strategies employed by Iraqi EFL undergraduate students and finds that the use of online reading strategies influences the Iraqi EFL learners' attitude as well as enhances their reading process. The results indicate that the effective use of digital reading strategies demonstrate a positive effect to increase learners' digital reading comprehension, whether in ESL or EFL. Villanueva (2022) further underscores that problem-solving strategies are the most frequently used among Filipino students, followed by global and support strategies. Villanueva's finding emphasizes the role of language familiarity and strategy awareness in improving reading comprehension.

Digital reading environments pose as both opportunities and challenges for reading comprehension. Elements such as text availability, accessibility, layout, and digital tools directly influence students' reading performance (Gascoigne & Parnell, 2016). Authentic digital texts increase students' motivation to engage with more complex material, promoting deeper learning (Wood, 2011). Visual components, including layout and design, enhance comprehension but may also introduce challenges, particularly for readers unfamiliar with navigating digital formats. The integration of strategy tools, such as note-taking features, search functions, and highlighting tools, further supports reading comprehension (Azman et al., 2017; Huang, 2013) Despite the availability of these tools, studies emphasize the need to align reading strategies with the specific demands of digital environments. For instance, inter-textual reading requires students to employ linking strategies to compare and integrate information from multiple sources. Teachers, therefore, play a crucial role in helping learners develop appropriate strategies for online reading (Cho & Afflerbach, 2017).

The existing studies have explored the necessity and significance of digital reading strategies and their correlation with reading proficiency from the perspectives of psycholinguistics, behaviorism and cognitive learning theory. While the majority of studies focus on general ESL/EFL learners or undergraduate students across various disciplines (Mukhlif & Amir, 2017; Villanueva, 2022), few have ever attached importance to the pre-service English teachers in local Chinese normal universities, who will play a key role in China's future educational development, particularly in the poverty-stricken areas. Based Gagné's Information Processing Theory (IPT), this study tends to make a comparative analysis of the use of digital reading strategies and reading level between the high- and low-proficiency group students in English majors at local Chinese normal universities, so as to contribute to the enhance of their digital reading proficiency.

This study focuses on three threefold approaches—profiling digital reading strategies, examining correlations with reading proficiency, and identifying differences between high and low proficiency groups, creating a comprehensive model for understanding digital reading strategy application. Unlike existing studies that have mainly focused on reading contexts or digital environments in developed regions, this study lays a unique stress on underdeveloped areas in China, highlighting the digital literacy challenges and opportunities faced by students in these regions.

The integration of quantitative analysis tools is employed, particularly the use of SPSS27.0 to address the following questions:

RQ1: What is the profile of English majors' digital reading strategy use in local normal universities in China?

RQ2: What are correlations between English majors' digital reading proficiency and digital reading strategies?

RQ3: What are the differences in the application of digital reading strategies between the high proficiency learners and the low proficiency learners?

Methodology

This study employs a quantitative approach methodology grounded in the post-positivist paradigm. This is a case study examining the correlation between students' reading proficiency and their digital strategy use in a local normal university in China.

Participants

The sample consists of English majors enrolled into the School of Foreign Languages of Zhaoqing University in 2022 (N=677, male=70, female=607). The vast majority of the participants received senior-high education in impoverished regions, where the integration of information technology and education is emerging. Few have ever had the privilege to the systemic digital reading training. All the participants attend online reading courses for three successive semesters in the university. In the first two semesters, the participants receive 45-minute training on the application of digital reading strategies per week and 16 weeks per semester. The digital reading tests are undertaken in the first two weeks of the third semesters with a view to assess participants' reading proficiency.

Instruments

1. **Digital reading training platform**: The digital reading training program is performed on the language learning laboratory platform initiated by Lancoo Group Science & Technology Co., Ltd., which utilizes a computer network system to provide authentic online teaching environments, personalized learning support and abundant digital learning resources at varying difficulty levels to meet the individualized learning needs of students at different levels.

2. **Digital reading proficiency tests:** The digital reading materials for the tests are selected from the Model Tests for English Majors available on the Lancoo Platform. The reading materials consist of 5 reading passages with an average length of 550 words, covering the themes of politics, economy, history, culture and entertainment, with the genres covering narration, exposition, description and argumentation.

As regards the reading equivalency level, the passages of reading tests are selected to align with the TEM-4, the most authoritative measurement of the English professional proficiency level for the English sophomores in China, with the difficulty coefficient ranging from 0.4 to 0.6.The complete tests comprised a total of 25 items, intended to measure the participants' abilities in declarative knowledge and procedural knowledge. Its reliability is deemed satisfactory with a Cronbach's alpha value of 0.89.

3. **Survey of digital reading strategies:** Anderson's (2003) OSORS is adapted for use in this study. The adapted instrument is named the Survey of Digital Reading Strategies (SODRS), which measures three categories of digital reading strategies, with 18, 11 and 9 items dedicated to evaluating global, problem-solving and support reading strategies, respectively. Responses are rated on a 5-point Likert scale (1=never or almost never do this, 2=do this only occasionally, 3=sometimes do this (about 50% of the time), 4=usually do this, and 5=always or almost always do this). The overall rating indicates the frequency of reading strategy use, and the average for each subscale shows which of the subcategories is most or least frequently used.

