INDIVIDUAL PROFILES IN ONLINE READING: RELATIONSHIPS BETWEEN DEFAULT PSYCHOLOGICAL STANCES, GOAL ORIENTATIONS, STRATEGIES, AND PERFORMANCE

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Individual Profiles in Online Reading: Relationships between Default Psychological Stances, Goal Orientations, Strategies, and Performance

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CERTIFICATE OF ORIGINALITY

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Abstract

With the advent of the digital-explosion age, the prevalence of information technology and the ease of accessing online resources have propelled the emergence of human-driven digital media and textual production. This has transcended traditional conceptions of reading and encompasses the ability to acquire knowledge, comprehend information, and meaningfully interact with technology. In response to these demands, the Progress in International Reading Literacy Study (PIRLS), conducted every five years since 2001, developed the e-PIRLS assessment in 2016. This assessment seeks to evaluate students' online reading ability by simulating web browsing experiences and motivating students to read texts, interact with them, and answer comprehension questions. The above trends show that the skill of reading online effectively has emerged as a necessary competency for students in the present era. However, scholars have found that despite being somewhat computer literate, students born in the 21st century still encounter significant challenges in online reading. These difficulties include, but are not limited to, becoming lost in the abundance of information and struggling to establish connections between multimodal content. Consequently, it is imperative to employ appropriate strategies and provide psychological support to overcome these challenges. That said, previous research has neither adequately investigated the influence of psychological factors on online multimodal reading nor explored the effects of strategies for objective online reading assessments, and in particular it has not taken individual differences into consideration. Therefore, this study, guided by the Cognitive Affective Engagement Model (CAEM), employed a person-centered approach to investigate 280 fourth-grade students' online multimodal reading in Hong Kong.

Using latent profile analysis, this study first identified the participants' psychological default stance shaped by their online reading self-efficacy and emotions. Three distinct profiles emerged: positive (G1), moderate (G2), and ambivalent (G3). Second,

multinomial logistic regression analyses were conducted to examine whether goal orientations for online reading tasks influenced the memberships of these three profiles. The results indicated that goal orientations significantly affected the classification of students in the G1 and G2 groups, with higher goal orientations increasing the likelihood of students being classified into G1. However, no significant effects were observed for G3. Third, using the Wald chi-square test, this study further explored differences in online reading strategy use and performance among students with varying psychological profiles and found that G3 students exhibited the highest confidence in their strategy application but achieved the lowest reading scores. Students in G1 reported greater strategy use than those in G2 did, which was also reflected in their superior online reading performance. Finally, mixture path analyses were conducted to examine how different psychological profiles moderated the relationship between students' online reading strategies and their reading performance, and the results revealed that strategies significantly impacted only students in the G2 and G3 groups. Specifically, mastering the ability to manage disorientation significantly improved online reading performance for both the G2 and G3 students. The strategy of identifying the main idea was effective only for G3 students, while a trial-and-error approach proved beneficial exclusively for G2 students. Interviews provided additional insights into the differences among the three groups and explained how goal orientation influenced the formation of their profiles. To strengthen the findings, as triangulation sources for the mixture path analyses the study also utilized backend data (e.g., question-answering duration, clicks on multimodal elements) that were extracted from the testing platform, combined with interview responses.

This study not only validates and extends the Cognitive Affective Engagement Model for multiple sources from a theoretical perspective, but it also provides empirical support for the critical role of psychological mechanisms and reading strategies in the complex context of online reading. Importantly, it highlights how individual differences influence the interactions among these variables. The findings offer valuable

pedagogical insights for enhancing the students' online reading performance, including how educators can help students cultivate more positive psychological profiles and which strategies should be emphasized for students with different psychological characteristics.

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Chapter 1 Introduction

1.1 Multimodal Literacy

Multimodality, defined by Mills and Unsworth (2017), refers to the incorporation of multiple modes in the process of semiosis or meaning-making. Viewed through a social semiotic lens, modes can be seen as the semiotic tools or structures shaped by social and cultural contexts, and enabling the construction of meaning (Halliday, 1978). The nature of language and literacy practices has inherently been multimodal, because they involve navigating and interpreting a range of meanings in communication. This extends beyond spoken or written words to encompass nonverbal cues, body language, movement, sound, and even silence (Mills et al., 2013). In this light, multimodal literacy emerges as a field of study that focuses on the exploration of a language combining two or more modes of meaning, with recognition of the interconnectedness of different semiotic resources (Mills & Unsworth, 2017).

Multimodal literacy, which encompasses both reading and writing, places a significant emphasis on multimodal reading in educational research and application. This emphasis is influenced by Western empiricist traditions, which prioritize knowledge acquired through direct observation (Mills, 2016). Within the field of multimodal reading research, scholars have recognized the collaborative nature of language and images in conveying meaning and enhancing comprehension across diverse modes of communication (Alvermann et al., 2013; Coiro et al., 2014). This recognition is further reinforced by the inclusion of multimodal literacy in government-mandated curriculum documents in many countries, such as Australia, Canada, the United States, Singapore and Sweden. The significance of multimodal reading is also evident in large-scale assessments, such as the Programme for International Student Assessment (PISA), in which approximately 30% of test items involve images in what is referred to as

"noncontinuous text" (Mills & Unsworth, 2017). The above indicates that whether in everyday communication or in curriculum and assessment reforms, multimodal reading has become an essential topic that literacy scholars can no longer overlook.

1.2 Online Multimodal Reading

With the advent of the digital explosion age, the prevalence of information technology and the ease of accessing online resources have driven the rise of user-generated digital media and textual production. This, in turn, has caused a significant upsurge in the circulation of multimodal texts within digitally mediated environments (Mills & Unsworth, 2017). Consequently, the inclusion of an ever-growing variety of images across the different paper and digital media texts has established intermodality as a vital component of literacy in the 21st century (Bateman, 2014; Bezemer & Kress, 2009; Luke, 2003). Furthermore, the advent of new technologies has fundamentally transformed the very essence of literacy. Specifically, contemporary literacy has transcended traditional conceptions of reading and encompasses the ability to acquire knowledge, comprehend information, and meaningfully interact with technology (Pianfetti, 2001). This expansion reflects the need to navigate and engage with technology in a meaningful way. In response to these demands, the Progress in International Reading Literacy Study (PIRLS), an international reading achievement study that has been conducted every five years since 2001 with 9- to 10-year-olds, developed the e-PIRLS assessment in 2016. This assessment seeks to evaluate students' online reading ability by simulating web browsing experiences and thereby motivating students to read texts, interact with them, and answer comprehension questions (Mullis et al., 2017). Through pilot programs in selected countries, this assessment initiative is planned to be implemented worldwide in 2026 across the 60 countries and regions (including Hong Kong) that participate in PIRLS. In other words, the skill of reading online effectively has emerged as a necessary competency for students today (Mills, 2016).

Notably, online reading remains a cognitively demanding task and is distinctive from other types of multimodal reading because it involves hypertexts, which comprise nodes and hyperlinks (Madrid et al., 2009). Nodes function as individual text units, akin to paragraphs or pages in a book, and convey the content of the text. Hyperlinks, on the other hand, establish connections between these nodes, thus facilitating access to various pieces of information. By leveraging these hyperlinks, readers can navigate from their current position within the text and can explore additional information on specific topics, thereby influencing their reading process (Schurer et al., 2023). The nonlinear structural nature of online reading, in particular, presents challenges for students in terms of planning their reading paths and selecting pertinent information (Cho & Afflerbach, 2017). In fact, scholars have found that despite being fairly computer literate, students born in the 21st century still encounter significant challenges in online reading (Liou, 2004). These difficulties include, but are not limited to, becoming lost in the abundance of information and struggling to establish connections between various elements of multimodal content (K. T.-C. Chen, 2019; H. Huang et al., 2009; Schurer et al., 2023). Therefore, measures should be taken to address this issue. As is indicated in the literature, psychological support and reading strategies are crucial in helping individuals overcome these challenges (B. Cho et al., 2018; List et al., 2019).

1.3 The Role of Psychological Factors in Reading

1.3.1 Psychological factors in paper-based reading

Previous studies have found that students who struggle with reading face challenges that extend beyond cognitive shortcomings, to include a range of motivational issues (Lau & Chan, 2003). Therefore, investigating how psychological factors influence learners' reading process and outcomes has emerged as a focal point of scholarly inquiry. Significant research has explored the psychological factors linked to students' reading performance in paper-based contexts (e.g., Kavanagh, 2019; Logan et al., 2011;

X. Yang et al., 2024; Zhu et al., 2023). Within this domain, researchers have devoted significant attention to the motivational aspects of self-efficacy and goal orientation, as well as emotional factors such as enjoyment, anxiety, and boredom. For example, self-efficacy is frequently regarded to be a vital factor in activating and influencing students' learning actions and outcomes (Bandura et al., 1996). Scholars have uncovered positive correlations between self-efficacy and reading performance, although there are noticeable variations across different age groups and ethnic backgrounds (Louick et al., 2016; Peura et al., 2021; Prat-Sala & Redford, 2010). Notably, studies exploring the relationship between self-efficacy and reading strategies are relatively limited and have primarily focused on the English as a Foreign Language (EFL) context (Muche et al., 2024; Shehzad et al., 2020). This scarcity of research is particularly noteworthy given the significant differences in language learning confidence observed between first-language and second-language learners (S. Zhu, Yao, Chan, & Zhu, 2024b). Thus, findings from EFL contexts may not be directly transferable to L1 learners. However, research involving self-efficacy and reading strategies in native Chinese (L1) speakers remains largely unexplored.

Regarding emotions and reading strategies, enjoyment typically exhibits a positive correlation with reading performance (Ma et al., 2021; Rogiers et al., 2020, 2020), while anxiety and boredom are negatively associated with it (Zaccoletti et al., 2020). Notably, the extent of these relationships can vary, depending on task characteristics (paper-based vs. digitally based), the language of reading (L1 or L2), and the individual's age. However, research into the relationship between emotions and reading strategies is quite scarce, regardless of whether the context is paper-based or online-based.

Regarding goal orientation in learning, the significant effects of intrinsic and extrinsic goal orientations on learning achievement have been well-documented (e.g., Alhadabi & Karpinski, 2020; Dao, 2021; Dull et al., 2015; Lou & Noels, 2017). Notably, the effects of goal orientation in learning are influenced by task characteristics, task

difficulty, and task preference (Horvath et al., 2006), whereas little research has examined their role in the context of reading, particularly in relation to self-efficacy and emotions.

1.3.2 Psychological factors in online reading

There is already a substantial body of research on the theory underlying the process of online hypertext comprehension. The most well-known theoretical models for processing multiple documents and multimodal texts include the Multiple-Documents Task-Based Relevance Assessment and Content Extraction (MD-TRACE) (Rouet & Britt, 2011), and the Information Problem-Solving Using the Internet (IPS-I) model (Brand-Gruwel et al., 2009). Because online multimodal texts demand greater cognitive effort and a wider range of strategies for comprehension (Cho & Afflerbach, 2017), these models focus primarily on the cognitive aspects of information processing. Similarly, empirical research has primarily examined the skills and strategies used in online reading (e.g., K. T.-C. Chen, 2019; B. Cho & Afflerbach, 2017; Habók et al., 2024; Z. Sun et al., 2016). It is undeniable that these theories and empirical studies have provided valuable insights into online reading, but the challenges of online reading extend beyond the cognitive domain and include emotional and motivational aspects (List & Alexander, 2017). In particular, when facing difficulties with comprehension, students need emotional support and guidance to manage negative emotions, maintain motivation, and handle the complexity of reading tasks effectively (Lau & Chan, 2003). In that light, List and Alexander (2017) introduced the *Cognitive Affective Engagement Model (CAEM)* to investigate the impact of motivational factors on the comprehension of multiple sources, including multimodal texts, in online environments. However, corresponding empirical studies remain scarce. The core mechanism in the CAEM is the idea that students' psychological characteristics (e.g., self-efficacy, emotions) shape a default stance, which in turn influences their reading behaviors during text comprehension (e.g., strategy use) as well as their performance in multiple-source tasks

(e.g., online reading tasks) (List & Alexander, 2017, 2018, 2019). Because self-efficacy, emotions, and goal orientations are task-specific (Bong & Skaalvik, 2002; Horvath et al., 2006; Zaccoletti et al., 2020b) and have not been well discussed in the context of online reading, it is necessary to fill that gap by exploring students' psychological (cognitive) and emotional reactions in online multimodal reading. The CAEM serves as the foundational framework for this research.

1.4 Strategies in Reading Comprehension

Notably, relying solely on psychological support may not help students overcome difficulties effectively unless it is paired with appropriate learning behaviors (e.g., strategies) (Dörnyei, 2005; Norman & Aron, 2003; Papi, 2010). Reading comprehension is contingent upon myriad cognitive and linguistic processes, with strategic approaches playing a pivotal role, particularly in challenging situations (Afflerbach et al., 2008). According to Pressley and Afflerbach (1995), effective text comprehension is achieved when a reader actively predicts the content, ties the text to existing knowledge, poses questions during the reading process, monitors comprehension, and distills the text into summaries. Accordingly, reading strategies can be viewed as a consciously controlled and methodical plan designed to enhance reading comprehension (Muijselaar et al., 2017).

Extensive research on paper-based reading has demonstrated close relationships between reading strategies and reading performance (M.-H. Chou, 2021; Muijselaar et al., 2017; Sheorey & Mokhtari, 2001; Yeom & Jun, 2020). Specifically, skilled readers are adept at employing effective strategies that enhance various cognitive processes, thereby fostering a deeper and more coherent comprehension of the text. In contrast, less proficient readers often approach reading on a word-by-word basis and lack the strategic approach necessary to integrate and understand the material fully (Lau & Chan, 2003). Moreover, it is essential to acknowledge that reading strategies are domain-

specific, and their influence on reading performance may differ across various contexts, such as leisure reading versus reading for assessment (Cohen & Upton, 2006), and across different types of texts, including paper-based single-text reading, paper-based multiple-texts reading, and online multimodal reading (B. Cho & Afflerbach, 2017). Although previous studies have identified specific strategies used in online reading contexts (H. C. Huang, 2013; Park et al., 2020; Park & Kim, 2011; Tsai & Tsai, 2003), the extant research remains limited in linking these online reading strategies to performance in an assessment setting.

