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A comparative study on the use of four reading strategies in English reading across humanities and science disciplines

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Abstract

This study aims to explore the use of four reading strategies among students of humanities and science disciplines during English reading. While existing literature confirms discipline-specific cognitive differences resulting from field training, the relationship between academic discipline and reading strategy use remains empirically inconsistent. Therefore, the present study aims to compare the use and preference of students across humanities and science disciplines regarding scanning, predicting, visualizing and summarizing. Questionnaires were distributed to 40 humanities students and 40 science students, and answers were analyzed quantitatively and qualitatively. The results show significant disciplinary differences in strategy use, with humanities students demonstrating greater competence in scanning and predicting, while science students showed adeptness in visualizing. While no significant differences emerged in strategy preference, the findings suggest that strategy facilitation is mediated by three key factors:

- Efficiency considerations,
- Language proficiency levels, and
- Discipline-specific norms.

The results emphasize the role of linguistic competence in reading strategy use and the importance of discipline-specific strategy instruction to reduce field-specific cognitive disparities.

Keywords: English reading strategies; Disciplines; Scanning; Predicting; Visualizing; Summarizing

1. Introduction

Reading is a complex operation built on literacy and expanded through cognitive interpretation. In an interactive model, cognitive factors influencing reading comprehension include background knowledge, conceptual abilities, and strategies (Smith et al., 2021). English as a Foreign Language (EFL) learners further encounter difficulties in English reading due to gaps in linguistic background knowledge, necessitating the activation of conceptual skills and strategies within the interactive framework to bridge these gaps. To achieve improved reading comprehension, readers employ reading strategies to facilitate deeper understanding and retention. Reading strategies actively engage readers in constructing meaning from texts and allow readers to process information more effectively (Higgs et al., 2023). Through consciously implementing reading strategies when reading, readers can monitor their understanding, make inferences, and integrate new information with existing knowledge, thereby enhancing their overall reading proficiency.

Reading strategies contribute to the reading process in constituting a wholesome and goal-oriented reading experience. Previous research (Nasab and Motlagh, 2015; Ali and Razali, 2019) has identified three strategies in reading in

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accordance with the classification of learning strategies proposed by Chamot and O'Malley (1990), including (a) cognitive, (b) meta-cognitive, and (c) social/affective strategies. In particular, cognitive reading strategies are direct text-processing techniques which readers utilize to process relevant information in texts. These strategies facilitate goal-oriented mental activities such as scanning, predicting, visualizing, and summarizing, which lead to comprehension and the integration of new information with prior knowledge. Empirical studies have found a positive correlation between the use of reading strategies and reading comprehension in EFL contexts. (Hilmi, 2024; Zhao, 2024). Given the challenges EFL readers face in English reading, the facilitation of reading strategies is essential in fostering deeper reading comprehension among EFL students.

Empirical studies have found varying effects of reading strategies in accordance with individual differences. These differences stem from English language proficiency as well as other functional factors, such as gender, socio-economic backgrounds, and learning motivation (Meniado, 2016; Alfarwan, 2021; Sheikh et al., 2022). These factors contribute to cognitive discrepancies, which influence readers' preference of reading strategies and effective strategy use. Following this logic, students from specific disciplines—who develop distinct thinking methods through their academic training—may exhibit varying levels of reading strategy use during L2 reading. Particularly, students of natural sciences and humanities have been found to display differences in cognitive processing (Putri et al., 2020). As reading strategy facilitation draws on cognitive processing, this study aims to explore the differences in the use and preference of four reading strategies—scanning, predicting, visualizing, and summarizing—across students of humanities and science disciplines. An understanding of potential differences in reading strategy preferences among humanities and science students could enable instructors to design more tailored and effective curricula for English reading courses. By aligning pedagogical approaches with the cognitive frameworks of these student groups, educators may optimize instructional outcomes and enhance reading proficiency.