4. **The criterion of statistic scoring:** Oxford and Burry-Stock's (1995) criterion is adopted to analyze the results of the survey and the average scores of the subjects are used to infer the learners' use of these strategies. The more frequently they use a strategy, the higher scores are given to the strategy question, as is shown in Table 1.

Table 1. Oxford and Burry-Stock's Statistic Scoring Method

Frequency	Mean	Evaluation
High	4.5-5.0	always or almost always do this
	3.5-4.4	usually do this
Medium	2.5-3.4	sometimes do this (about 50% of the time)
Low	1.5-2.4	do this only occasionally
	1.0-1.4	never or almost never do this

Grouping of the high- and low-proficiency students

There is still no acknowledged principles in academia for grouping high- and low-proficiency students. Some researchers use scores from authoritative exams as the basis for grouping, while others rely on student rankings.

This study classifies participants into High Proficiency Group (HPG) and Low Proficiency Group (LPG) according to the scores of two digital reading tests. Those who rank in the top third in both reading tests are categorized into the high-proficiency group, while those in the bottom third are classified into the low proficiency group, and others are placed in the middle-proficiency group. Accordingly, out of the 677 participants, 97 are in the HPG and 101in the LPG.

Procedures

1. **Administration of Tests:** Two 40-minute online reading proficiency tests were conducted on September 5th and 12th, 2023, via the Lancoo Platform. Scores were automatically graded and ranked.

2. **Distribution of SODRS:** Following the second proficiency test, participants completed the SODRS via their cellphones, taking approximately ten minutes. Participants were assured of confidentiality and data security.

3. **Data Analysis:** Data from the tests and SODRS were analyzed using SPSS 27.0 to explore correlations between students' reading proficiency and their use of digital reading strategies.

4. **Reliability and validity of instruments:** This questionnaire is based on the classification of digital reading strategies by Anderson (2003) and some changes about the investigation are made in line with the specific situation of English majors in local normal university in China. Hence, it is necessary to test the reliability and the validity of the questionnaire.

After importing the questionnaire data into SPSS 27.0 and selecting the reliability analysis, the results show that the Cronbach's α for the overall SODRS is.913, which indicates very good reliability. The reported reliabilities for each subsection are global reading strategies,.923, problem solving strategies,.814; support strategies,.900 and overall,.913. These data help to establish that the SODRS is a highly reliable instrument for assessing the digital reading strategies of EFL learners in China. The reliability testing results is shown in Table 2.

Table 2. The Reliability Statistics of the Questionnaire

Cronbach's Alpha		Cronbach's Alpha Based on Standardized Items	N of Items
Overall	.913	.950	3
G-Strategy	.923		
P-Strategy	.814		
S-Strategy	.900		

To determine whether the reading strategies are suitable for factor analysis, this study employs the KMO (Kaiser-Meyer-Olkin) measure of sampling adequacy and Bartlett's test of sphericity to test the validity of the SODRS in this study. The results reveal that the KMO value is.750, higher than the minimum requirement of 0.6, and the Bartlett's Test of Sphericity is.000, reaching a significant level ($p<0.05$), therefore it indicates good validity. The testing results of validity is shown in Table 3.

Table 3. The Validity of the Questionnaire

Items		value
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.750
Bartlett's Test of Sphericity	Approx. Chi-Square	605.524

	df	3
	Sig.	.000

Results

Answer to RQ1

To address RQ1, descriptive statistics is conducted through a Likert five-point scale, where higher scores indicate more frequent use of the corresponding reading strategies, with the score and frequency having a direct proportional relationship.

This study adopts criterion of frequency scoring by Oxford and Burry-Stock to account the descriptive results. The overall applications of global strategies are shown in Table 4.

Table 4. The Descriptive Statistics of Global Strategy Use (N=677)

Global Strategies		Mean	Std. Error	SD
G1	I have a purpose in mind when I read digital materials.	2.93	.039	1.012
G2	I consult friends about the digital reading materials.	2.35	.037	.952
G3	I consult teachers about the digital reading materials.	2.10	.038	.987
G4	I think about what I know to help me understand digital texts.	3.06	.040	1.028
G5	I take an overall view of the digital text before reading it.	2.97	.041	1.066
G6	I think about whether the digital text fits my reading purpose.	3.02	.039	1.012
G7	I review the digital text first by noting its characteristics.	2.92	.039	1.010
G8	I decide what to read closely and what to ignore.	2.87	.038	.988
G9	I read digital pages for academic purposes.	3.25	.039	1.020
G10	I use tables, figures, and pictures to increase my understanding.	3.20	.040	1.045
G11	I use context clues to help me understand the digital materials.	3.36	.039	1.022
G12	I use typographical features to identify key information.	3.40	.041	1.070
G13	I critically analyze and evaluate information in the digital texts.	3.02	.038	.994
G14	I check my understanding when I encounter new information.	3.25	.038	.988
G15	I try to guess the content of the digital text when I read.	3.18	.039	1.015
G16	I check to see if my guesses about the texts are right or wrong.	3.13	.040	1.037
G17	I scan the digital text before choosing to read it.	3.18	.041	1.073
G18	I read digital pages for fun.	2.49	.040	1.037