Furthermore, it is important to note that significant differences exist between reading in English and reading in Chinese. Reading can be bifurcated into two key processes: those that operate on the letter and word level, and those that encompass above-the-word-level comprehension. Students' ability to read accurately and fluently at the letter and word level forms the foundation for effectively utilizing strategies in higher-level comprehension processes beyond individual words (Hoover & Gough, 1990). The differential characteristics of the logographic system of Chinese and the alphabetic system of English manifest at the letter and word levels. Chinese characters are morpheme-based, whereas alphabetic words are built from phonemes, and these distinct differences have sparked scholarly debate about the role of phonological awareness in decoding words in each language (Ho et al., 1999; H. S. Huang & Hanley, 1997). Although existing studies have extensively explored the relationship between reading strategies and reading performance in English within paper-based reading contexts, and the relationship between reading strategies and reading performance in Chinese (e.g., Lau & Chan, 2003; Muijselaar et al., 2017; Y. J. Wu et al., 2021), current research related to online reading is predominantly confined to the field of English language learning, whether it be for L1 or L2 learners (e.g., H. C. Huang, 2013; Park et al., 2020; Park & Kim, 2011; Tsai, 2009).

Moreover, it is worth noting that previous research into the relationship between psychological differences and reading performance or strategies, whether for online reading or paper-based reading, has tended to examine variables separately. However, this variable-centered approach fails to acknowledge that psychological factors interact and function as an interconnected whole. In fact, variations in psychological variables (e.g., self-efficacy, enjoyment, anxiety, boredom) among learners can result in distinct psychological profiles (i.e., the default stance in the CAEM), which may subsequently influence reading behaviors and performance in diverse ways (List & Alexander, 2018). Therefore, for further investigation, it is necessary to integrate various psychological variables into a default stance and adopt a person-centered approach.

1.5 Aims of the Study

Collectively, research on psychological factors within online reading contexts has been somewhat overlooked, thus raising questions about how psychological mechanisms interact with online reading strategies, and whether the relationship between online reading strategies and performance differs on the basis of readers' individual psychological profiles. Meanwhile, the above statements also indicate that online reading, as a form of multimodal reading, is essential for students to master in today's digital age (Bateman, 2014; Bezemer & Kress, 2009; Luke, 2003; K. Mills, 2016). However, because of the involvement of multimodal elements within a nonlinear hyperspace, combined with the need for human-computer interaction skills, it is particularly challenging for students to comprehend text content effectively within a limited time frame (i.e., in an assessment context) (B. Cho & Afflerbach, 2017; Schurer et al., 2023).

Therefore, it is necessary to explore the role of strategies in online reading assessments, particularly in the context of Chinese reading—an area that has received relatively less attention. Considering that fourth grade marks a critical transition from "learning to

read" to "reading to learn" (McMaster et al., 2014), and that Hong Kong's fourth graders are set to participate in the ePIRLS assessment for the first time in 2026, this study sought to conduct a person-centered, mixed-methods investigation into their online reading strategies, performance, and associated psychological factors. Specifically, the research questions were:

1. What are the characteristics of the default psychological stances, specifically in regard to online reading self-efficacy and emotions, among fourth-grade students in Hong Kong?

2. How do goal orientations of online reading tasks influence the varied default psychological stances among students?

3. What are the differences in online reading strategy use and performance among students with varying default psychological stances?

4. How do the different default psychological stances moderate the relationship between students' online reading strategies and their reading performance?

To enhance the credibility of the findings, qualitative data were incorporated to complement the quantitative research. Specifically, based on the quantitative results, the first two research questions utilized focus group interviews to provide deeper insights into the questions being studied. For the latter two research questions, in addition to focus group interview data, backend data were extracted from students with diverse psychological profiles during their task-related reading processes. Particular attention was given to observing the students' strategies for processing multimodal information (e.g., images and hyperlinks) within a hyperspace environment. This mixed-methods approach addressed the limitations of relying solely on self-reported questionnaires in the quantitative phase of the study.

Chapter 2 Literature Review

2.1 Theoretical Frameworks of Multiple Source Use

Because online reading inherently involves a diverse range of textual formats with multimodal elements, section 2.1 primarily focuses on reviewing the theories relevant to utilizing multiple sources, particularly the Cognitive Affective Engagement Model employed in this research.

2.1.1 Theories of multiple source use

The prevailing theories on multiple-sources use revolve around the core concept of multiple-text comprehension (MTC), also known as the comprehension of multiple sources (Primor & Katzir, 2018). Bråten et al. (2013) defined MTC as the "building of a coherent mental representation of an issue from the contents of multiple texts that deal with the same issue from different perspectives" (pp. 322–323). Slightly differently, List and Alexander (2017) described MTC with an emphasis on the processes rather than the result of understanding, stating, "MTC refers to the processes and behaviors whereby students make sense of complex topics or issues based on information presented not within a single source, but across multiple texts" (p. 143). Synthesizing these two definitions, in this study we understood MTC as the processes and behaviors that are used to construct a coherent understanding of an issue or topic through multiple texts/sources.

In the 1990s, a pivotal wave of research on the use of multiple sources emerged, establishing the theoretical groundwork for MTC. Wineburg (1991) was at the forefront of investigating the synthesis of multiple texts. This line of inquiry was particularly relevant for historians, who regularly need to reconcile differences in various historical sources. Specifically, Wineburg's studies probed the contrasts between how experts and

novices read and interpret different historical materials. Using the think-aloud protocol, Wineburg (1991) observed that experts use several strategies, such as sourcing, corroboration, and contextualization—techniques that help them evaluate the origins and contexts of information, detect discrepancies between documents, and resolve conflicts. In contrast, novices often do not employ such strategies and are less adept at navigating conflicting information. Subsequently, Kintsch (1998) introduced the Construction-Integration (CI) Model, which outlines the process by which a reader forms a mental representation of a text through its lexical and syntactic features and draws inferences from its interconnected components to achieve coherence in a single text.

The Documents Model (DM)

Building upon the foundation of the CI model, the Documents Model (DM), proposed in 1999 by Britt and colleagues and Perfetti and colleagues (Britt et al., 1999; Perfetti et al., 1999), became one of the most influential models for MTC. This model focuses on the types of connections formed during MTC, helping to describe the mental representations that learners are likely to develop when tackling complex multitext reading or writing tasks. Specifically, the Documents Model suggests that students comprehend multiple texts by constructing two types of models: the *Inter-text Model* and the *Integrated Mental Model* (Perfetti et al., 1999).

The *Inter-text Model* represents information about the sources themselves, including "nodes" for each source that contain details about the source's form (e.g., type, date), setting (e.g., place, culture), and rhetorical goals (e.g., intent, audience) (Britt & Rouet, 2012). The inter-text model delineates the connections between specific pieces of information and their originating sources by establishing links between contents and sources. It also charts the degree to which different sources are in agreement, in conflict, or serve to complement each other through these source-source relationships.

The Integrated Mental Model can be conceptualized as a content-centric cross-textual framework that builds upon the inter-text model; it captures the common themes or issues discussed across texts. For instance, the integrated mental model might involve forming a cohesive interpretation of a historical event depicted from various viewpoints, or developing a comprehensive, overarching understanding of a contentious scientific matter by analyzing conflicting documents (Bråten & Strømsø, 2011).

The MD-TRACE Model

In the early 2010s, Rouet and Britt (2011) expanded the Documents Model (DM) and developed the multiple-documents task-based relevance-assessment and content-extraction (MD-TRACE) model. This model delineates how students tackle problem-solving through the use of multiple sources. Rouet and Britt's (2011) framework extension not only encompasses the mental constructs formulated by the reader but also outlines the particular processes, outcomes, and resources that necessitate engaging with various texts. Specifically, MD-TRACE posits that students process multitext information through five steps. The first step involves the hypothesis that students create a task model upon receiving a multiple-text assignment. This model is a mental depiction of the requirements of the task, which clarifies the objectives that are needed to complete the assignment successfully. In the second step, students plan and determine the need to consult multiple texts to meet the task's requirements. The third step involves the actual engagement with multiple texts, which includes three subprocesses: text selection, processing, and integration. The fourth step is for students to respond to the task question/goal. The fifth and final step is verification, whereby the students ascertain whether their generated response aligns with the task model they developed in step one. Nevertheless, the specific processes that occurred within the initial step are not detailed (Bråten & Strømsø, 2011).

The Information Problem Solving Using the Internet (IPS-I) Model

Compared with holistic umbrella frameworks such as the Documents Model and the MD-TRACE Model, the Information Problem Solving Using the Internet (IPS-I) Model, proposed by Brand-Gruwel et al. (2009), specifically targets multiple text comprehension within the context of the internet. This framework is divided into three major components: constituent skills, regulation activities, and conditional skills.

The constituent skills component involves a sequential process that begins with *defining the problem*, in which the specific information issue to be solved is clarified along with identification of the needed information's type and scope. Following the definition of the problem, the *search for information* phase requires the use of internet tools such as search engines and databases and involves the selection of keywords and the evaluation of search results for relevance. After locating potential sources, the next phase is to *scan the information*, which entails a rapid review to select sources and assess their quality and relevance with respect to the information problem at hand. The fourth phase involves *processing the information* gathered by carefully reading and understanding selected sources, extracting key details, and integrating them with existing knowledge. This phase may also involve the comparison and assessment of source reliability. The final phase comprises *organizing and presenting the information* in a structured manner to create a coherent answer or solution that can be appropriately conveyed.

In addition, the IPS-I Model underscores the significance of metacognition. Within the constituent skills, metacognitive regulation activities, such as orientation, monitoring, steering, and evaluating, interact with the five skills and permeate the entire process of MTC in an online environment. Beyond this, paper-based reading abilities, the skill to evaluate information, and computer skills are considered conditional skills that support the five constituent skills.

In summary, the DM, the MD-TRACE Model, and the IPS-I Model are currently the mainstream theoretical frameworks that are designed for cognitively describing and guiding how individuals search effectively for, evaluate, and utilize information to construct coherent understanding in a multitext environment (Anmarkrud et al., 2014; Bråten et al., 2018; List et al., 2019; Primor & Katzir, 2018; Strømsø et al., 2013). All three models encompass key steps, such as problem definition, an information search, information evaluation, and information integration, and emphasize the importance of monitoring, evaluating, and adjusting one's own thinking and actions during the processing of multiple texts (Brand-Gruwel et al., 2009; Britt et al., 1999; Perfetti et al., 1999; Rouet & Britt, 2011). However, it is important to note that MTC is a more complex task than single-text reading is, and online reading in a hyperspace context, with its nonlinear structure of multiple texts, can be even more challenging. This complexity suggests that cognitive skills and effort alone are insufficient (List & Alexander, 2017). Students facing difficulties need to marshal a variety of psychological factors, such as beliefs, motivation, and emotions, to help them successfully build a coherent understanding (List & Alexander, 2019). Although the roles of motivational and emotional factors in reading performance have been well-established in paper-based reading environments (e.g., Bai et al., 2021; Jurik et al., 2014; Ma et al., 2021; Muche et al., 2024; Rogiers et al., 2020; Zaccoletti et al., 2020), these three mainstream theoretical models have not explicitly incorporated those factors into their considerations.

2.1.2 The Cognitive Affective Engagement Model (CAEM)

Among the various theories addressing text processing, the *Cognitive Affective Engagement Model* (*CAEM*), introduced by List and Alexander (2017), offers a theoretical framework for investigating the impact of motivational factors on the comprehension of multiple sources, including multimodal texts, in online environments. List and Alexander (2017) classify theories such as the DM (Perfetti et al., 1999), MD-

TRACE (Rouet & Britt, 2011), and IPS-I model (Brand-Gruwel et al., 2009) as "coldly cognitive analyses" (p.182). Conversely, they regard student motivational and affective factors as "warm characteristics." Through an examination of various studies that explored students' think-aloud reports, text engagement behaviors, and written responses to multiple-text tasks, List and Alexander (2017) underscore the importance of integrating warm concerns into cold analyses.

Specifically, the CAEM can be divided into three parts: the initiating task (Phase 1), the default stance (Phase 2), and the multiple source use behavior (Phase 3). The Phase 1 initiating task represents students' own interpretation or perspective of the multitext reading task, including their attitudes toward such tasks or their expected cognitive products (e.g., goal orientations) for the task at hand.

The Phase 2 default stance is about the students' personal characteristic default stance, which is composed of various motivational and emotional factors that are unique to the individual. The default stance can be regarded as a purposeful emphasis on the "students' initial starting points in approaching multiple-text tasks, with the recognition that such stances may evolve during the course of task completion" (List & Alexander, 2018, p. 44). It can be broken down into behavioral disposition, which refers to habituated practices in source evaluation, along with the beliefs and experience in handling multiple sources, such as self-efficacy in evaluation; and affective engagement, such as emotions. Because individuals vary across different psychological variables, when these variables are combined, each person's default stance will also be unique. In light of this, List and Alexander (2017) proposed four types of default stances and placed them in the dimensions formed by the horizontal and vertical axes. These stances are evaluative, critical analytic, disengaged, and affective engagement stances. It is important to note that all four are merely theoretical hypotheses and have not been tested through empirical research.

Phases 1 and 2 can be seen as the preparation stages for the multitext reading task, while Phase 3 is the execution stage of processing multiple sources (List & Alexander, 2019). Phase 3 may involve cognitive and metacognitive strategies, as well as practical aspects such as the time invested in the reading process and the number of texts accessed. Regarding the relationship between the three phases, Phase 1 leads to the development of Phase 2, which in turn manifests as Phase 3. The framework of the CAEM process is displayed in Figure 2.1.