In this study, four cognitive reading strategies from bottom-up processing, top-down processing, and visual and textual models of interactive processing were selected to understand humanities and science students' use and preferences of reading strategies. In selecting processing strategies for this study, scanning was prioritized among bottom-up approaches due to its focus on textual details. From top-down strategies, predicting was chosen for its reliance on prior knowledge and contextual inference. Within interactive processing, visualizing was incorporated to examine image-based comprehension, and summarizing was included to assess textual comprehension. While studies have been conducted on the strategy preference of different disciplines in English reading, few have targeted specific disciplines with different cognitive processes in consideration. To bridge this gap, the research questions in this study are proposed as follows:

- Is there any difference in the use of four reading strategies in English reading among humanities students and science students?
- Is there any difference between the most and least preferred of the four reading strategies among humanities students and science students?
- What are the factors that influence students' preference of the four reading strategies?

2. Literature review

2.1. Reading comprehension for EFL readers

Reading is a multifaceted interaction between cognition, linguistic skills, and the written form of language. Reading comprehension can be classified into three levels according to cognitive complexity:

- Literal,
- Interpretive, and
- Applied comprehension (herber, 1978).

In terms of cognitive activity, this classification corresponds to factual examination, inferencing of implicit information, and administering the product of thought to reader-text transaction. In english reading for efl learners, l2 reading is further made complex by

- Linguistic factors,
- Contextual factors,
- Cognitive factors.

EFL students often encounter significant challenges in attaining deeper levels of reading comprehension due to these linguistic, contextual, and cognitive barriers.

In accordance with the literal level of reading comprehension, linguistic factors include vocabulary knowledge (Kasim and Raisha, 2017), and syntactic complexity (Basilan and De Sagun, 2024). Limited vocabulary knowledge and weak syntactic awareness hinder readers' ability to decode complex texts, forcing them to rely on surface-level processing in reading. Contextual factors include text genre (Qi et al., 2025) and cultural background (Razavi and Gilakjani, 2020). Lack of familiarity with genre- and cultural-specific conventions may lead to misinterpretations or overreliance on dictionary definitions rather than contextual cues. Finally, cognitive factors include working memory and language transfer (Lu, 2023). As EFL learners must consciously decode unfamiliar linguistic structures while simultaneously attempting to integrate information and monitor comprehension, working memory constraints greatly influence the reading experience (Brunfaut et al., 2021). In an attempt to aid the reading process, EFL readers carry over their knowledge of the native language during reading (Liu et al., 2023), resulting in language transfer. Language transfer may be positive or negative, the latter of which becomes errors in learning. Collectively, these obstacles limit the progression of English reading beyond literal comprehension, resulting in reading difficulties among EFL learners.

To overcome barriers in English reading, EFL readers must develop strategic processing skills to support linguistic competency. In reading research, bottom-up, top-down, and interactive processing are fundamental cognitive approaches to text comprehension (Grabe and Stoller, 2019). Bottom-up processing is a text-driven approach where comprehension is built on small linguistic units to construct larger meaning. On the other hand, top-down processing is a knowledge-driven approach where readers use prior experiences, expectations, and contextual cues to predict and interpret text. Previous studies have found the use of top-down and bottom-up reading strategies to be beneficial in overcoming cognitive difficulties in English reading (Navaz and Fathima Hana, 2025; Yang et al., 2019). As strategies to help efficiently comprehend texts, reading strategies hold their ground in a vortex of approaches to assist readers in improving English reading comprehension.

2.2. Reading strategies in EFL settings

Reading strategies play a pivotal role in overcoming the challenges faced by EFL learners in English reading (Aizawa et al., 2020; Ali and Razali, 2019; Msaddek, 2023). Empirical research on EFL reading highlights the interplay of bottom-up, top-down, and interactive reading strategies. Bottom-up strategies are foundational for EFL learners, as they rely on textual features to construct literal meaning. Scanning is a selective reading strategy built on bottom-up processing, through which readers focus on visual cues (e.g., numbers, or distinctive phrasing) to search for specific information (Abidin, 2020). To execute scanning effectively, readers first identify the target information, then move their eyes systematically—often in a zigzag or vertical pattern—across the text, pausing only when encountering potential matches. This strategy prioritizes speed and accuracy, making it particularly useful for navigating dense or lengthy materials (Asmawati, 2015). Proficiency in scanning is associated with familiarity with textual conventions and the ability to optimize cognitive effort for task-specific retrieval. Prior studies have found that scanning significantly improved EFL readers' performances in reading comprehension tests, as readers could pinpoint important information in long texts (Komara and Dewi, 2021). By prioritizing textual details, bottom-up strategies such as scanning enhance reading efficiency, and empower targeted information retrieval in linguistically unfamiliar texts.