It can be seen from Table 4 that the mean of the overall use frequency of global strategies range between 2.10 and 3.40, with an overall mean of 2.982. Among the 18 items, 17 are with a medium frequency of use, accounting for 94%, suggesting that the majority of students' global strategy use is at a moderate level. The top three frequent use of the global strategies are item12, 11 and 14, with an average mean of

3.40, 3.36 and 3.25 respectively, which reveals that the participants are inclined to use typographical features like bold face and italics to identify key information, employ context clues to better understand the digital materials and check their understanding when encountering new information. The three strategies with the lowest frequency of use are item3, 2 and 18, with an average mean of 2.10, 2.35 and 2.49 respectively, revealing that the participants seldom consult friends or teachers about the digital texts they are reading, nor do they read digital texts for fun.

The overall applications of problem-solving strategy are shown in Table 5.

Table 5. The Descriptive Statistics of Problem-Solving Strategy Use (N=677)

Problem-Solving Strategies		Mean	Std. Error	SD
P1	I read slowly and carefully to understand the digital texts.	3.16	.038	.990
P2	I try to get back on track when I lose concentration.	3.36	.038	.989
P3	I adjust my reading speed according to the digital reading texts.	3.28	.039	1.004
P4	When the digital text becomes difficult, I pay closer attention to what I am reading.	3.29	.039	1.015
P5	I stop from time to time and think about the digital text.	3.12	.037	.965
P6	I try to visualize information to help remember the digital pages.	2.88	.040	1.053
P7	When the digital text becomes difficult, I reread it to increase my understanding.	3.34	.040	1.042
P8	I guess the meaning of unknown words or phrases in digital texts.	3.25	.039	1.013
P9	I critically evaluate the digital text before I choose to use the digital information I read.	2.91	.038	.984
P10	I can distinguish between fact and opinion in digital texts.	3.01	.038	.984
P11	When reading digital pages, I look for sites that cover both sides of an issue.	2.75	.041	1.077

As revealed in Table 5, the frequency means of the problem-solving strategy use range between 2.75 and 3.36, with an overall mean of 3.123, which suggests that the average application of students' problem-solving strategies reaches a moderate level. It is noteworthy that item11 is the least frequently used, indicating that students are less inclined to use the web sites for both sides of standpoints of an issue when reading digital pages. And item 2 is most frequently used, revealing that the majority of students can get back on track when losing concentration, which is essentially important to the understanding of the digital texts.

The overall applications of support strategy are shown in Table 6.

Table 6. The Descriptive Statistics of Support Strategy Use (N=677)

Support Strategies		Mean	Std. Error	SD
S1	I take notes while reading digital texts to understand what I read.	2.91	.040	1.048
S2	When digital text becomes difficult, I listen to recordings or watch videos to help me understand what I read.	2.95	.042	1.093
S3	I underline or circle information to help me remember the digital texts.	3.37	.043	1.117
S4	I use reference materials (e.g. an online dictionary) to help me understand the digital texts I read.	3.41	.042	1.093
S5	I paraphrase (restate ideas in my own words) to better understand the digital pages I read.	2.88	.041	1.074
S6	I go back and forth in the digital text to find relationships among ideas in it.	3.12	.040	1.037
S7	I ask myself questions I like to have answers in the digital text.	2.96	.040	1.034
S8	When reading digital texts, I translate from English into my native language.	3.22	.041	1.064
S9	When reading digital texts, I think about information in both English and my mother tongue.	3.17	.037	.970

The statistics in Table 6 shows that the means of the frequency use of support strategies range between 2.88 and 3.41, with an overall mean of 3.11, indicating a medium frequency of support strategy use. Compared with global strategy, average learners tend to use support strategies relatively more frequently, among which item4 ranks the highest and item5 the lowest. The above statistics reveals that most participants prefer to use reference materials such as online dictionary to help them understand the digital reading texts and paraphrase or restate ideas in their own words when they read digital pages for better understanding.

Answer to RQ2

To address the correlation of English majors' reading proficiency and digital reading strategies between the HPG and the LPG, the profile of students' reading proficiency between the HPG and LPG is described and Pearson correlation analysis is conducted.

The mean of the first digital reading test score of the HPG is 84.96 and that of the LPG is 72.30, with an overall mean of 78.50, ranging between 65 to 94. The mean of the second digital reading test score of the HPG is 89 and that of the LPG is 75.28, with an overall mean of 82.07, ranging from 63 to 98. The concrete statistics of reading proficiency is shown in Table 7.

Table 7. Descriptive Statistics of Reading Proficiency between HPG and LPG (N=198)

Reading Test Scores	Groups	N	Minimum	Maximum	Mean	Std. Deviation
Reading Test 1	HPG	97	82	94	84.96	2.610
	LPG	101	65	76	72.30	3.116
Reading Test 2	HPG	97	86	98	89.13	3.002
	LPG	101	63	80	75.28	3.902

Connolly & Sluckin's (1957) criterion is applied to analyze the correlation coefficients of reading proficiency and digital reading strategies between the HPG and the LPG, as is shown in Table 8.