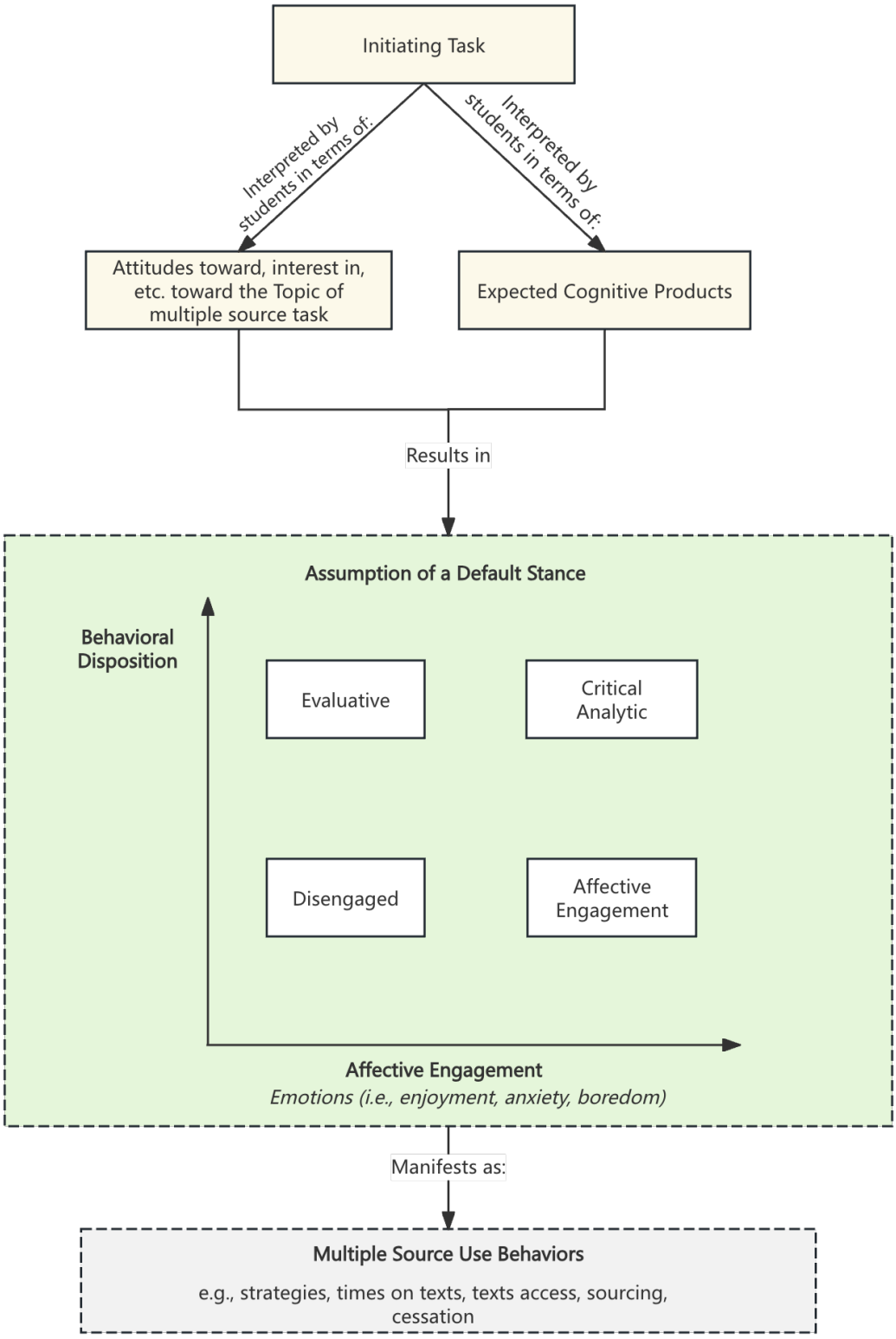
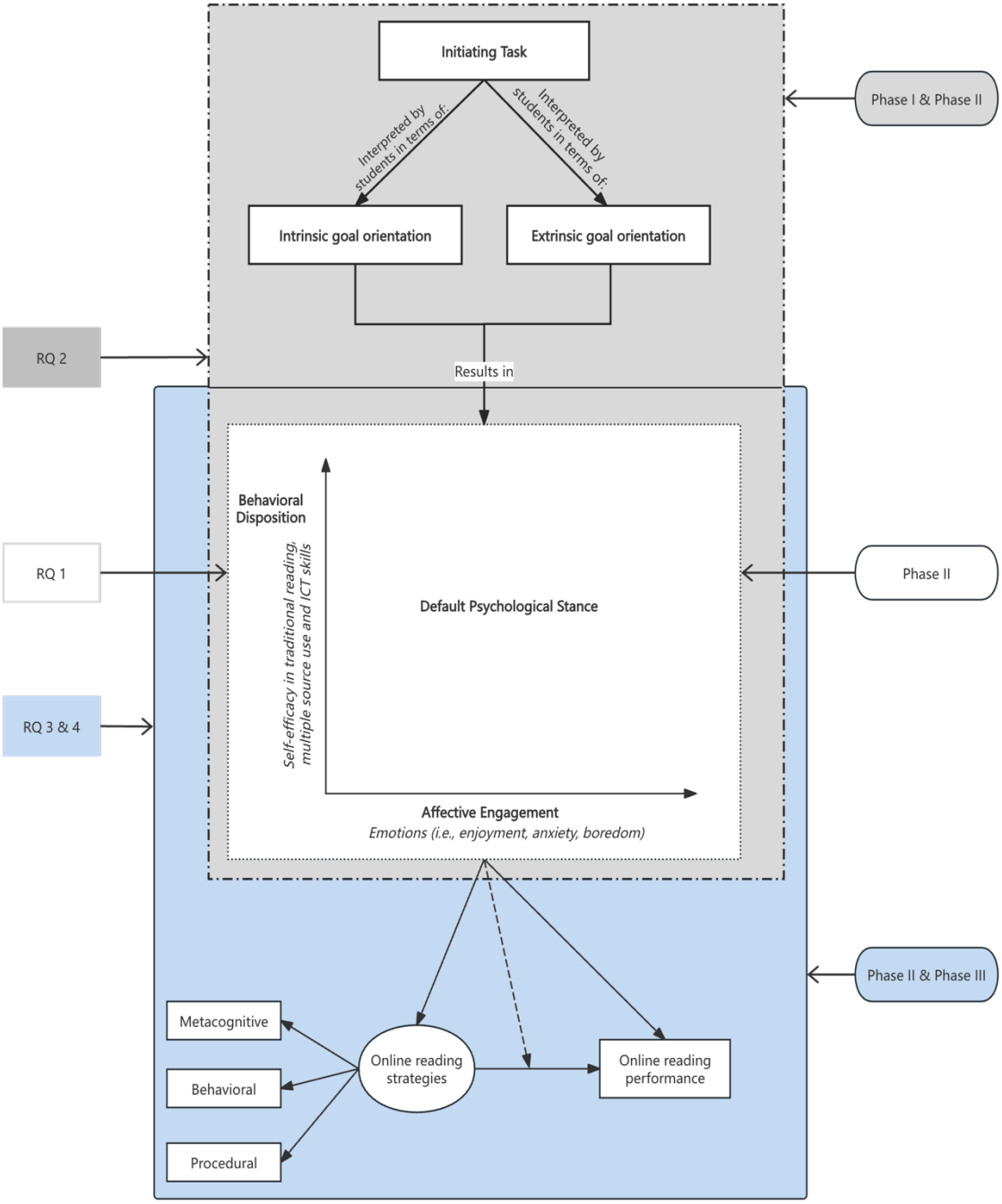


Figure 2.1 Outline of the CAEM, adapted from List & Alexander (2018).

The CAEM was selected as the theoretical framework for this study because it is "specifically interested in determining the student-level or individual difference factors that make a difference in multiple text processing" (List & Alexander, 2017, p. 186). The CAEM explicitly acknowledges the potential variations in students' psychological characteristics and their effects on multiple text-processing behaviors in various reading contexts. In other words, it embraces the warm concerns in multiple source use. This aligns well with the aims of the current study, which intended to investigate the role of psychological factors in online reading from a person-centered perspective. Furthermore, as a relatively new framework, the CAEM also presents opportunities for further development and refinement through empirical research (List & Alexander, 2017). To have a clear view of how this study employed the CAEM in the specific research context, Figure 2.2 provides an overview. The next sections in this chapter

present the rationales for selecting these specific variables from the umbrella framework.

Figure 2.2 Application of the CAEM in the current research



2.2 Default Psychological Stance in Online Reading

The literature review in Section 2.2 relates primarily to the first aim of the study: To identify the characteristics of psychological profiles—specifically, online reading self-efficacy and emotions—among fourth-grade students in Hong Kong. The reasoning behind this section is founded upon the content of the horizontal and vertical axes in Phase 2 of the CAEM.

2.2.1 Online reading self-efficacy

Self-efficacy is an important motivational concept for understanding learning and achievement. It refers to individuals' perceptions of their capacity to devise and effectively carry out a successful action in particular tasks (Bandura, 1988). In a reading context, self-efficacy emphasizes the direct influence of an individual's personal belief in his or her competence in comprehending, interpreting, and engaging with texts. This implies that students choose reading activities that are aligned with their perceived competence levels, selecting tasks they feel capable of and avoiding those they find too challenging (Hatlevik et al., 2018). Currently, a considerable body of research has investigated the impact of self-efficacy on behaviors and outcomes during the reading process (e.g., Han, 2021; Muche et al., 2024; Shehzad et al., 2020). Nevertheless, it is worth noting that self-efficacy is not only task-specific but also multidimensional (David et al., 2007). Research has consistently found stronger associations between specific self-efficacy beliefs and actual performance than between general judgments about overall abilities and performance (Bong & Skaalvik, 2002; Hatlevik et al., 2018), thus indicating that self-efficacy in online reading differs from that in traditional paper-based reading of a single-text model. In addition, because self-efficacy is a perception that is based on learners' abilities, and different tasks require different skills, self-efficacy in a particular task can be further categorized into subdimensions (Bandura et al., 1996). However, there has been a lack of investigation into the subdimensions of

online reading self-efficacy, so to investigate online reading self-efficacy, it is essential first to identify the potential core subdimensions that form the foundation of this construct.

The significance of self-efficacy is also acknowledged within the framework of the CAEM. According to the CAEM, behavioral disposition refers to the extent to which learners perceive themselves to have acquired certain skills and to be using them consistently (List & Alexander, 2019). A later empirical study conducted by List and a colleague provides an example of the behavioral disposition as self-efficacy in multiple source use (H. Y. Lee & List, 2021). Although multiple source use is a critical skill for students to employ in developing MTC, it is not the only core skill in online reading. With this in mind, the current study drew on the CAEM and incorporated the foundational skills from the IPS model, which was developed specifically for online environments (Brand-Gruwel et al., 2009). These skills include traditional reading skills, multiple source use skills, and computer skills (also referred to as ICT skills). Consequently, this study examined traditional reading self-efficacy, multiple source use self-efficacy, and ICT skills self-efficacy as the behavioral dispositions that represent the three subdimensions of online reading self-efficacy. In the following sections, the significances of self-efficacy in each of these skills are reviewed individually.

Self-efficacy in traditional reading

Online reading shares a similar foundation with traditional reading because they both rely on fundamental cognitive processes such as decoding, comprehension, inference-making, and the use of reading strategies to construct meaning from texts (Mills & Unsworth, 2017). Thus, the reading skills in traditional reading still play a significant role in reading online. To be more specific, traditional reading skills can be defined as the "automatic actions that result in decoding and comprehension with speed, efficiency, and fluency and usually occur without awareness of the components or control involved"

(Afflerbach et al., 2008, p. 368). In that light, self-efficacy in traditional reading in this study refers to an individual's belief in his or her ability to decode and comprehend text efficiently and fluently. In fact, empirical research has explored the connection between students' self-efficacy and paper-based reading performance across various educational settings. Studies conducted among university students in the UK (e.g., Prat-Sala & Redford, 2010), secondary school students in the US (e.g., Louick et al., 2016), and upper-grade primary students in Finland (e.g., Peura et al., 2021) have generally demonstrated a positive correlation between self-efficacy and reading performance. However, those studies have primarily focused on transparent orthographies, such as English and Finnish, while languages with more complex decoding processes, such as Chinese, with its logographic writing system, have received comparatively less attention. Still, a recent study by the author and her colleagues (2024) comparing L1 and L2 Chinese reading self-efficacy among first-grade students in Hong Kong found a significant positive relationship between reading self-efficacy and performance on conventional reading tests for both groups. Together, these findings suggest that self-efficacy plays an important role in traditional reading, although the extent of its significance may vary across different reading languages, age groups, and ethnicities.

Because online reading is essentially a form of reading, scholars have demonstrated that the skills required for traditional reading are also applicable to online reading and can be transferred accordingly (Afflerbach & Cho, 2009; Brand-Gruwel et al., 2009; B. Cho & Afflerbach, 2017). It is reasonable to believe that students' perceptions of their abilities in traditional reading may also positively influence the process and outcomes of their online reading, although this hypothesis warrants further empirical investigation.

Self-efficacy in multiple source use (MSU)

One significant distinction between online reading and reading a single text lies in the fact that online reading involves engaging with multiple reading materials. This requires readers to construct a global understanding by sourcing, selecting, evaluating, and integrating information from different sources and passages (e.g., webpages) to achieve a coherent comprehension (B. Cho & Afflerbach, 2017; Goldman et al., 2010; McCrudden et al., 2016; Rouet & Britt, 2011). Thus, self-efficacy in multiple source use can be understood as individuals' confidence in sourcing, selecting, evaluating, and integrating information from various sources, including multimodal information.