Conversely, top-down strategies enable learners to make up for linguistic gaps by leveraging background knowledge through contextual guessing and schema activation. Predicting is a cognitive reading strategy that enhances comprehension by actively engaging readers in anticipating what will be read based on prior knowledge, textual clues, and contextual clues (Duffy, 2009). By formulating hypotheses about reading contents, readers strengthen their focus and establish meaningful connections between new and existing knowledge. Effective prediction relies on (a) students' interpretation of textual clues, (b) activation of prior knowledge related to the topic, and (c) continuously revising predictions as new information is encountered (Brod, 2021). Sumirat, Padilah, and Haryudin (2019) explored the impacts of the prediction strategy in EFL reading and found that predicting what will be read can significantly increase reading comprehension. When systematically applied, top-down reading strategies such as predicting transform reading into an interactive process, bridging comprehension gaps, and promoting critical thinking.

Built on the foundation of bottom-up and top-down strategies, interactive processing models hold that proficient readers dynamically integrate both strategies. Interactive strategies emphasize the reciprocal relationship between decoding textual elements and applying prior knowledge. Visualizing is an interactive reading strategy that enhances comprehension by enabling readers to construct mental imagery in accordance with the text, resulting in enhanced comprehension and retention (Top Teaching Tasks, 2020). As EFL readers read, they are encouraged to pause at key descriptive passages and visualize sensory details to deepen engagement with the text. This cognitive strategy

strengthens readers' abilities to infer meaning and connect textual information to prior knowledge. Research suggests that visualizing supports the decoding of complex texts to promote reading comprehension (Devi and Sia, 2020) and fosters motivation by cultivating an immersive reading experience (Darmayanti, 2021). For EFL learners, this strategy is particularly beneficial as it bridges linguistic gaps by connecting abstract language to mental pictures.

Another interactive reading strategy is summarizing, in which readers organize and restate key ideas from a text in their own words to optimize reading comprehension. Through this strategy, readers identify essential details and reproduce information efficiently. In pedagogical practices, summarizing can be scaffolded through guided instruction, such as providing graphic organizers and encouraging peer discussions to refine understanding (Prasetyo and Farhan, 2024). Prior research looking into the impacts of summarizing in reading comprehension has established the benefits of this strategy for EFL readers (Ramirez-Avila and Barreiro, 2021). These benefits include the reinforcement of grammatical structural knowledge and discourse coherence, and the development of critical thinking and language production skills. Therefore, summarizing proves valuable in EFL reading, as it equips learners with linguistic and cognitive skills for reading success.

Reading strategy preference has been shown to vary according to individual differences, such as disciplines, or 'fields of study'. A previous study by Bećirović, Brdarević Čeljo and Polz (2017) revealed significant differences in choice of reading strategies among the English and management departments in a university in Sarajevo. Empirical findings by Daguay-James and Bulusan (2020) revealed statistically significant disciplinary variations in reading strategy utilization among EFL freshmen, with divergences in self-reported utilization of reading strategies related to predicting, summarizing, and scanning. On the other hand, some studies have found no significant difference in reading strategy use and preference across disciplines. Ahmed (2020) found no significant differences in reading strategy use among various disciplines. Likewise, Köse and Güneş (2021) found no significant difference among reading strategy frequency and preference among the faculty of education and the faculty of arts and humanities. While factors contributing to these divergent outcomes are yet unclear, these empirical findings reveal possible discipline-dependent variables in reading strategy facilitation.

In summary, empirical research has demonstrated the efficacy of reading strategies for EFL readers. Context-appropriate implementation of specific reading strategies can reap linguistic and cognitive advantages for readers. However, existent studies examining disciplinary differences in reading strategy utilization yield inconclusive findings, suggesting a need for further exploration.