Table 8. The Correlation Analysis between Reading Proficiency & Digital Reading Strategies

		Reading Scores	G-Strategy	P-Strategy	S-Strategy
Reading Scores	Pearson Correlation	1	.591**	.543**	.522**
	Sig. (2-tailed)		.000	.000	.000
	N	198	198	198	198
G-Strategy	Pearson Correlation	.591**	1	.899**	.820**
	Sig. (2-tailed)	.000		.000	.000
	N	198	198	198	198
P-Strategy	Pearson Correlation	.543**	.899**	1	.870**
	Sig. (2-tailed)	.000	.000		.000
	N	198	198	198	198
S-Strategy	Pearson Correlation	.522**	.820**	.870**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	198	198	198	198

Note. **. Correlation is significant at the 0.01 level (2-tailed).

It can be seen that the significant levels between the reading proficiency and the three strategy categories are all.000, which means statistical significance existing for correlation analysis. The correlation coefficients for global strategy, problem-solving strategy and support strategy are.591**,.543**,.522** respectively. According to the criterion for correlation coefficient of Connolly & Sluckin (1957), the Pearson's correlation coefficient between 0.40-0.70 means there being a kind of medium correlation between the two variables, which indicates that there is a positive correlation between English majors' reading proficiency and their use of digital reading strategies. In other words, the learners who achieve better digital reading proficiency are inclined to use these three strategies more frequently. Beyond that, among them, the highest correlation coefficient is.591**, which is the correlation coefficient value of learners' reading proficiency and their application of global strategies. The correlation coefficient

between learners' reading proficiency and their application of problem-solving strategies ranks in the second place, with a Pearson's r of.543**, and the correlation coefficient between their reading proficiency and application of support strategies ranks the last place, with a Pearson's r of.522**. In addition, the correlation coefficients between each of the three subcategories of reading strategies reveal an obvious positive relationship, being.899**,.870** and.820** respectively.

It can be concluded from the above descriptions that the reading proficiency of English majors in local normal university shows a positive correlation with digital reading strategies, and the strength of correlation in descending order is global strategies, problem-solving strategies, and support strategies, all exhibiting a positive and significant relationship.

Answer to RQ3

The third research question focuses on identifying the differences in the application of digital reading strategies between the high proficiency learners and the low proficiency learners.

The independent samples t-test is employed to compare the disparities between HPG and LPG students in the use of digital reading strategies. The independent samples t-test for overall reading strategy and the application of the overall strategy between HPG and LPG are shown in Table 9 and 10

Table 9. Independent Samples Test for Overall Digital Reading Strategies

Digital Reading Strategies		Levene's Test for Equality Variances		oft-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
O-S	Equal variances assumed	.809	.370	10.112	196	.000	33.568	3.320	27.021	40.114
	Equal variances not assumed			10.126	195.845	.000	33.568	3.315	27.030	40.105
G-S	Equal variances assumed	.105	.747	10.253	196	.000	12.216	1.581	13.097	19.336
	Equal variances not assumed			10.257	195.906	.000	12.216	1.581	13.098	19.334
P-S	Equal variances assumed	.684	.409	9.047	196	.000	9.594	1.060	7.503	11.685
	Equal variances not assumed			9.059	195.894	.000	9.594	1.059	7.506	11.683

S-S	Equal variances assumed	1.239	.267	8.599	196	.000	7.767	.906	5.970	9.544
	Equal variances not assumed			8.581	194.624	.000	7.757	.904	5.974	9.540

According to the results of the independent samples t-test, there is a significant difference between the HPG and the LPG in terms of the frequency of overall strategy use (t=10.112, df=196, p=0.000<0.05), which means that the frequency of overall strategy use among students in the high-proficiency group is significantly higher than that in the low-proficiency group (MD=33.568).

Table 10. Report of Overall Digital Reading Strategy Use between HPG and LPG

Groups	N	Mean	Std. Deviation	Std. Error Mean
HPG	97	132.330	22.519	2.286
LPG	101	98.762	24.122	2.400
Total	198	115.207	28.731	2.042

As shown in Table 10, the mean value of overall strategies for the HPG is 132.33, which falls into the high frequency category of "usually used". And the mean value of overall strategy use for the LPG is 98.762, which falls into the medium frequency category of "sometimes used". Hence, the HPG use digital reading strategies much more frequently than the LPG learners. This result is consistent with the research findings of Xu Guohui (2019) who used junior high school students as subjects, indicating that the more frequently students use reading strategies, the higher their corresponding reading test scores tend to be. Accordingly, it can be concluded that the frequency of using reading strategies does affect students' academic achievements. The HPG students have a set of reading strategies they commonly use, which in return ensures stable reading proficiency performance in each reading test, gradually forming their own reading style. Therefore, if low proficiency students intend to improve their digital reading performance and literacy, it is essential for them to cultivate and apply digital reading strategies in their daily lives.

The independent samples t-test for the global strategy use between the two group are shown in Table 11 and the figures of application status shown in Figure 1.