Previous empirical research on self-efficacy in MSU has been relatively limited, although not nonexistent, and among the few available studies, findings are inconsistent. For instance, using path analysis, H. Y. Lee and List (2021) discovered that self-efficacy in MSU was only associated with students' subjective task performance in handling multiple texts, while its relationship with their objective task performance was insignificant. Conversely, Bråten et al. (2023) observed a positive correlation between students' self-efficacy in MSU and their actual MSU-based task performance. Despite the inconsistencies in the literature, the extant studies still provide clues that self-efficacy in MSU may play a role in influencing students' performance in processing multiple sources.

That said, it is important to note that those two studies focused on undergraduate students and assessed MSU tasks centered around multiple-text reading-based writing rather than specifically targeting multiple-text reading comprehension. Given the potential decline in self-reported self-efficacy levels with age (Peura et al., 2021; Zhu, Yao et al., 2023) and self-efficacy's task-specific nature (Bandura et al., 1996), as well as the scarcity of and discrepancies in the current literature on MSU self-efficacy

(Bråten et al., 2023), further investigation related to MSU self-efficacy among other age groups is necessary.

Self-efficacy in information and communication technologies (ICT) skills

Online reading differs significantly from paper-based multiple-text reading, due to online reading's reliance on hyperlinks to connect different web pages. Such hypertexts promote interactivity and facilitate the development of intricate and interconnected knowledge structures (Spiro & Jehng, 1990). However, the inherent flexibility and interactivity of hypertext also introduce complexity into the process of reading comprehension (Schurer et al., 2023), such that sufficient computer skills are a necessary requirement for effectively dealing with online reading tasks (Brand-Gruwel et al., 2009).

Skills in the Information and Communication Technologies (ICT) entail the knowledge and ability to use digital technologies and network resources for information access, management, integration, evaluation, creation, and communication (Van Tetering & Jolles, 2017). In light of this, ICT self-efficacy in online reading can be defined as an individual's perception and belief in their capability to effectively utilize digital technologies and online resources to accomplish online reading tasks. Previous research has already established the significant influence of ICT self-efficacy on computer-related task performance (Compeau & Higgins, 1995; Hatlevik et al., 2018). A review conducted by Moos and Azevedo (2009) shows that ICT self-efficacy is a significant factor for influencing an individual's learning behavior and performance in digital environments. For example, Tsai and Tsai (2003) discovered that university students' ICT self-efficacy is closely associated with their information search strategies and academic performance in web-based learning environments. Comparable findings have been noted in research pertaining to online reading. For instance, Bates and Khasawneh (2007) found that students who are confident in their computer-related abilities

typically engage with computers more frequently and for extended periods, thus leading to elevated expectations of their own online reading performance. Similarly, Salmerón et al. (2018) discovered that adolescents' ICT self-efficacy predicts more persistence and a greater number of navigations in internet-based activities.

While scholars acknowledge the significant role of ICT self-efficacy in activities related to online reading, most of this research has not been conducted in testing environments. Indeed, there is a substantial difference between reading for leisure and reading for assessment (Cohen & Upton, 2006), arising from the fact that test-takers are presented with a wide range of information sources and task demands, all under the pressure of limited time in an assessment (Yeom & Jun, 2020). Therefore, the influence of ICT self-efficacy on the processes and outcomes of online reading in testing situations requires further exploration.

2.2.2 Online reading emotions

The importance of emotions in education is widely recognized and frequently explored in academic research (Ekholm et al., 2018), with a wealth of studies revealing the significant influence of emotions on student learning achievement (e.g., Goetz et al., 2013; Pekrun et al., 2011; Pishghadam et al., 2016). The significance of emotions has been recognized in the field of reading, as well. Theoretically, emotions can consume mental resources during a reading task, potentially interfering with the construction and integration of meaning (Pekrun, 2006). This is particularly pronounced in challenging reading activities (e.g., online reading). Neuroscientific research supports this view, with findings by Ponz et al. (2014) indicating that emotions modulate activity in a brain region that processes diverse emotional responses during reading activities. Nevertheless, empirical research into emotions associated with reading has only gained scholarly attention recently, with studies still being relatively scarce and previous

investigations focusing primarily on general-achievement emotions (Hamedi et al., 2020; Prinz-Weiß et al., 2023; Zaccoletti et al., 2020a, 2020b).

Notably, the impact of any particular emotion on learning varies depending on the context and the nature of the task at hand (Pekrun, 2022), thus suggesting that the importance of different emotions may change across various language tasks. For instance, Pishghadam et al. (2016) explored the impact of various emotions on EFL learners during activities such as listening, speaking, and writing, and they found a pattern: anger surfaced mainly during listening; enjoyment and pride were associated with speaking; shame was linked to both listening and speaking; hope, boredom, and hopelessness were felt during writing and listening; and anxiety was present across all the language skills. Nonetheless, research specifically addressing emotions in online reading, which is a challenging multimodal reading task (K. T. C. Chen, 2019; H. Huang et al., 2009), is still quite limited, indicating a need for further empirical studies in this area.

In the CAEM, the affective engagement factors (horizontal axis in Figure 1) represent a measure of students' affective investment in the initiating task, thus encompassing their initial levels of personal emotions, situational interest, and preexisting attitudes (List & Alexander, 2018). Given the crucial role of emotions in reading (Hamedi et al., 2020; Prinz-Weiß et al., 2023; Zaccoletti et al., 2020a, 2020b) and the current research gap in the impact of emotions on online reading tasks, this study chose as variables the students' enjoyment, anxiety, and boredom—three emotions that are particularly relevant to learning environments and reading activities (Hamedi et al., 2020; Prinz-Weiß et al., 2023; Zaccoletti et al., 2020a, 2020b).

Enjoyment

Reading enjoyment refers to the feelings of pleasure and satisfaction an individual experiences during the process of reading (Clark & Rumbold, 2006). Existing studies

have identified enjoyment as a positive predictor of learning achievement (Frenzel et al., 2007; Goetz et al., 2007) and have found it to be closely associated with effort (Valiente et al., 2012) and self-regulation skills (Villavicencio & Bernardo, 2013), yet research findings in the field of reading have been inconsistent. For instance, Hamedi et al. (2020) discovered that enjoyment was a positive predictor of L2 English reading performance among Iranian university students, whereas Zaccoletti et al. (2020a) did not find such a significant linear regression relationship between enjoyment and reading achievement among fifth-grade Italian students. Moreover, results from the PIRLS (2021) have even reported low levels of reading enjoyment in many of the countries/regions that have the highest reading performance levels, such as England, Sweden, and Hong Kong. The above literature review indicates that the theoretical positive role of enjoyment in reading does not consistently manifest in empirical research, and its effect may be influenced by various factors such as age, the language of reading, and the culture. These contradictory outcomes make the role of enjoyment in online reading even more elusive and suggest that further research is needed.

Anxiety

Anxiety is one of the most prevalent negative emotions encountered in learning environments. Within the broad range of anxiety, test anxiety was the first to be extensively explored in relation to academic performance (Hembree, 1988). Because anxiety can disrupt the efficient functioning of the goal-directed attention system and increase attention to threat-related stimuli (Eysenck et al., 2007), it is usually believed to exert a negative influence on academic achievement (Hembree, 1988).

Presently, within specific subject domains, mathematics anxiety is the most well-documented, with numerous studies acknowledging its detrimental impact on mathematics performance (Ashcraft & Moore, 2009; Carey et al., 2017; Cargnelutti et al., 2017).

Interestingly, a similar pattern has been observed in the reading domain. For instance, Miesner and Maki (2007) discovered that scholars with higher levels of academic anxiety exhibited poorer reading comprehension; moreover, learners' comprehension declined as their anxiety increased following engagement with a text. Comparable findings were also reported by Hamedi et al. (2020) and Maloney et al. (2010). A study by Zaccoletti et al. (2020b) emphasized a pronounced negative impact of reading anxiety on upper elementary students, indicating that anxiety significantly impaired reading comprehension more than other emotions. Based on the review, it is reasonable to hypothesize that online reading—being a more complex and nonlinear form of hypertext reading than paper-based reading—may elicit increased anxiety in students, thereby causing difficulties in reading comprehension. Nevertheless, this assumption necessitates further empirical scrutiny.

Boredom

Boredom is described as a negative emotional state that students experience in learning environments and that is characterized by a lack of interest, difficulty in concentrating, and feelings of displeasure (Pekrun et al., 2010). Students easily become bored when they perceive their learning material or activities as dull, repetitive, meaningless, or not appropriately challenging (Daschmann et al., 2011). Compared with the research on emotions such as enjoyment and anxiety, that on boredom in learning contexts has been less common and is more recent (Pekrun et al., 2014).

Generally, boredom is associated with negative outcomes, although its detrimental effects are considered relatively mild (Goetz et al., 2007; Hamedi et al., 2020). Interestingly, boredom may have a dual role in reading because it can provide feedback on dissatisfaction with the current situation, thus potentially motivating individuals to strive for desired goals and enhancing their self-regulation (Elpidorou, 2018). However, boredom can also interfere with one's cognitive and metacognitive strategies (Muis et

al., 2018), which may significantly affect one's ability to integrate and comprehend information from multiple texts when reading online (Raccanello et al., 2022). Recently, Raccanello et al. (2022) conducted the only study to date that has investigated boredom in the context of online reading. Using path analysis, those authors explored the relationship between boredom and online reading comprehension in fifth-grade students in both home and test settings and found that the negative effect of boredom on the ability to comprehend multiple texts online was only noticeable in a testing environment. Moreover, that adverse effect was limited to students who had a high level of proficiency in reading individual words. That study suggests that the setting in which reading takes place, as well as the goal of the reading task, can influence how boredom impacts online reading comprehension. Furthermore, the extent to which boredom affects reading comprehension can differ from one person to another. Consequently, it is essential to adopt a person-centered approach and pursue additional research into the emotions associated with online reading.

2.2.3 Summary and research question (1)

Section 2.2 has examined the motivational (i.e., self-efficacy) and emotional (i.e., emotions) psychological factors involved in online reading, as postulated in phase 2 of the CAEM. We began by highlighting the critical role of self-efficacy in traditional reading contexts, noting, however, that existing research has not adequately addressed the task-specific and multifaceted nature of self-efficacy necessary for online reading. Basing the thinking on the assumptions of the CAEM and the IPS-I model, subsection 2.2.1 delineated three core subdimensions of online reading self-efficacy: self-efficacy in traditional reading, self-efficacy in utilizing multiple sources, and self-efficacy in ICT skills. Subsequently, subsection 2.2.2 discussed three primary learning emotions associated with reading—enjoyment, anxiety, and boredom—and revealed that the findings regarding the impact of emotions on reading comprehension are inconsistent and underscore the presence of individual differences in these effects.

Altogether, therefore, this section underscores the undeniable importance of self-efficacy and emotions in the reading process, while also pinpointing two significant research gaps. (1) The role of psychological factors in learning is highly task-specific, yet empirical research has not sufficiently addressed the distinctive modality of online reading, which exhibits notable differences from that of paper-based reading. (2) Although scholars have long acknowledged that psychological variables are highly individualized and that different combinations of psychological traits can lead to varying impacts—as illustrated by Dever et al.'s (2022) research, wherein combinations of positive and negative emotions were found to correlate with decreased performance—most studies still treat psychological traits as different, independent variables. Such a variable-centered approach, which assumes homogeneity within the study population (Yao & Zhu, 2024), hinders our efforts to explore the characteristics of psychological variables in reading from a more nuanced and precise perspective.

Therefore, the first research question (RQ1) in this study is: What are the characteristics of a student's default psychological stance, specifically concerning online reading self-efficacy and emotions, among fourth-grade students in Hong Kong? Addressing this question will not only help to fill the research gaps mentioned earlier but will also provide empirical verification for the four profile types proposed in the CAEM.

2.3 The Effects of Goal Orientations on Students' Online Reading Default Psychological Stances

The literature review in this section, building upon the foundation of phase 1 in the CAEM, addresses this study's second research aim by focusing on the potential influence of goal orientations on students' online reading default psychological stance.

2.3.1 Achievement goal orientation

Originating from educational research, goal orientation posits that individuals approach tasks with a mindset geared toward either learning or performance (Bell & Kozlowski, 2002). This concept captures the implicit goals that students set for themselves when they select, engage in, and persevere through various learning tasks (Meece et al., 2006). Specifically, goal orientation is categorized into two distinct types: intrinsic and extrinsic goal orientation (Pintrich et al., 1993). Intrinsic goal orientation, also known as mastery goal orientation, can be regarded as a student's drive for task mastery and displays an eagerness to acquire expertise through learning new abilities and tackling novel challenges. Conversely, extrinsic goal orientation or performance goal orientation is defined by a student's aim to achieve favorable academic outcomes and indicates affirmation of one's abilities in the eyes of others and of receiving external encouragement (Alhadabi & Karpinski, 2020; Bell & Kozlowski, 2002; X. Chen & Hu, 2021; Dao, 2021; Pintrich et al., 1993; Zhou et al., 2024). Notably, there are various frameworks for classifying goal orientation. Common approaches include the dichotomous model discussed earlier, the trichotomous model (mastery, performance-approach, and performance-avoidance goals) proposed by Elliot & Church (1997), and the 2×2 framework, which further differentiates mastery goals into mastery-approach and mastery-avoidance and performance goals into performance-approach and performance-avoidance (Pintrich, 2000). Given the younger age group targeted in this study and the need to minimize the number of questionnaire items, the dichotomous model was selected. More detailed insights into the distinct characteristics of different goal orientations were obtained through follow-up interviews.