3. Method

3.1. Participants

A total of 80 sophomore students participated in the study, with 20 students from the geography, Chinese, physics, and chemistry departments respectively. The sophomore students were recruited from a university in Taiwan and assigned to two groups according to their disciplines: the humanities group and the science group. The humanities group consisted of sophomores from the geography and Chinese departments (N=40), whereas the science group consisted of sophomores from the physics and chemistry departments (N=40). The participants have had experience in studying English as a foreign language for more than nine years, beginning from third to twelfth grade, as per the compulsory education system in Taiwan. Participants have adequate proficiency in English reading, as they have English reading experience in high school and were taking English as a compulsory subject in university. Table 1 presents participant distribution on the same English midterm test prior to this study.

Table 1 Participant distribution on English midterm test

	Humanities		Sciences	
	N	P	N	P
100%	22	27.5%	15	18.75%
80% or above	41	51.25%	47	58.75%
60% or above	14	17.5%	9	11.25%
Below 60%	3	3.75%	9	11.25

Note. N=Number, P=Percentage

Table 1 demonstrates an equitable distribution of humanities and science students across the test performance categories of 80 and above, and below 80. Therefore, there is no significant disparity between the English proficiency of humanities and science participants in this study.

3.2. Study design

In this study, participants answered a questionnaire regarding their usage of the four metacognitive strategies in English reading: scanning, predicting, visualizing, and summarizing. *A Questionnaire on the Students' Perceptions of Four Strategies in English Reading* was designed, comprising 24 question items and two open-response question items. Items 1-24 were designed in a five-point Likert scale, ranging from "strongly agree", "agree", "neutral", "disagree", to "strongly disagree". Items 1-6 examined students' perceptions of the scanning strategy. Items 7-12 explored students' perceptions of the predicting strategy. Items 13-18 inspected students' perceptions of the visualizing strategy. Items 19-24 probed into students' perceptions of the summarizing strategy. Finally, items 25-26 were two open-ended questions inquiring about the most and least preferred of the reading strategies and readers' reasons for their preference. The questionnaire was administered in Mandarin to help the subjects thoroughly understand each question item.

To understand the reliability and validity of the questionnaire, a pilot study was conducted the previous year with 20 sophomores each from the chemistry department and English department. In the pilot study, the perceptions of the questionnaire for the subjects were computed by Reliability Statistics in the Scale of SPSS20.0. The reliability coefficient of the questionnaire on the students' perceptions of scanning, predicting, visualizing and summarizing was reliable, as the Cronbach's coefficient alpha (α) was higher than 0.70 ($\alpha = 0.94$). In confirming the validity of the questionnaire, the results of the pilot study were computed by the Kaiser-Meyer-Olkin and Bartlett's Test of Factor Analysis in Dimension Reduction of SPSS20.0. The KMO Measure of Sampling Adequacy is considered valid when the result is higher than 0.60. The result of the statistical data was 0.62, which was higher than the standard 0.60, and the questionnaire is therefore considered valid.

The results of items 1-24 of the questionnaire were processed by means of an Independent Samples T-Test. Responses to open-ended questions were analyzed via frequency and percentage to understand the most- and least-preferred reading strategies in the humanities and science groups, respectively. Reasons for preference were analyzed qualitatively.

4. Results and discussion

4.1. Differences in reading strategy use

To answer the first research question, descriptive statistics of the questionnaire items 1-24 were analyzed to understand the differences in utilization of the four reading strategies among humanities students and science students. The following Table 2 presents items in the questionnaire that yield significant differences across disciplines on reading strategy use.

Table 2 Significant differences across disciplines on reading strategy use

Item	Group	Mean	SD	t	Sig. (2-tailed)
2. I can quickly scan for time in an English text by looking for contextual cues (e.g., at, o'clock).	H	3.80	1.018	0.130	0.008**
	S	3.78	0.660		
6. I usually know what words to look for when scanning in English texts.	H	3.50	1.1013	1.906	0.004**
	S	3.13	0.723		
8. I can predict what will be read in the text by looking at the topic sentence.	H	3.88	0.822	1.316	0.005**
	S	3.48	0.640		
16. When reading an English text, I can visualize consecutive events.	H	3.68	0.660	-2.139	0.044*
	S	4.03	0.797		
17. When reading an English text, I can visualize additional details on the basis of what is read from the text.	H	3.38	0.952	-3.420	0.014*
	S	4.03	0.733		

Note. H=Humanities, S=Science, SD= Standard deviation, *$p< 0.05$, **$p<.01$

As displayed in Table 2 above, significant differences were found regarding the use of scanning, predicting, and visualizing across students of different disciplines. However, there were no significant differences across humanities and science disciplines regarding the use of summarizing.