Table 11. The Statistic Results of the Global Strategy Use between the HPG and LPG

Items	Groups	N.	Means	Std. Deviation	Frequency
G1	HPG	97	3.37	0.961	Medium
	LPG	101	2.5	0.923	Medium
G2	HPG	97	2.92	0.975	Medium
	LPG	101	1.98	0.748	Low

G3	HPG	97	2.79	1.05	Medium
	LPG	101	1.77	0.773	Low
G4	HPG	97	3.51	0.991	High
	LPG	101	2.6	0.97	Medium
G5	HPG	97	3.49	0.948	High
	LPG	101	2.54	1.005	Medium
G6	HPG	97	3.28	0.921	Medium
	LPG	101	2.6	0.917	Medium
G7	HPG	97	3.39	0.985	Medium
	LPG	101	2.47	0.796	Low
G8	HPG	97	3.4	0.897	Medium
	LPG	101	2.35	0.842	Low
G9	HPG	97	3.62	0.882	High
	LPG	101	2.75	1.024	Medium
G10	HPG	97	3.57	0.923	High
	LPG	101	2.73	0.948	Medium
G11	HPG	97	3.71	0.924	High
	LPG	101	2.82	0.921	Medium
G12	HPG	97	3.75	0.925	High
	LPG	101	2.85	0.984	Medium
G13	HPG	97	3.6	0.932	High
	LPG	101	2.6	0.939	Medium
G14	HPG	97	3.68	0.861	High
	LPG	101	2.79	0.909	Medium
G15	HPG	97	3.58	0.862	High
	LPG	101	2.7	0.975	Medium
G16	HPG	97	3.6	0.965	High
	LPG	101	2.56	0.921	Medium
G17	HPG	97	3.55	0.99	High
	LPG	101	2.79	0.993	Medium
G18	HPG	97	2.91	1.091	Medium
	LPG	101	2.02	0.904	Low

The application status of the global strategies between the HPG and LPG is shown in Figure 1.

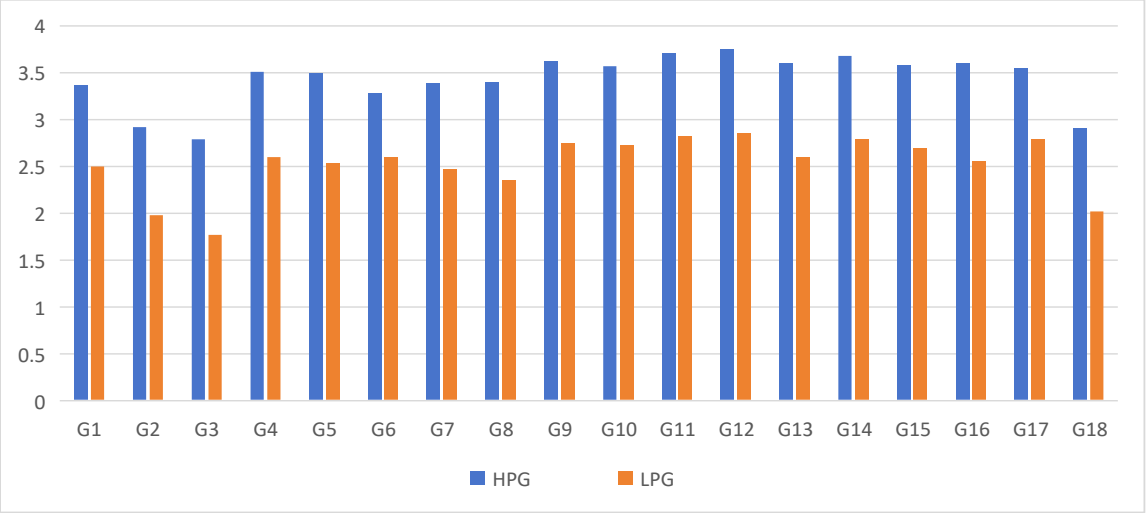

Figure 1. The Frequency Figure of Global Strategy Use between HPG & LPG

Table 11 and Figure1 reveal that HPG apply global strategies more frequently than LPG. Among the 18 items of global strategies, 11 items are high frequently used and 7 items are medium frequently used by the HPG, accounting for 61% and 39% respectively. As to the LPG, 13 items are medium frequently used and 5 items are low frequently used and no item is high frequently used. The overall frequency mean of the global strategies between the HPG and LPG are 3.428 and 2.538.

The independent samples t-test for the problem-solving strategy use between the two group are shown in Table12 and the figures of application status shown in Figure 2.