Broadly speaking, there is a recognized positive relationship between students' intrinsic goal orientation and their self-regulatory behaviors, their deep learning, and their academic achievements (Dao, 2021; Geitz et al., 2016; Meece et al., 2006; Pintrich, 2000). This is because learners who adopt an intrinsic-oriented approach are typically

more resilient in the face of failure, utilize more advanced strategies, and actively seek out tasks and materials that are complex and challenging (Pintrich et al., 1993). In contrast, extrinsic goal orientation is often equivocally or negatively associated with academic success (Dao, 2021; Geitz et al., 2016; Meece et al., 2006; Pintrich, 2000), although this effect may vary with the level of task difficulty (Horvath et al., 2006; Senko et al., 2013). Researchers believe that students with this orientation tend to exhibit maladaptive behavioral patterns, such as a heightened inclination to disengage from tasks when encountering difficulties, a diminished interest in tackling challenging assignments, and a preference for easier tasks where success appears more attainable (Bell & Kozlowski, 2002). Although the general trends outlined above underscore the significant role of goal orientation in learning, it is important for researchers to recognize that its underlying mechanisms are highly complex, particularly when examined in relation to other psychological variables from a person-centered perspective (Luo et al., 2011).

In the CAEM framework, the function of the task initiation phase (Phase 1) is consistent with the prior MSU models (Brand-Gruwel et al., 2009; Britt & Rouet, 2012; Pekrun, 2006) and serves to establish goals for engaging with multiple texts. List and Alexander (2018) believed that the cognitive outcomes that students anticipate from MSU tasks (e.g., goal orientation) are crucial factors that may influence their default psychological stance. This theoretical premise aligns closely with Pekrun's control-value theory (2006), which underscores the significance of one's personal goals and perceived control over learning activities in shaping one's learning disposition. In general, students with an intrinsic goal orientation and a strong sense of self-efficacy tend to encounter positive emotional states (e.g., enjoyment) in their learning journey (Linnenbrink & Pintrich, 2002; Pekrun, 2006). Conversely, an extrinsic goal orientation coupled with low self-efficacy can predispose students to negative emotions, such as boredom or anxiety (Daniels et al., 2009; Ranellucci et al., 2015). However, scant

research has adopted a person-centered approach to explore these relationships, thus potentially oversimplifying the outcomes of such associations.

2.3.2 The relationship between goal orientation and self-efficacy

It is evident that goal orientation and self-efficacy are interconnected. Goal orientation focuses on how competence is defined (Pintrich, 2000), whereas self-efficacy relates to an individual's perception of his or her ability to succeed in a specific task (Bandura, 1997). These two constructs, both fundamentally tied to competence, are essential components of motivational theory (C. Huang, 2016). Theoretically, engaging in learning with a focus on mastery can cultivate a sense of self-efficacy, which, in turn, promotes greater effort and ultimately leads to improved performance. Conversely, prioritizing extrinsic goals may shift one's attention away from the process of achievement, thereby limiting opportunities to build self-efficacy. Even worse, extrinsic goal orientation may lead to greater sensitivity to setbacks in achievement, thus posing a threat to one's learning self-efficacy (Honicke et al., 2020).

Empirical studies on goal orientation and self-efficacy reveal that intrinsic goal orientation significantly predicts self-efficacy (Bell & Kozlowski, 2002; X. Chen & Hu, 2021; M.-H. Cho & Shen, 2013; Song et al., 2015), with a moderate to strong correlation reported in a meta-analysis (C. Huang, 2016). Meanwhile, inconsistency in the relationship between extrinsic goal orientation and self-efficacy was also observed. For example, in a recent study, Alhadabi & Karpinski (2020) identified a negative correlation between extrinsic goal orientation and self-efficacy (r=–.37), while Honicke et al. (2020) revealed a positive relationship (r=.36). However, C. Huang's (2016) meta-analysis found only a weak correlation between extrinsic goal orientation and self-efficacy. Such discrepancies in the degree and direction of the relationship reveal the intricate and multifaceted nature of the connection between goal orientation and self-efficacy.

In fact, Bell and Kozlowski (2002) identified the moderating effect of individual differences on the relationship between goal orientations and self-efficacy, emphasizing the influence of varying abilities. For instance, Bell and Kozlowski (2002) showed that extrinsic goal orientation results in a positive outcome for individuals with lower abilities and a negative outcome for those with higher abilities. However, different patterns may be observed in self-efficacy. Individuals with an extrinsic orientation tend to display their abilities to others and are prone to perceive an imperfect performance as an indication of failure and fixed ability (Dweck, 1989). Because individuals with lower abilities typically make more mistakes and exhibit lower performance levels, an extrinsic orientation should correlate negatively with the self-efficacy of these individuals. In contrast, those with higher abilities tend to make fewer mistakes and perform better, thus suggesting that extrinsic goal orientation might correlate positively with the self-efficacy of individuals with higher abilities. Furthermore, because self-efficacy and goal orientation are influenced by personal traits, such factors as nationality, beliefs, and values have been shown to play a significant role (Geitz et al., 2016; Liem et al., 2008). Nevertheless, most prior research has been limited to Western contexts (e.g., Dull et al., 2015; Geitz et al., 2016; Honicke et al., 2020; Phillips & Gully, 1997) and little attention has been paid to East Asian settings, which emphasize academic achievement under Confucian traditions (Ebrey, 1991). Because cultural and national differences may result in unique learning patterns (Marambe et al., 2012), further investigation is required.

The extant research undeniably shows that the relationship between goal orientations and self-efficacy is not always a straightforward, linear one; individual differences significantly contribute to this variation. Variable-centered methods, although prevalent in the literature, may ignore the nuances in students' goal orientations and self-efficacy beliefs. The employment of a person-centered approach is warranted to further inquire into the relationship between goal orientations and self-efficacy within the context of online multimodal reading.

2.3.3 The relationship between goal orientation and emotions

Within the control-value theory of achievement emotions, goal orientation is considered a primary antecedent of emotions (Pekrun, 2006). However, due to the presence of both positive and negative emotions, the relationship between goal orientation and different emotions varies. The theoretical review by Phillips and Gully (1997) emphasizes the importance of examining autonomous and controlling reasons (reflecting intrinsic and extrinsic goal orientations, respectively) within achievement goal research and suggests that autonomous reasons (e.g., intrinsic goal orientation) may foster positive academic emotions, while controlling reasons (e.g., extrinsic goal orientation) could lead to negative academic emotions. To be more specific, intrinsically goal-oriented learners usually view challenges as opportunities for growth, and they tend to embrace mistakes, regulate their emotions, and stay motivated to learn, often increasing their efforts after failure. In contrast, extrinsically goal-oriented learners avoid challenges because they perceive setbacks as being uncontrollable (Dweck & Leggett, 1988). This mindset tends to result in negative emotions, such as anxiety or helplessness, and avoidance behaviors, such as withdrawing from comparisons with others (Lou & Noels, 2017).

While the theoretical hypotheses are well-defined, empirical research has uncovered a more nuanced and inconsistent picture. For example, Gillet et al. (2015) investigated the mediating role of autonomous reasons and controlling reasons in the relationship between achievement goals and outcome variables (including positive emotions and negative emotions). The results indicated that autonomous reasons positively predicted positive emotions and negatively predicted negative emotions. Similarly, Tanaka and Murayama (2014), using hierarchical linear modeling, found that intrinsic goals reduced the negative within-person relationships between difficulty and interest and between utility and boredom. Comparative patterns can also be found in Benita et al. (2014), Kong et al. (2023), Lou & Noels (2017), and Luo et al. (2011). In contrast,

research has found that extrinsic goal orientation positively predicts anxiety, hopelessness, and shame (Li et al., 2024), with no association with positive emotions (Pekrun, 2006; Pekrun et al., 2009).

In fact, the above inconsistency is related to the different classifications of goal orientation and the specific groups (e.g., age, ethnicity, gender) being measured (Kong et al., 2023; Lau & Lee, 2008b; Li et al., 2024). Previous research focused primarily on the relationship between goal orientations and emotions in traditional classroom settings, resulting in the connections within reading contexts not being sufficiently emphasized. Moreover, when examining the relationship between goal orientation and emotions, previous research has typically treated various emotions as independent variables, thus overlooking the coexistence of emotions in real-life situations (Yeşilçınar & Erdemir, 2022) and ignoring the potential moderating impact of individual differences. Because of the distinctive features of online reading (e.g., interactivity, multimedia presentation), which could affect the functioning of goal orientations and the emotional responses of students, more research attention is warranted.

2.3.4 Summary and research question (2)

Section 2.3 started from the theoretical assumptions of the initialing task in phase 1 of the CAEM, combined with the control-value theory, to emphasize the significance of intrinsic and extrinsic goal orientations in learning. Through a literature review, this section constructed the relationships between goal orientations, self-efficacy, and emotions and revealed notable research gaps. (1) Although goal orientations may be significant contributing factors to self-efficacy and emotions, previous studies have been confined primarily to general learning contexts, with insufficient attention paid to the reading domain. (2) Despite repeated acknowledgment of the potential role of individual differences in the relationships between goal orientation, self-efficacy, and

emotions, empirical studies on this topic have been extremely limited. In particular, the concurrent investigation of learners' self-efficacy and emotions is scarce.

Indeed, as Bohn-Gettler and McCrudden (2022) indicated, ignoring the crucial interactions between the reader, the task characteristics, and the reader's psychological mechanism may lead to an oversimplification of research outcomes and a consequent lack of understanding of the complex system affect reading. Therefore, to further clarify and untangle the relationships between goal orientation, self-efficacy, and emotions under the conditions of online reading tasks, advancements in empirical research methods (e.g., mixture regression) may be critical. Consequently, this study proposes the second research question (RQ2): How do goal orientations of online reading tasks influence the varied default psychological stances among students?

2.4 Online Reading Strategy and Its Association with Students' Default Psychological Stance

The literature review presented in this section merges phases 2 and 3 of the CAEM to elucidate the necessity of addressing the third and fourth research aims: to examine the differences in online reading strategy use and performance among students with varying psychological profiles (Aim 3), and to explore the ways in which different psychological profiles moderate the relationship between students' online reading strategies and their reading performance (Aim 4).

2.4.1 Online reading strategy

The use of strategies in language learning is characterized as deliberate cognitive actions chosen by learners to facilitate the completion of linguistic tasks (Cohen, 1999). Over the past few decades, academic inquiries have focused intensively on the strategic approaches that students employ during reading, recognizing them as indispensable and instrumental to the learning process (Cohen, 2006). Strategies are notably distinct in

their application, varying according to the task at hand (B. Cho & Afflerbach, 2017), the individual differences of the learners (M. Chou, 2013; Tsai, 2009), and the context of the learning environment (Yeom & Jun, 2020). The findings in the literature consistently underscore a positive correlation between strategies and conventional reading comprehension (Bachman & Palmer, 2010; Purpura, 2016; L. Zhang et al., 2014), noting that readers with higher proficiency tend to utilize a wider and more frequent array of strategies compared with their less proficient peers (Lau & Chan, 2003; Y. Sun et al., 2021). However, strategies are highly task-specific (B. Cho & Afflerbach, 2017), and those employed for reading paper-based texts may differ markedly from those used with hypertexts. This difference indicates a need for further research to delineate the dynamics between the use of strategies use and the resulting performance in online multimodal reading contexts.

In fact, in investigating strategy use in computer-based reading, researchers have observed a significant transition in the application of reading strategies from traditional paper-based single texts to computer-based multiple texts (P.-H. Hsieh & Dwyer, 2009; Park et al., 2020; Park & Kim, 2011). This shift has been driven by the increasing prevalence of digital reading materials and the proliferation of online information sources.

Strategies in the metacognitive domain

Metacognition refers to an individual's knowledge and control over their cognitive processes and states (Flavell, 1979) and involves their ability to monitor, evaluate, and regulate their own thought processes. In the reading context, metacognitive strategies are used for self-monitoring and self-assessment to enhance reading comprehension and efficiency (Baker & Brown, 1984; Pressley & Afflerbach, 1995). Such strategies enable readers to actively engage in the reading process and reflect on and adjust their level of

understanding. Consequently, metacognitive strategies play a significant role in both traditional reading and interactive online reading.

Specifically, in traditional reading, metacognitive strategies include predicting the content of the text, clarifying reading purposes, identifying main ideas, summarizing key information, and evaluating the usefulness of information (Mokhtari & Reichard, 2002; Sheorey & Mokhtari, 2001). The flexible application of these strategies helps readers to deeply understand the text, construct coherent mental representations, and integrate new information with prior knowledge (B. Cho et al., 2018). With the proliferation of computerized reading, researchers have begun to explore the transformation in the application of metacognitive strategies within digital environments (P.-H. Hsieh & Dwyer, 2009; Park et al., 2020; Park & Kim, 2011). Although traditional metacognitive strategies continue to play an important role in online reading of multiple texts (B. Cho & Afflerbach, 2017), the digital environment also presents new demands on readers, such as planning hypertext navigation paths, using webpage titles to determine themes, assessing the reliability of online information, and comparing similarities and differences between information on different web pages (Goldman et al., 2010; McCrudden et al., 2016; Park et al., 2020; Park & Kim, 2011; Tsai, 2009). These studies highlight the adaptability and significance of metacognitive strategies in the 21st century's reading environments.

Strategies in the behavioral domain

In addition to metacognitive strategies, strategies in the behavioral domain are also quite important in both paper-based and online-based reading. In paper-based reading, for example, readers can enhance their focus, manage their time well, and deepen content comprehension by employing strategies that involve self-regulation. These strategies include breaking the text into smaller, more digestible parts and varying the speed of reading (Pintrich, 2000; Zimmerman, 2000). Moreover, strategies such as

notetaking, highlighting key points, and writing summaries in traditional reading also contribute to an active engagement with the text and enhance understanding (Kobayashi, 2005; Peverly et al., 2007).