To begin with, answers to Item 2 achieved statistical significance because the *p*-value of Item 2 is lower than .01 (*t*=0.103, *p*=0.008), indicating humanities students have more positive perceptions (M=3.80>3.78) of using scanning for time-related information in English texts. This is in accordance with Vakili and Mohammed's (2022) finding that humanities disciplines use more adverbials than science disciplines. Accordingly, humanities students are more familiar with time-related English grammatical elements in a text, which has positive effects on their use of scanning. Furthermore, Item 6 achieved statistical significance because its *p*-value is lower than 0.01 (*t*=1.906, *p*=0.004). Humanities students are more positive they know what to look for when scanning during English reading. This finding is supported by Majumdar et al.'s (2021) development of a humanities course in which students were introduced to different forms and terminologies associated with the targeted texts. Through the course, humanities students acquire familiarity with key vocabulary related to certain topics, thereby cultivating the ability to identify terminology relevant to locating specific information in a text. In summary, humanities students have displayed more positive perceptions of the use of the scanning strategy to find time-related textual elements, and know what words to look for during scanning.

Table 2 also shows a significant difference in the use of predicting across students of different disciplines. Answers to Item 8 achieved statistical significance because the *p*-value of Item 8 is lower than 0.01 (*t*=1.316, *p*=0.005), suggesting humanities students demonstrate greater proficiency in anticipating textual content based on topic sentences compared to science students. (M=3.88>3.48). This finding aligns with Zare and Maftoon's (2015) observation that science students typically exhibit reluctance toward formulating hypotheses when presented with inadequate data. Accordingly, science students are more cautious in facilitating prediction during reading comprehension tasks.

In terms of visualizing, Item 16 achieved statistical significance because the *p*-value of Item 16 is lower than 0.05 (*t*=-2.139, *p*=0.044), which suggests that science students are more competent in mentally sequencing and visualizing successive events compared to humanities students (M=4.03>3.68). This finding can be supported by Hall et al.'s study (2022) that educational activities in science disciplines display higher levels of visualization skills. Furthermore, Item 17 achieved statistical significance because the *p*-value of Item 17 is lower than 0.05 (*t*=-3.420, *p*=.014), indicating that science students believe they are more capable of visualizing additional details on the basis of what is read from the text than humanities students. Albaili's (1993) study supports this finding in that science students are found to be prone to engaging in right-hemispheric style processing. In other words, science students synthesize concepts and associate facts to construct a comprehensive visualization of the text that enriches their reading comprehension through detailed elaboration. The systematic thinking patterns cultivated through training in science disciplines bring cognitive advantages in visualizing while reading.

In answer to the first research question, humanities students' answers to the questionnaire exhibited increased and practiced facilitation of scanning and predicting over science students. In visualizing, science students were more adept at implementing the strategy due to pedagogical training in their disciplines. There were no significant differences in the use of summarizing across humanities and science disciplines.