Table 12. The Statistic Results of the Problem-Solving Strategy Use between the HPG and LPG

Items	Groups	N.	Means	Std. Deviation	Frequency
P1	HPG	97	3.67	0.956	High
	LPG	101	2.69	0.946	Medium
P2	HPG	97	3.69	0.87	High
	LPG	101	2.87	0.902	Medium
P3	HPG	97	3.75	0.854	High
	LPG	101	2.66	1.003	Medium
P4	HPG	97	3.66	0.912	High
	LPG	101	2.74	1.007	Medium
P5	HPG	97	3.47	0.83	High
	LPG	101	2.61	0.99	Medium
P6	HPG	97	3.41	1.018	Medium
	LPG	101	2.39	0.824	Low
P7	HPG	97	3.72	0.965	High

	LPG	101	2.81	0.912	Medium
P8	HPG	97	3.65	1	High
	LPG	101	2.72	0.981	Medium
P9	HPG	97	3.23	0.823	Medium
	LPG	101	2.65	0.932	Medium
P10	HPG	97	3.43	0.877	Medium
	LPG	101	2.66	0.93	Medium
P11	HPG	97	3.16	0.909	Medium
	LPG	101	2.34	0.962	Low

The application status of the problem-solving strategies between the HPG and LPG is shown in Figure 2.

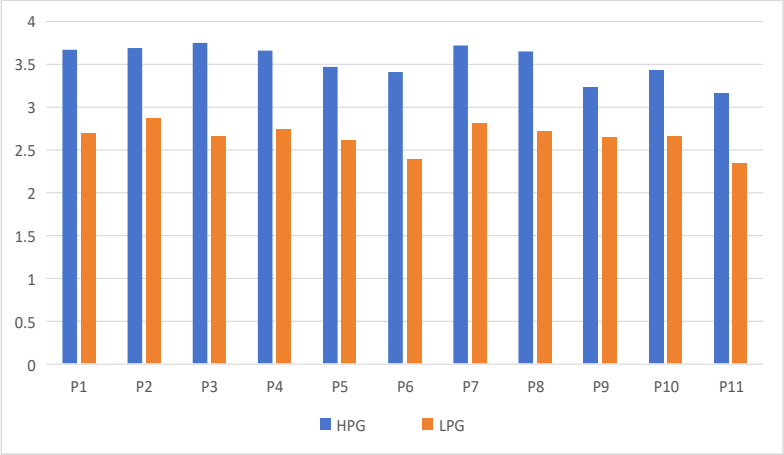

Figure 2. The Frequency Figure of Problem-Solving Strategy Use between HPG & LPG

Table 12 and Figure 2 indicate that HPG use all the problem-solving strategies with high frequency except item 6, 9, 10 and 11, while none of LPG uses the problem-solving strategies high frequently, and item 6 and 11 are even used with low frequency. The overall frequency mean of the problem-solving strategies between HPG and LPG are 3.523 and 2.615.

The independent samples t-test for the support strategy use between the two group are shown in Table 13 and the figures of application status shown in Figure 3.

Table 13. The Statistic Results of the Support Strategy Use between the HPG and LPG

Items	Groups	N.	Means	Std. Deviation	Frequency
S1	HPG	97	3.37	1.054	Medium
	LPG	101	2.58	0.951	Medium
S2	HPG	97	3.31	0.928	Medium
	LPG	101	2.46	1.015	Low

S3	HPG	97	3.82	0.968	High
	LPG	101	2.85	1.081	Medium
S4	HPG	97	3.75	1	High
	LPG	101	2.95	0.994	Medium
S5	HPG	97	3.36	1.012	Medium
	LPG	101	2.44	0.963	Low
S6	HPG	97	3.57	0.923	High
	LPG	101	2.76	0.953	Medium
S7	HPG	97	3.46	0.958	High
	LPG	101	2.51	0.034	Medium
S8	HPG	97	3.63	0.917	High
	LPG	101	2.82	1.014	Medium
S9	HPG	97	3.5	0.851	High
	LPG	101	2.74	0.924	Medium

The application status of the support strategies between HPG and LPG is shown in Figure 3.

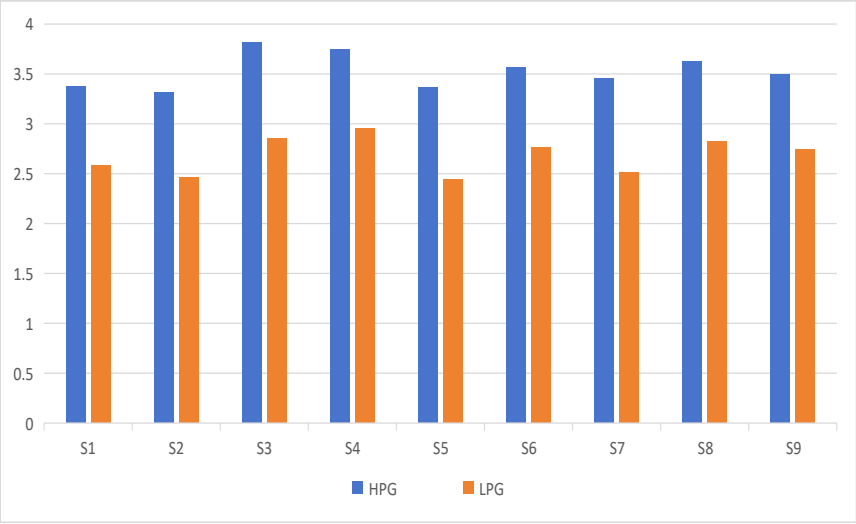

Figure 3. The Frequency Figure of Support Strategy Use between HPG and LPG

From Table 13 and Figure 3, it can be seen that items3, 4, 6, 7, 8 and 9 are high-frequent used by HPG while item 2 and 5 are used with low frequency by LPG. The overall frequency mean of the support strategies between the HPG and LPG are 3.541 and 2.679.