Similarly, in the online reading environment, the vastness and nonlinear nature of multimodal information make readers more prone to losing their way (B. Cho & Afflerbach, 2017; Park et al., 2020; Park & Kim, 2011; Tsai, 2009). To address this challenge, scholars have identified that students also need to employ behavioral strategies for self-control, such as narrowing the scope of their information engagement, effectively managing their reading time, and using digital tools for notetaking (B. Cho et al., 2018). Beyond these strategies, the strategic use of navigational aids (such as hyperlinks and headings) is also crucial for maintaining a sense of direction and avoiding becoming lost in the maze of digital texts (Tsai, 2009; Tsai & Tsai, 2003; J. Y. Wu & Peng, 2017). Skilled readers can quickly scan webpage titles and hyperlink texts to assess their relevance to the reading goals and then decide whether to click through (Salmeron et al., 2005). Readers are also advised to use the hierarchical structure of web pages and breadcrumb navigation to track their reading paths, return to previous pages, or reorient themselves at any time (Madrid et al., 2009). Thus, although there are differences in text structure and information presentation between traditional and online reading, behavioral strategies play a significant role in both reading modes, albeit with some variations.

Strategies in the procedural domain

Another noteworthy dimension is the use of procedural strategies during the reading process. These strategies mainly involve readers' sustained effort to correct errors and resolve reading difficulties (Hill, 1999). Specifically, when readers encounter obstacles in understanding text content, they may need to employ a range of strategies to overcome the challenges, such as rereading difficult sections, consulting dictionaries or

reference materials, or seeking help from others (Kletzien, 1991; Mokhtari & Reichard, 2002). Moreover, readers can enhance their comprehension by creating mental visualizations of the text. This might involve imagining scenes or concepts in their mind's eye or sketching out concept maps to clarify their understanding (Zahedi & Abdi, 2012).

In the context of online reading, the application of procedural strategies displays some new characteristics. The nonlinear structure and multimodal nature of web texts enable readers to adopt a more flexible and diverse set of strategies when they encounter comprehension difficulties (B. Cho et al., 2018; H. Huang et al., 2009; Tsai, 2009). For example, when readers cannot find useful information on a webpage, they can quickly switch to other related pages instead of being confined to the current one (Tsai & Tsai, 2003). This flexible strategy of switching pages allows readers to efficiently gather and integrate information from multiple sources. Furthermore, visual cues in online reading, such as images, videos, and animations, can provide additional support for understanding (B. Cho et al., 2018). When students are confused about a concept or description, they can reread the related content and refer to accompanying visual resources for a more comprehensive and in-depth understanding (H. Huang et al., 2009). This strategy of integrating text with visual information is relatively uncommon in traditional paper-based reading. Moreover, in an online reading setting, students can use search engines to find additional information, participate in online discussions or Q&A communities for help, and use online collaborative tools to solve problems with others (Coiro & Dobler, 2007; Kiili et al., 2012). The strategic use of the interactivity and connectivity of the online environment provides readers with more channels to obtain support but also requires significant proficiency in ICT skills. Nevertheless, it is essential to recognize that the strategies employed in online reading differ according to the context, such as whether one is reading for pleasure or for assessment purposes (Bachman & Palmer, 2010). These variations are primarily due to the functional constraints present within testing platforms.

In summary, despite the differences in text characteristics and technological environments between traditional and online reading, both modes require readers to flexibly use metacognitive, behavioral, and procedural strategies to enhance their reading efficiency and comprehension. Although a variety of online reading strategies have been identified, few studies have explored the relationship between these strategies and reading performance, especially in assessment contexts. This lack of research limits our understanding of the actual effectiveness and impact of online reading strategies, thereby hindering us from offering valuable guidance for practical instruction.

2.4.2 The relationships between default psychological stances and online reading strategies

Whereas the importance of psychological factors in learning is well-recognized in academic literature, scholars maintain that these factors alone may not result in optimal performance without the presence of appropriate learning pathways (Dörnyei, 2005; Norman & Aron, 2003; Papi, 2010). Specifically, the behavioral factors related to learning are typically regarded as mediators between psychological factors (e.g., strategies) and the learning outcome (e.g.,T. Y. Kim & Kim, 2014; Moskovsky et al., 2016; Schaffner et al., 2013; Wong, 2018; X. Zhu, Zhan, & Yao, 2022). A similar hypothesis is also presented in the CAEM, where List and Alexander (2019) state that learners' default stances not only directly influence their MSU outcome but can also affect their performance through the strategies they adopt during their MSU.

Self-efficacy and reading strategies

Theory states that self-efficacy underscores the direct impact of students' confidence in their ability to understand, interpret, and engage with texts (Bandura et al., 1996). This suggests that students are inclined to choose reading tasks that they believe match their

level of competence, opting for challenges within their perceived capability and avoiding tasks that they deem too daunting (Hatlevik et al., 2018). Specifically, individuals with high self-efficacy tend to set loftier goals and hold positive views about their abilities and performance. This optimistic self-perception motivates them to proactively seek and try various strategies to better manage task demands. In contrast, individuals with low self-efficacy might avoid certain strategies, doubting their capacity to execute them effectively (Schunk & Ertmer, 2000). Furthermore, self-efficacy may influence how individuals select and adjust strategies in the face of different tasks or contexts (Schunk, 1995). Those with high self-efficacy are more likely to flexibly choose and combine different strategies on the basis of the task characteristics and their own strengths, and they are adept at adjusting their strategies in response to feedback and outcomes in order to optimize performance. In contrast, individuals with low self-efficacy may tend to rely on a single or fixed strategy, lacking the willingness and ability to adapt as situations change. Although research probing the links between self-efficacy and online reading has been relatively rare, studies on traditional paper-based reading have shown positive associations between self-efficacy and reading achievement (e.g., Jiang, 2023; Y. Wang et al., 2021). These results could potentially provide valuable perspectives for evaluating online hypertext reading.

Empirical research has demonstrated that self-efficacy plays a role in activating the use of strategies. For instance, Muche et al. (2024) discovered that the use of metacognitive reading strategies and self-efficacy jointly accounted for significant differences in students' reading comprehension performance, with self-efficacy being the stronger predictive factor. Similar findings were also observed in a study conducted by Shehzad et al. (2020). Utilizing cluster analysis, Graham et al. (2020) also revealed a close relationship between self-efficacy and the self-regulatory strategy. These findings suggest that individuals with higher self-efficacy are more likely to employ a variety of strategies to enhance their reading comprehension and regulate their learning process. However, it is important to note that these studies were conducted in a paper-based

reading context. Although online hypertexts require readers to exert greater cognitive efforts and belief support than single-text reading does (B. Cho & Afflerbach, 2017), only a few investigations have looked into the effects of self-efficacy on online reading strategies, and they focused predominantly on online information searching and locating strategies (David et al., 2007; Salmerón et al., 2018; Tsai & Tsai, 2003). Other types of strategies, such as metacognitive, behavioral, and procedural strategies, also warrant further investigation.

Emotions and reading strategies

In addition to self-efficacy, emotions are also considered a significant factor influencing the use of strategies. According to Pekrun's (2006) control-value theory, learners experience various achievement emotions during the learning process—such as enjoyment, anxiety, and boredom—that can have a crucial impact on learning outcomes by affecting learners' allocation of cognitive resources and their use of strategies (Pekrun, 2006, 2022; Pekrun et al., 2014; Pekrun & Perry, 2014). In a specific reading context, positive emotions (e.g., enjoyment) may enhance learners' task engagement, which encourages them to actively employ various metacognitive strategies, thereby enriching their understanding and retention of the material (Linnenbrink & Pintrich, 2002).

Conversely, negative emotions, such as anxiety and boredom, may diminish learners' inclination and capacity to employ effective strategies. Readers experiencing anxiety and boredom may struggle to maintain concentration, potentially missing critical details or logical connections within the text. They might also default to superficial learning strategies, such as rote memorization, and they may resist engaging in deeper comprehension and critical thinking (Zeidner, 1998).

Although a substantial body of research supports the assumptions in the control-value theory (Pekrun, 2006), only a few studies have been conducted in the reading context.

For instance, M.-H. Chou (2021) found that only positive emotions can moderate the relationship between English proficiency and reading strategies. Although negative emotions are associated with both predictive factors and reading strategies, they do not moderate the relationship between them.

Nevertheless, research on emotions in the context of online reading strategies remains quite limited. Since online reading strategies are more complex than those for print reading (B. Cho & Afflerbach, 2017), and students' emotions during the reading process may be more variable, further research in this context is necessary.

Notably, the impact of emotions on the reading process and outcome may vary when different psychological variables are combined (Dever et al., 2022). For instance, when considering self-efficacy and emotions together, self-efficacy can influence an individual's emotional response to difficulties or setbacks, thereby affecting the persistence of the individual's strategy use (Pajares, 1996). This means that individuals with high self-efficacy tend to regulate their emotions better, viewing setbacks as temporary hurdles rather than reflections of their abilities. This positive emotional regulation helps them maintain the patience and perseverance needed to continue using strategies (Bandura, 1988).

Furthermore, when individual differences are considered, the influence of psychological factors on the reading process and outcomes may become even more complex. Because various psychological variables inherently coexist and permeate the entire reading process, their combined effect may significantly impact students' strategy use and moderate the relationship between their strategies and performance (Villavicencio & Bernardo, 2013). However, research exploring this interaction is currently lacking.

2.4.3 Summary and research questions (3) and (4)

This section began by reviewing the similarities and differences between paper-based and online reading strategies from metacognitive, behavioral, and procedural perspectives. We then discussed the potential influence of psychological variables—self-efficacy and emotions—on reading strategies and performance. Specifically, in this review we have identified important research gaps. (1) Although scholars have revealed differences between online reading strategies and paper-based reading strategies, the relationships between different strategies and online reading performance remain unclear. This lack of clarity prevents us from identifying which strategies are more important and necessary for efficient online reading instruction. (2) While there has been some exploration of the relationships between self-efficacy, emotions, and reading strategies, and the potential for psychological variables to moderate the relationship between reading strategies and performance, few studies to date have examined these psychological variables in combination and particularly the case of students with varying psychological profiles. The absence of such research may leave teachers unable to tailor reading strategy instruction to individual students' needs, thus potentially diminishing the effectiveness of strategies on reading performance. In light of these gaps, this study proposed the following research questions.

RQ 3 What are the differences in both online reading strategy use and performance among students with varying default psychological stances?

RQ 4 How do students' different default psychological stances moderate the relationship between their online reading strategies and their reading performance?

Chapter 3 Methodology

This study adopted a mixed-methods approach, specifically an explanatory sequential mixed-methods design. Initially, we conducted quantitative research, which was subsequently enriched and contextualized by qualitative data (Creswell, 2015). The rationale for choosing this design lay in the fact that quantitative research focuses on the statistical analysis of variables. Even so, it often overlooks the personal meaning and insights behind certain phenomena (Onwuegbuzie & Leech, 2005). Conversely, qualitative research focuses on individual narratives but is constrained in its ability to generalize findings and perform statistical inferences. Each method has strengths, but both fall short when tasked with independently providing a comprehensive and profound explanation of an issue (Creswell, 2015). As a remedy, mixed-methods research synergizes the advantages of both quantitative and qualitative approaches, at different stages of an investigation. It enables targeted interviews using a large sample supported by quantitative models to substantiate the findings from qualitative analysis. Such a research approach not only maintains the rigor of quantitative analysis but also captures the multifaceted layers of the results, thus offering a systematic and multidimensional understanding of the research questions (Creswell & Clark, 2017). The overall research flow chart for this study was as follows:

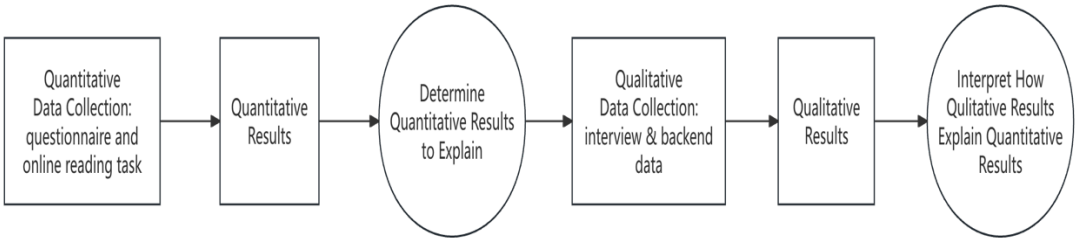


Figure 3.1 Explanatory sequence of the study's mixed-methods design

3.1 Research Contexts

The Chinese curriculum documents in Hong Kong explicitly emphasize the importance of online reading. The advancement of the "Secondary Education Curriculum Guide" in 2017 marked the new phase of "Learning to Learn 2+". Since then, the "Learning from Reading" initiative has branched out into two key areas of curriculum development promoted by the Education Bureau: "Cross-curricular Language Learning" and "Interactive Learning with Information Technology." The "Curriculum guidelines for Chinese Language Education learning area (Primary 1 to Secondary 6)" (2023) specifically states that in the first phase of learning (Primary 1 and 2), students need to "know some methods to locate and access information based on specific search criteria," and in the second phase of learning (Primary 4 and 5), students are further expected to "search, filter, and carefully share information through computer networks and other media" and "use information technology tools to process information and produce user-generated content." It is evident that the Education Bureau in Hong Kong intends for schools and teachers to promote and encourage the use of interactive digital reading, such as audiobooks, animations, and interactive games, to enhance students' reading comprehension skills.

In response to the needs of these curriculum reforms, schools in Hong Kong have begun to place greater emphasis on using technology to strengthen teaching and learning. These resources include teaching materials compiled in "Hong Kong Education City (香港教育城)," such as interactive worksheets, game-based assessments, and self-learning resources delivered through instructional videos. However, although these learning resources are effective, their focus is not on developing online reading ability. Thus, the resources for assessing online reading skills, which focus on interpreting and integrating information and perspectives across web pages, including text, visuals, and interactive elements, remain an unresolved issue. In addition, strategies and teaching

methods aimed at improving students' online reading abilities are also yet to be adequately addressed.