4.2. Preference of reading strategy

To answer the second research question, data collected from open-response questions on the preference of reading strategies were analyzed by frequency and percentage. Figure 1 presents the preferred reading strategy of humanities students and science students.
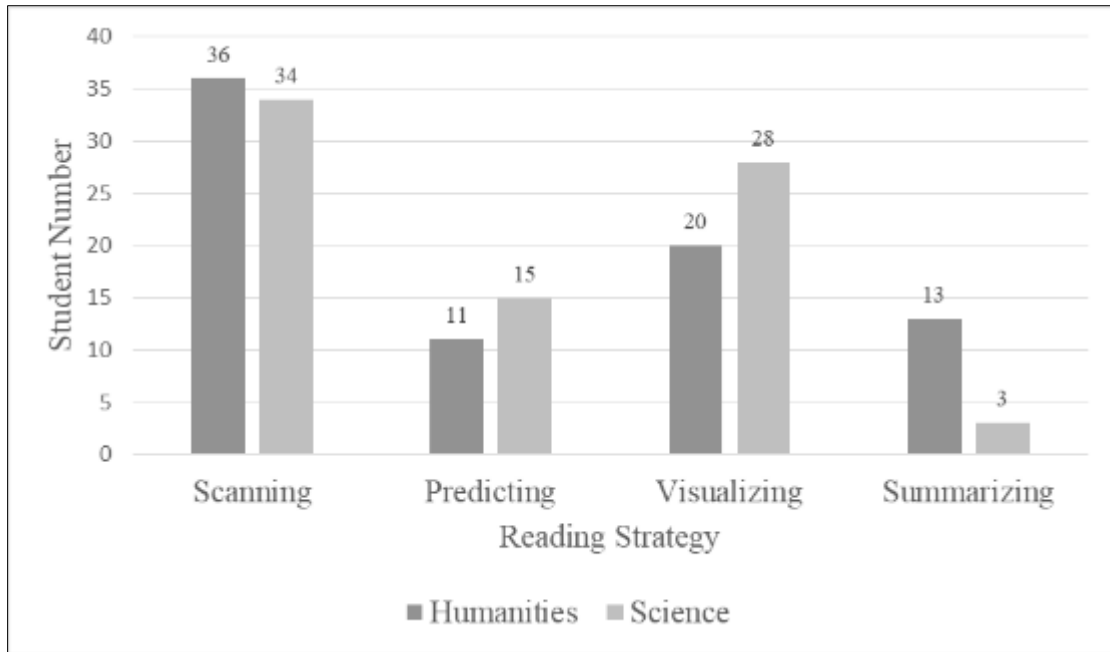
Figure 1 Preferred reading strategy of humanities students and science students

As presented in Figure 1, scanning is the most preferred reading strategy for both humanities and science students, followed by visualizing. For humanities students, summarizing is favored over predicting, and vice versa for science students. Furthermore, science students' responses show visualizing is preferred over summarizing, though Table 1 displays a lower mean in the use of scanning for science students. Reasons for this will be discussed in the next section. The following Figure 2 presents the least preferred reading strategy of humanities students and science students.
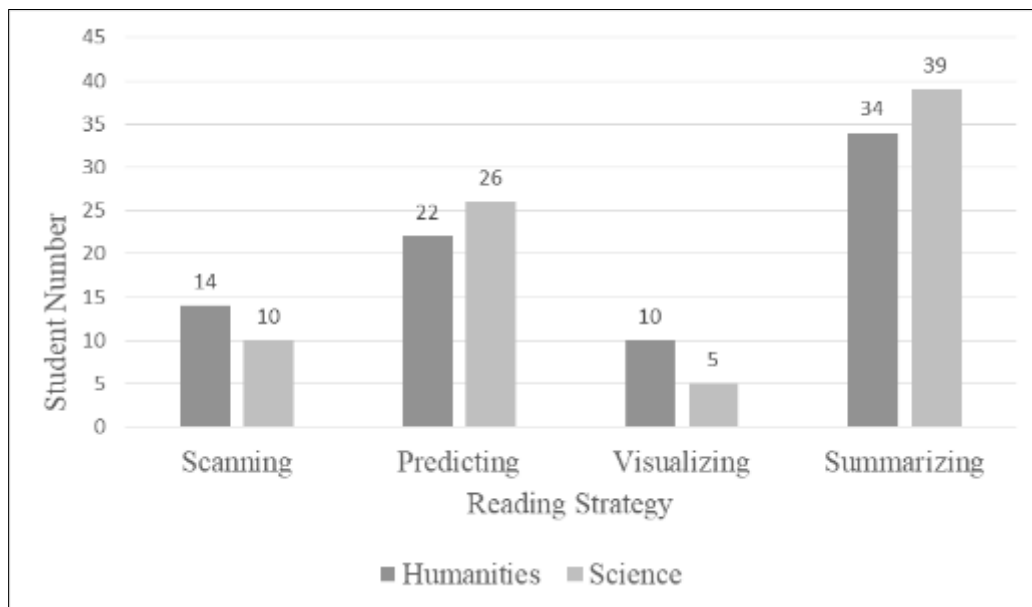

Figure 2 Least preferred reading strategy of humanities students and science students

The data presented in Figure 2 indicate that summarizing is the least preferred reading strategy among both humanities and science students, with predicting and scanning also relatively low in ranking. Notably, there is no significant difference between the two student groups regarding the order of least preferred reading strategies, indicating no significant disciplinary differences in aversion to reading strategies. The underlying reasons for these preferences will be explored in the subsequent section.