Discussion

The results of RQ1show that the means of the three categories of reading strategies are between 2.982-3.123, which is at a medium frequency. The findings offer a comprehensive view of the preferred strategy

students adopt when engaging with digital texts. The results highlight moderate levels of strategy use across all categories—global, problem-solving, and support strategies—suggesting that students rely on a balanced approach in managing their reading tasks online.

In terms of global strategy use, the data indicates that students moderately apply these techniques, with most scores falling in the medium frequency range. Notably, strategies such as using typographical features to highlight key information (Item 12), using context clues for comprehension (Item 11), and checking understanding with new information (Item 14) emerged as the most frequently used. These preferences suggest a tendency among students to rely on visual aids and contextual clues to support their reading. Conversely, lower mean scores for strategies such as consulting friends or teachers (Items 2 and 3) and reading for enjoyment (Item 18) indicate a lack of social engagement and recreational reading in digital contexts. This could imply that digital reading is often seen as a solitary, academic-oriented activity rather than a social or leisurely pursuit.

For problem-solving strategies, students also show moderate usage, with the overall mean slightly higher than that for global strategies. The most frequently used strategy in this category, "getting back on track after losing concentration" (Item 2), emphasizes the need for focus maintenance, which is essential for comprehension in a digital environment filled with distractions. In contrast, the relatively lower use of seeking balanced viewpoints by consulting diverse sites (Item 11) suggests that students may not consistently practice critical evaluation of perspectives. This observation might reflect a gap in critical reading skills or an inclination to rely on sources that confirm their initial understanding without exploring opposing views.

Support strategies exhibit similar frequency trends, though students seem to rely on these slightly more than on global strategies. The high frequency of using reference materials, such as online dictionaries (Item 4), indicates a preference for readily available digital tools that aid comprehension, underscoring the importance of immediate access to supporting resources. The lower frequency of paraphrasing information in their own words (Item 5), however, suggests a potential area for improvement in internalizing and personally contextualizing information. This reliance on external aids over self-generated insights may indicate a more passive approach to processing digital content.

Overall, these findings reveal a moderate but varied approach to digital reading strategies. The data suggests that while students value direct comprehension aids like visual markers and external resources, they may underutilize strategies that involve critical reflection, social engagement, and paraphrasing. Encouraging students to balance strategy use by incorporating more reflective and analytical practices could foster deeper engagement with digital texts. Additionally, fostering a culture that views digital reading as both a collaborative and enjoyable activity might enhance students' overall digital literacy. Future studies could explore how training interventions focused on underused strategies might impact digital reading comprehension and engagement levels among students.

The findings of RQ2 shed light on the relationship between English majors' reading proficiency and their digital reading strategies, providing valuable insights into how different strategies may influence reading

performance. The descriptive data indicate that students in HPG consistently outperform those in LPG across both digital reading tests, with the HPG showing significantly higher means in both tests (84.96 and 89.13 for the first and second tests, respectively) compared to the LPG (72.30 and 75.28, respectively). This consistent difference in reading proficiency suggests that higher proficiency levels may be associated with more effective reading strategies or greater familiarity with digital reading tasks. The Pearson correlation analysis further supports this, demonstrating significant positive correlations between reading proficiency and the three digital reading strategies: global (G-strategy), problem-solving (P-strategy), and support (S-strategy). Specifically, the strongest relationship is observed between reading proficiency and global strategies (r =.591**), followed by problem-solving strategies (r =.543**), and support strategies (r =.522**). According to Connolly & Sluckin's (1957) criterion, these coefficients indicate a moderate positive correlation, suggesting that students who perform well in digital reading are more likely to engage with these strategies. This implies that higher reading proficiency is associated with the frequent use of comprehensive approaches, such as understanding the main ideas or navigating digital texts effectively.

Among the strategies, global strategies show the highest correlation with reading proficiency, suggesting that students who prioritize overarching comprehension techniques may achieve better outcomes in digital reading. This finding aligns with previous research emphasizing the role of global strategies in enhancing comprehension and navigation within digital platforms, where information is often fragmented across various sections or hyperlinks (R. Oxford & Crookall, 1989). Students employing these strategies might be better equipped to handle the non-linear and visually complex nature of digital texts, thereby improving their reading efficiency.

Problem-solving strategies, which include tactics for addressing comprehension difficulties, also show a significant positive relationship with reading proficiency. This indicates that proficient readers may be more adept at overcoming obstacles in digital reading, possibly by employing strategies like rereading, focusing on key terms, or inferring meanings from context. Given the complexities of digital reading, these skills are essential for navigating interruptions and maintaining comprehension, thereby supporting a better overall performance.

Support strategies, though showing the lowest correlation, remain significantly related to reading proficiency. This suggests that the use of supportive tools, such as annotations or references to external resources, might enhance reading comprehension, albeit to a lesser extent than other strategies. The lower correlation may reflect that while support strategies can aid understanding, they are perhaps not as integral to proficient reading as more active strategies like global and problem-solving approaches.