3.2 Participants

Considering those gaps, this study developed an online reading assessment platform to provide resources for evaluating the online reading skills of primary school students in Hong Kong. In this context, a sample of 280 fourth-grade students (Mean age = 9.54, SD = 0.50) from three public primary schools in Hong Kong was recruited. Among the participants, there were 125 boys (44.6%) and 155 girls (55.4%). The schools were selected on the basis of their diverse socioeconomic profiles and commitment to integrating technology into their curriculum. All students participated with informed consent obtained from their guardians, and the study adhered to ethical standards for educational research.

Regarding the socioeconomic backgrounds of the participants (see Table 3.1), the parents' educational levels showed a clear distinction between those with higher education and those without. Among mothers, 27.5% had attained a university or postgraduate degree (21.4% held a university or college degree, while 6.1% had a postgraduate degree), and 36.8% had only a primary, junior high, or high school education. Of the fathers, 29.3% had attained a university or higher degree (18.9% held a university or college degree, and 10.4% had a postgraduate degree), and 30.4% had completed only a primary, junior high, or high school education. Meanwhile, a significant number of students were unaware of their parents' educational levels (35.7% for their mother; 40.4% for their father). This distribution indicates that approximately one-third of the students had at least one parent with higher education, while another third did not. This reflects a diverse socioeconomic profile for the sample, with significant variability in the level of academic support that was available at home.

Table 3.1 Educational levels of the participants' parents

Parent's Education Level	Mothers (%)	Fathers (%)
Unknown	100 (35.7%)	113 (40.4%)
Primary School or Below	25 (8.9%)	14 (5.0%)
Junior High School	28 (10.0%)	21 (7.5%)
High School	50 (17.9%)	50 (17.9%)
University/College	60 (21.4%)	53 (18.9%)
Above University (Master's/Ph.D.)	17 (6.1%)	29 (10.4%)

In terms of household resources (Table 3.2), 86.1% of the students reported having a study desk, and 54.6% had their own room. In addition, 74.3% of the students reported having access to a quiet study environment, 60.4% had a computer for completing school assignments, and 77.5% had access to a tablet for learning. Finally, 86.8% of the students had Wi-Fi available at home. These household resources, combined with the varied educational backgrounds of the parents, offer an overview of the participants' learning environments.

Table 3.2 Household resources available to the students

Household Item/Facility	Yes (%)	No (%)
Study Desk	241 (86.1%)	39 (13.9%)
Own Room	153 (54.6%)	127 (45.4%)
Quiet Study Environment	208 (74.3%)	72 (25.7%)
Computer for Schoolwork	169 (60.4%)	111 (39.6%)
Tablet for Learning	217 (77.5%)	63 (22.5%)
Wireless Network (Wi-Fi)	243 (86.8%)	37 (13.2%)

3.3 Instruments

The data in this study were collected through an online reading task, a questionnaire, interview responses, and backend data recorded by the computer during the online reading process.

3.3.1 Online reading tasks

Despite their regular exposure to reading materials in a digital context and the use of iPads for completing assignments, the participants had not had prior experience with standardized online reading exams. To address that issue, this study developed three sets of mock practice tasks to enable the students to familiarize themselves with the format before the formal assessment. In other words, this study prepared a total of four sets of online reading tasks.

The layout of the online reading platform was modeled after ePIRLS and featured a mock browser interface crafted to mimic the experience of surfing the web. Passages were displayed in the format of webpages, requiring the students to navigate by clicking on relevant links to engage with the material. To the right of this browsing interface was the response panel, where a digital avatar provided students with step-by-step directions for responding to questions associated with each passage. Upon finishing a question, students were required to click "Save," to move on to the subsequent question. Answers were locked and could not be changed once saved, until all questions were answered. Students were only able to review and edit their responses after completing all of the questions. In the upper right corner of the web page, there was a progress bar indicating the number of questions completed and the remaining time for the exam. A sample of the website design can be seen in Figure 3.2. The detailed information on this online multimodal reading platform can be accessed at https://onlineread.hku.hk/

Figure 3.2 Website layout example

The questions for the task were crafted following the ePIRLS framework. Each question specifically corresponded to one of the 18 online reading proficiency indicators in Table 3.3. These indicators were categorized into four distinct levels: Focus on and Retrieve Explicitly Stated Information (Level 1), Make Straightforward Inferences (Level 2), Interpret and Integrate Ideas and Information (Level 3), and Evaluate and Critique Content and Textual Elements (Level 4) (Mullis et al., 2017).

Table 3.3 Indicators of online reading competence, from ePIRLS

Level 1	關注並檢索明確表述的資訊 Focus on and Retrieve Explicitly Stated Information
1-1	找出特定訊息在網頁中的具體位置 Identifying the part of the web page that contains the information
1-2	在文句中找出與特定閱讀目的有關的顯性訊息 Identifying the explicitly stated information related to a specific reading goal
1-3	在圖形中（如圖、表或地圖）找出特定的訊息 Identifying specific information on a graphic (e.g., graph, table, or map)

Level 2	簡單的推斷 Straightforward Inferences
2-1	在多個可能的網站中確定一個最合適、適用或有用的網站 Choosing among possible websites to identify the most appropriate, applicable, or useful one
2-2	在一個網頁中篩選出與主題相關的內容 Filtering the content of a web page for relevance to the topic
2-3	概述一個網頁的主要意圖 Summarizing the main intent of a web page
2-4	描述文字與圖像之間的關係 Describing the relationship between text and graphic(s)
2-5	推論鏈接的有用性 Inferring the potential usefulness of links
Level 3	詮釋及整合理念和信息 Interpret and Integrate Ideas and Information
3-1	比較和對比網站內與網站間的訊息 Comparing and contrasting information presented within and across websites
3-2	將一個網頁或網站的訊息與另一個網頁或網站的訊息進行聯繫 Relating the information in one web page or site to information in another web page or site
3-3	歸納來自相同或不同網頁或網站內的訊息 Generalizing from information presented within and across web pages or sites
3-4	將來自不同網頁的細節與這些網頁的總主題進行聯繫 Relating details from different web pages to an overall theme
3-5	從來自多個網站的訊息得出結論 Drawing conclusions from information presented in multiple websites
Level 4	評價及批判內容和文本要素 Evaluate and Critique Content and Textual Elements
4-1	評估在網站上尋找訊息的難易程度 Critiquing the ease of finding information on a website
4-2	評估訊息多大程度上可能改變人們的想法 Evaluating how likely the information would be to change what people think
4-3	描述網站中圖形元素的效果 Describing the effect of the graphic elements on the website
4-4	確定網站中所呈現的觀點或偏見 Determining the point of view or bias of the website

4-5	判定網站上訊息的可信度 Judging the credibility of the information on the website

The genre of the reading texts was expository. The reading passages and task questions were collaboratively designed by the author and a research assistant with a Master's degree in Chinese linguistics. The content was then reviewed by two professors specializing in Chinese language education. Before the examination, experienced teachers checked the appropriateness of the multimodal reading texts and the level of question difficulty.

Mock practice tasks

The first mock practice task was designed for the students to become familiar with our online task platform; hence, it comprised only 12 questions. The theme of the passage was "清代女天文學家王貞儀 Wang Zhenyi, the Female Astronomer of the Qing Dynasty," with a test duration of 25 minutes and a total score of 16 points. The reading material was distributed across four web pages, titled "世界各地的傑出女天文家 Outstanding Female Astronomers Around the World," "清朝第一位女天文學家 The First Female Astronomer of the Qing Dynasty," "王貞儀的傑出成就 The Remarkable Achievements of Wang Zhenyi," and "王貞儀破解月食之謎 Wang Zhenyi's Solution to the Mystery of Lunar Eclipses." The task included 4 multiple-choice questions, 2 multiple-response questions, 3 constructed-response questions, 2 dropdown questions, and 1 true/false question. Regarding multimodal elements, the material featured 9 static images and 3 dynamic images.

The second mock test task was consistent with the formal assessment, and it featured 26 questions with a total score of 35 points and an exam duration of 40 minutes. The theme was "趣談纜車 Fun Facts About Cable Cars," consisting of four web pages titled "軌道纜車的應用 Applications of Tramway Cable Cars," "索道纜車的應用 Applications of Aerial Cable Cars," "香港太平山山頂纜車 The Peak Tram of Hong

Kong's Victoria Peak," and "世界各地的纜車 Cable Cars Around the World." The task included 14 multiple-choice questions, 2 multiple-response questions, 5 constructed-response questions, 2 dropdown questions, 2 true/false questions, and 1 choose the correct link option. Regarding multimodal elements, the material featured 16 static images and 4 dynamic images.

The third mock test task had the same testing duration that task 2 did, with a total of 25 questions and a total score of 30 points. The theme was "偉大的發明家 Great Inventors." The reading passages consisted of 3 main web pages, each containing 2 sub-web pages, resulting in a total of 6 webpage hyperlinks. The first web page included "愛迪生的生平 The Life of Edison" and "愛迪生的發明 Edison's Inventions"; the second web page contained "張衡的成就 The Achievements of Zhang Heng" and "地動儀的操作原理 The Operating Principles of the Seismoscope"; the third web page featured "喬治.華盛頓. 卡弗的生平貢獻 The Life and Contributions of George Washington Carver" and "車上學校與農耕 Mobile Schools and Their Role in Agriculture." The task included 10 multiple-choice questions, 5 multiple-response questions, 6 constructed-response questions, 1 dropdown question, 1 true/false question, and 2 choose the correct link option. Regarding multimodal elements, the material featured 19 static images, 1 dynamic image, 1 table, and 1 in-page hyperlink.

Formal assessment task

The theme of the formal assessment online reading task was environmental conservation, with 26 questions and a total score of 37 points. The reading passage was composed of four web pages, which were titled "人類對大自然的破壞 Human Destruction of Nature," "森林中的危機 Crisis in the Forests," "海洋受到的威脅 Threats to the Oceans," and "全球合力保護生態 Global Collaboration for Ecological Protection." The questions included 13 multiple-choice questions, 2 multiple-response questions, 8 constructed-response questions, 2 true/false questions, and 1 choose the

correct link option. Regarding multimodal elements, the material featured 19 static images and 4 in-page hyperlinks. Detailed information on the formal assessment task can be found in Appendix A.

3.3.2 Questionnaires

All questionnaires were sourced from high-quality journals (such as SSCI Q1) or highly cited academic papers. The selected instruments were chosen with a focus on appropriateness for the target population of fourth-grade primary school students. All questionnaire items were presented in an online format in Chinese.

In the questionnaire adjustment process, the author initially made necessary modifications to the questionnaire's content before translating it into Chinese. The appropriateness of these adjustments and the accuracy of the translation were verified with the guidance of a professor specializing in the relevant field. Once the initial draft of the Chinese version was completed, a local teacher with extensive experience in teaching Chinese aided the author in refining the language to align with the linguistic conventions of Hong Kong students. To ensure the comprehensibility of the questionnaire for fourth-grade students, a pilot test was conducted with 20 fourth-grade students who were randomly selected from another primary school (not included in the current sample). The wording of the questionnaire was further adjusted on the basis of the results of the pilot study.

For the first research question, this study used six variables to examine the default stance of the student participants' online reading. The variables included three self-efficacy factors and three emotional factors.

Online reading self-efficacy

(1) The traditional reading self-efficacy scale, adapted from Peura et al. (2021), consisted of three items. For example, “我確信我可以學會更快地閱讀 I am certain I can learn to read faster.”

(2) The ICT self-efficacy scale, adapted from Hatlevik et al. (2018), comprised six items. For instance, “我知道如何在互聯網上搜索和尋找信息 I know how to search and find information on the Internet.”

(3) The multiple source use self-efficacy scale, adapted from Lee & List (2021), comprises seven items. For instance, “我知道, 我可以識別文本之間的關係 I know that I can identify relationships between texts.

Online reading emotions

The items of online reading emotions were adapted from Zaccoletti et al. (2020). Each had three items, as exemplified below.

(1) Enjoyment: 我喜歡在做測試時理解在線閱讀材料 I enjoy doing tests when I have to comprehend online materials.

(2) Anxiety: 如果考試要求我必須理解網上閱讀材料，我害怕得到一個糟糕的成績 When I do tests where I have to comprehend online reading materials, I’m afraid of getting a bad grade.

(3) Boredom: 我非常厭煩線上閱讀理解作業 I am very bored with online reading comprehension tasks.

Intrinsic and extrinsic goal orientation

For the second research question, intrinsic goal orientation (4 items) and extrinsic goal orientation (4 items) were used for data analysis. These two constructs were measured as *goal orientations*, using scales adapted from the work of Pintrich et al. (1993). Examples of items from these scales are as follows.

(1) Intrinsic goal orientation: 我更喜歡有挑戰性的線閱讀材料，這樣我就能學到新東西 I prefer online reading materials that challenge me so that I can learn new things.

(2) Extrinsic goal orientation: 在線上閱讀測試中獲得高分，現在對我來說是最愉快的事情 Receiving a high grade in online reading is now the most pleasant thing for me.

Online reading strategies

For the third and fourth research questions, a total of seven *online reading strategies* variables belonging to three dimensions were used for data analysis. This set of online reading strategies was adapted from Tsai (2009) and B. Cho et al. (2018), with 25 items in total. Specifically, disorientation (4 items) and control (4 items) belonged to the behavioral domain; evaluation (4 items), purposeful thinking (4 items), and selecting the main idea (3 items) belonged to the metacognitive domain; and trial & error (3 items) and problem-solving (3 items) belonged to the procedural domain. Examples of the variables are as follows.

(1) Disorientation: 當我在互聯網上搜索信息時，我總是感到迷失搜索方向 When reading online, I always feel lost regarding the direction of my search.

(2) Control: 當在線閱讀時，我會注意時間分配 When reading online, I monitor the time allocation.

(3) Evaluation: 在線上閱讀時，我會不斷評估在網上搜索到的信息之間的關係 When reading online, I often compare information gathered from different websites.