4.3. Reasons for preference

To answer the third research question, data from open-response questions inquiring about reasons for preference of reading strategy use were qualitatively analyzed. In terms of the most preferred strategy, humanities and science students reported favoring scanning because "it was fast" and "can help in getting the gist of the text quickly". This suggests that time efficiency plays a critical role in students' selection of reading strategies. Regarding predicting, students appreciated its benefits in compensating for limited vocabulary and facilitating topic engagement. Visualizing was valued for its ability to link textual content with imagery representation to enhance comprehension, though science students noted occasional difficulties in forming mental images due to insufficient textual detail. Finally, summarizing was preferred for its effectiveness in organizing key information for an overall review of the text. These findings contribute to a deeper understanding of the pedagogical considerations required to support discipline-specific reading strategy instruction in higher education.

No significant disciplinary differences were found in students' perceptions of least preferred strategies. For students across both disciplines, negative perceptions of scanning were attributed to the opinion that "readers still have to go back to the text to carefully read for specific details", and "some key words can be misleading, so readers still have to read the whole text". In terms of predicting, science students perceived the strategy to be inadequate due to its unreliability, with one student noting: "predictions are often proved wrong", and another expressing: "there's not enough information to make predictions". For visualizing, one humanities student expressed that the strategy "added to cognitive burden", and a science student stated that "I don't use visualizing, just out of habit". Finally, summarizing was perceived to be inefficient in reading ("it's too time-consuming", and "there's no point in organizing the text in your own words if you already understand it") and students further expressed concerns about grammatical accuracy in their output summaries. These findings highlight how reading strategy aversion stems from linguistic (e.g., grammar accuracy in summaries), practical (e.g., time efficiency), and discipline-specific norms (e.g., science students are unwilling to make predictions based on limited information).

In summary, the main reasons for the preference of reading strategies are associated with time consumption. This is in accordance with Witherby, Babineau, and Tauber's (2025) notion that learners' strategy selection is significantly influenced by perceived time investment and implementation effort. Such behavior aligns with cognitive load theories, suggesting that readers avoid strategies that are overly demanding. Secondly, lack of linguistic proficiency to implement strategies is also an important factor. This is consistent with Alaofi's study of 2020, in which it was found that linguistic proficiency was a major barrier in the use of summarization among students. In English reading, limited linguistic proficiency creates a threshold barrier that prevents learners from fully utilizing sophisticated reading strategies. Finally, disciplinary training influences students' reading strategy use across fields of study. This finding can be supported by Bergman's (2024) finding that practices and cognition vary across disciplines, and students can achieve better reading comprehension in texts associated with their field of study with explicit disciplinary training. Consequently, discipline-specific norms and constraints influence students' choice of reading strategy use.

5. Conclusion

The present study reveals significant disciplinary differences in strategy use, with humanities sophomore students employing scanning and prediction more frequently and adeptly than science sophomore students. On the other hand, science students can facilitate visualizing in English reading better than their humanities counterparts. These findings align with existing literature documenting discipline-specific variations in reading strategy application. Furthermore, results indicate differences in preferred reading strategies, while there is no significant variation in least preferred reading strategies. Strategy selection appears mediated by temporal constraints, linguistic proficiency, and discipline-specific norms. The results of this study provide further evidence that students across disciplines differ in their selection and preference of English reading strategies. Consequently, pedagogical interventions should:

- Accommodate learners' linguistic competencies to optimize strategy implementation,
- Incorporate specific reading strategy training to provide cross-disciplinary opportunities in practicing reading strategies (e.g., encouraging science students to undertake summarizing tasks), and
- Provide reflection exercises to bridge strategy gaps across academic domains.

Future research can expand the study to include a more comprehensive range of cognitive and metacognitive reading strategies in English reading while incorporating participants from additional academic disciplines to better understand discipline-specific patterns in reading strategy use.

Compliance with ethical standards

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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