The inter-correlations among the strategies themselves (with values of.899**,.870**, and.820**) indicate a strong relationship between the three types of strategies, suggesting that students often use these strategies in tandem rather than in isolation. This mutual relation implies that a multifaceted approach to digital reading—one that combines global comprehension, problem-solving, and supportive techniques—may be particularly beneficial for students.

This finding highlights the importance of digital reading strategies in enhancing reading proficiency among English majors. The positive correlations, particularly with global strategies, underline the value of comprehensive and proactive approaches in digital reading contexts. Future research might explore how targeted instruction in these strategies could further improve students' reading outcomes, particularly in increasingly digitalized learning environments.

The results of RQ3 highlight notable differences in digital reading strategy use between HPG and LPG learners. The findings indicate that HPG students engage in digital reading strategies more frequently across all subcategories—global, problem-solving, and support strategies—compared to their LPG counterparts. The consistent, higher frequency of strategy application among HPG students suggests that these learners have cultivated a more sophisticated approach to digital reading, which in turn, contributes to their stable and higher reading performance. This aligns with the findings of Xu Guohui (2019), which suggest that increased use of reading strategies correlates positively with reading proficiency.

A key observation is that HPG students are particularly adept at employing global strategies, as evidenced by the frequency of high-use items in this category. This contrasts sharply with the LPG students, who primarily utilize these strategies at a medium or low frequency. The data suggests that global strategies are integral to higher reading proficiency, as evidenced by their strong correlation with reading outcomes ($r=0.593$). This finding supports prior research by Oxford & Crookall (1989), underscoring the value of global strategies in developing effective reading skills. The apparent underemployment of global strategies by LPG students presents an opportunity for targeted instructional intervention, where educators might prioritize these strategies in teaching frameworks to address this gap.

Problem-solving and support strategies, while also more frequently utilized by HPG students, show slightly lower correlations with reading proficiency ($r=0.543$ and $r=0.522$, respectively). Nonetheless, the frequent use of problem-solving strategies, particularly among high proficiency learners, suggests that these strategies are an essential part of their reading repertoire. Problem-solving strategies seem to enable HPG students to navigate reading challenges independently, contributing to the development of their unique reading styles and reinforcing their confidence in digital reading tasks.

Moreover, the study reveals a medium frequency of digital reading strategy use across all participants, which corresponds with their moderate reading scores. This suggests that English majors, especially those in local normal universities in China, might benefit from cultivating advanced digital reading strategies to enhance their reading proficiency. The gap in strategy use between HPG and LPG students further indicates that proficiency is not merely a function of baseline skills but also of the frequency and sophistication of strategy application. Consequently, promoting more frequent use of digital reading strategies, especially underutilized global strategies, can be instrumental in improving reading outcomes for LPG students.

Overall, this study underscores the importance of encouraging lower proficiency students to adopt effective digital reading strategies to foster greater autonomy, improve their self-efficacy, and ultimately enhance their reading proficiency. Tailored instruction and structured practice of these strategies could

bridge the proficiency gap and provide LPG students with the tools necessary to develop consistent and effective digital reading practices similar to their high-proficiency peers.

Conclusion

The results of the study reveal significant distinctions in strategy application, demonstrating that high-proficiency learners engage more with global strategies, which are strongly correlated with improved reading outcomes. These findings underline a critical gap in digital reading pedagogy: while all students apply digital reading strategies with medium frequency, high-proficiency learners achieve superior results by consistently applying strategies that facilitate global comprehension and problem-solving.

Consequently, the implication of pedagogy is clear: integrating digital reading strategies into the classroom can benefit all students. Teachers are encouraged to create interactive learning opportunities that allow higher proficiency students to share their strategies with peers, fostering a collaborative learning environment. Through group activities and digital reading competitions, teachers can promote the practice of digital reading strategies across all proficiency levels. Furthermore, teachers should focus on both the theoretical and practical instruction of digital reading strategies, ensuring that students understand not only the mechanics of digital reading but also the cognitive processes involved.

By actively involving students in strategy exchange and supporting innovation in digital reading practices, teachers can help students identify their strengths and areas for improvement. This reflective approach empowers students to take ownership of their learning and fosters a deeper understanding of how to use digital reading strategies effectively.

Due to practical constraints, this research focuses on the digital reading strategies of English majors in Zhaoqing University with the small sample size of 677, the result of which is not sufficient to account exactly for the status quo of correlation between reading proficiency and digital reading strategy use of other English majors in other local normal universities. Besides, the use of digital reading strategies is a dynamic process that can be influenced by many factors. This study only combines two digital reading scores with the overall level of digital reading strategies, so there is room for further academic study on the improvement in terms of reading proficiency under the context of local normal universities in China.

Fund Project

Research and Practice Project on Promoting High-Quality Development of Basic Education through the Construction of New Normal University in Guangdong Province—Research and Practice on Improving the Information Literacy of Middle School English Teachers from the Perspective of Digital Education (Certified by Guangdong Education Department in 2023, No. 29, Item 34)

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