(4) Purposeful thinking: 我會不斷提醒自己線上搜索的目標 When reading online, I keep reminding myself of the purpose of reading online.

(5) Selecting main ideas: 我通過網頁中的標題或超鏈接來捕捉主要信息 I look through titles or hyperlinks in a web in order to catch major information.

(6) Trial & error: 當我在一個網頁中得不到任何信息時, 我會嘗試其他網頁 I try some other possible websites when I cannot find any information in a website.

(7) Problem-solving: 當我在網上閱讀時因一些問題而感到沮喪時,我會考慮一些解決方案 When I am frustrated by some problems while reading online, I consider some solutions.

Detailed information on the questionnaire is presented in Appendix B.

3.3.3 Backend data

Given the potential discrepancies between self-reported data and actual behavior, this study used backend data to provide triangulation and additional insights for Research Questions 3 and 4. The online reading platform designed for this study enabled us to track the number of times and durations of the students' interactions with three multimodal elements (i.e., images, buttons, webpage links). For backend data analysis, quantitatively, participants' time duration and the number of mouse clicks on multimodal elements were analyzed using the Wald chi-square test to examine group differences in actual reading behaviors, thereby triangulating the self-reported questionnaire data. Qualitatively, individual log files were exported for each participant and used to construct behavioral timelines. Using these timelines, the study conducted

a qualitative case analysis supported by process data (e.g., time on task, click accuracy, and response correctness) to explore the students' reading strategies in digital contexts. The specific types of backend data selected, and the methods of analysis, are presented in the corresponding chapters.

3.3.4 Interviews

To further elucidate the quantitative findings, group interviews were conducted. Participants were selected on the basis of their groupings identified through latent profile analysis. In each school, five to six students from each group were randomly chosen and recommended to the teachers. The teachers then selected three students from each group, prioritizing those with stronger communication skills. This process resulted in nine students per school, with a total of 27 (9*3 groups) students participating in the interviews. The quantitative results informed the interview framework and were tailored to the specific characteristics reflected in the students' questionnaire responses and backend data (detailed interview outlines can be seen in the corresponding chapters). This approach allowed for more targeted questioning, providing deeper and more nuanced explanations of the quantitative outcomes.

3.4 Data Collection Procedures

In the three months leading up to the formal assessment, schools arranged for the completion of the three mock tests in accord with their own teaching schedules. During the formal assessment, students first completed a 40-minute online multimodal reading task, followed by a 15-minute self-report survey. Both the reading task and the survey were conducted on tablets supplied by the schools. Throughout this process, the school's information technology (IT) teacher, the Chinese language teacher from each class, and research assistants were on hand to offer essential technical support to the students, such as assistance with logging into the reading platform.

After the quantitative data analysis, 27 individuals were selected for follow-up interviews. These students were divided into three groups, with each group comprising three students who shared a similar psychological profile. The author conducted a 40-minute group interview for each group. Before the questions, students were presented with their questionnaire responses, to assist them in recollecting their thoughts during the task completion. The interview data were recorded, transcribed by two graduate research assistants, and mutually checked during a reviewing process to ensure their accuracy.

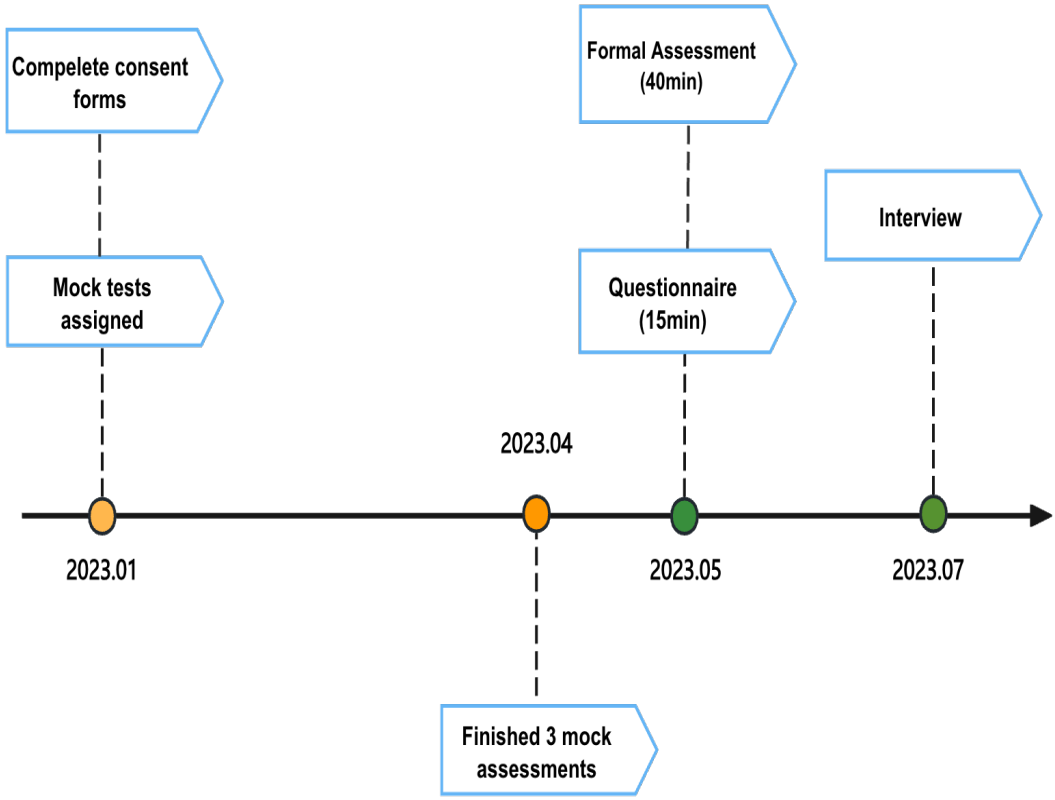


Figure 3.3 Data collection flowchart

3.5 Quantitative Data Analysis

3.5.1 Descriptive analysis, Cronbach's alpha coefficients, and bivariate correlations

This study was initially used SPSS 26.0 to conduct descriptive statistics, calculate Cronbach's alpha coefficients, and perform bivariate correlations to gain a preliminary understanding of the data. Specifically, the descriptive statistics covered measures of central tendency (i.e., the means) to capture the central points of data distribution; and measures of variability, including variances and standard deviations, to reflect the degrees of dispersion of the data. Moreover, the descriptive statistics also presented the shape of data distribution, particularly by describing the symmetry of the distribution through skewness, as well as measuring the tail characteristics of the distribution through kurtosis. Cronbach's alpha coefficients were used to measure the internal consistency of the items in the questionnaire. A Cronbach's alpha coefficient exceeding 0.7 typically indicates acceptable internal consistency of an instrument (Tavakol & Dennick, 2011).

Table 3.4 presents the descriptive statistical analysis of the variables used in the current research. The mean values for these variables generally ranged between 2.63 and 4.16, indicating moderate to high levels on the measured scales. Specifically, in terms of goal orientation, both the intrinsic and extrinsic goal orientations had similar mean values––of 3.78 and 3.93, respectively. This suggests that the participants were moderately oriented toward achieving goals for both intrinsic satisfaction and external pursuits.

The self-efficacy variables exhibited higher mean values than those for goal orientation did, with traditional reading self-efficacy at 4.16, multiple source use self-efficacy at 3.91, and ICT self-efficacy at 4.02. This result indicates a relatively high level of confidence among participants in these areas of self-efficacy.

Strategy use showed a broader range of mean values, from 2.63 to 4.09, highlighting differences in how frequently the students employed different online reading strategies. Skewness and kurtosis values indicated that the data distribution for most variables was acceptable (skewness values were between –2 and +2, and kurtosis values were between –7 and +7), suggesting that the distributions were generally normal (Kline, 2011). As measured by Cronbach's alpha, reliability was high across most variables, with values typically above 0.8, indicating good internal consistency (Tavakol & Dennick, 2011).

Table 3.4. Descriptive statistical analysis

Variable	Mean	S. D.	Skewness	Kurtosis	Cronbach's Alpha
Intrinsic Goal Orientation	3.7812	0.89736	-1.058	1.345	.840
Extrinsic Goal Orientation	3.9304	0.8923	-1.182	1.602	.841
Self-efficacy in TR	4.1631	0.8588	-1.194	1.867	.918
Self-efficacy in MSU	3.9102	0.82049	-0.865	1.371	.925
Self-efficacy in ICT	4.0155	0.8567	-0.974	0.939	.895
Enjoyment	3.9048	0.95564	-0.728	0.146	.860
Boring	2.9095	1.34986	0.053	-1.219	.933
Anxiety	2.9667	1.24005	0.012	-1.021	.866
Strategy_disorientation	2.6286	1.33249	0.367	-1.104	.947
Strategy _control	3.9274	0.78043	-0.227	-0.64	.867
Strategy _evaluation	3.8143	0.94465	-0.42	-0.388	.912
Strategy _purposeful thinking	3.892	0.86067	-0.487	0.153	.888
Strategy _main idea selection	4.006	0.86595	-0.651	0.216	.902
Strategy _problem solving	3.7536	0.86019	-0.259	-0.07	.674
Strategy _trial & error	4.0857	0.84372	-0.913	0.931	.822
Online reading score	16.65	6.658	-0.061	-0.785	-

Bivariate correlations were used to determine preliminarily whether there was a statistically significant relationship between pairs of variables. Correlation coefficients (r) ranged from –1 to 1, indicating weak (0 to ±0.3), moderate (±0.3 to ±0.7), or strong (±0.7 to ±1) linear relationships (Ratner, 2009). In this study, a p-value below the threshold of 0.05 was construed as statistically significant, showing the rejection of the null hypothesis.

Table 3.5 provides a correlation analysis of the variables used in the current research. There was a significant positive correlation between intrinsic goal orientation (IGO) and extrinsic goal orientation (EGO) (r = 0.695, p < 0.01). Moreover, both were positively correlated with several other variables, including self-efficacy and strategy use. In terms of self-efficacy, all three types (SE_TR, SE_MSU, SE_ICT) were significantly correlated (r ranging from 0.438 to 0.693, p < 0.01), with a particularly strong relationship between self-efficacy in traditional reading and multiple source use. In addition, self-efficacy was positively associated with reading enjoyment and most strategy use measures.

Regarding emotions, boredom and anxiety showed a moderate positive correlation (r = 0.574, p < 0.01), but neither was significantly associated with enjoyment. Furthermore, both boredom and anxiety were negatively correlated with goal orientation and self-efficacy, while they showed a significant positive correlation with disorganized strategy use (S_Dis) (boredom: r =0 .591, p < 0.01; anxiety: r = 0.791, p < 0.01). Regarding strategy use, most strategies were significantly positively correlated—particularly control (S_Con), evaluation (S_Eva), purposeful thinking (S_Pur), and selecting main ideas (S_Sel)—all of which exhibited correlation coefficients above 0.7 (p < 0.01), indicating that these strategies may often be used together.

Online reading performance was significantly negatively correlated with boredom, anxiety, and disorganized strategy use (r = –0.287, –0.312, and –0.362, respectively, p < 0.01). At the same time, test scores showed a significant but weak positive correlation

with extrinsic goal orientation, self-efficacy in traditional reading (SE_TR), selecting main ideas (S_Sel), and trial-and-error strategy (S_Tri) (r = 0.145, 0.166, 0.158, 0.154, respectively, $p < 0.05$).

Table 3.5 Bivariate correlations among the primary variables

Variable	IGO	EGO	SE_ TR	SE_ MSU	SE_ ICT	En	Bo	An	S_Dis	S_ Con	S_ Eva	S_ Pur	S_ Sel	S_ Tri	S_ Pro	Score
IGO	1															
EGO	.695**	1	.													
SE_TR	.464**	.466**	1	.												
SE_MSU	.600**	.604**	.693**	1												
SE_ICT	.236**	.210**	.438**	.487**	1											
Enjoyment	.455**	.488**	.614**	.699**	.384**	1										
Boredom	-.126*	-.155**	-0.04	-.004	0.038	.016	1									
Anxiety	-.133*	-.138*	-.146*	-.127*	-0.058	-.061	.574**	1								
S_Dis	-.054	-.082	-.044	-.057	-.189**	.019	.591**	.791**	1							
S_Con	.439**	.418**	.576**	.612**	.458**	.581**	.080	-.037	.031	1						
S_Eva	.434**	.419**	.602**	.562**	.392**	.557**	.086	.038	.115	.816**	1					
S_Pur	.476**	.412**	.595**	.565**	.458**	.572**	.065	-.020	.041	.837**	.838**	1				
S_Sel	.438**	.402**	.541**	.574**	.449**	.570**	.066	-.056	-.048	.845**	.711**	.746**	1			
S_Tri	.332**	.271**	.488**	.453**	.366**	.405**	.005	-.017	-.06	.592**	.521**	.523**	.544**	1		
S_Pro	.293**	.343**	.415**	.404**	.358**	.377**	.196**	.115	.167**	.694**	.608**	.619**	.651**	.405**	1	
Score	0.05	.145*	.166**	0.10	.058	.056	-.287**	-.312**	-.362**	.071	.040	.093	.158**	.154*	-.002	1

Note. *= p<.05, **= p<.01. IGO=Intrinsic goal orientation; EGO=Extrinsic goal orientation; SE_TR=Self-efficacy in traditional reading; SE_MSU=Self-efficacy in multiple source use; SE_ICT=Self-efficacy in ICT skills; En=enjoyment; Bo=boredom; An=anxiety; S_Dis=Strategy_disorientation; S_Con=Strategy_Control; S_Eva=Strategy_Evaluation; S_Pur=Strategy_Purposeful thinking; S_Sele=Strategy_Selecting main idea; S_Tri=Strategy_Trial&Error; S_Pro=Strategy_Problem solving

3.5.2 Confirmatory factor analysis

Before conducting specific statistical analyses on the research questions, this study used Mplus 8.6 to employ Confirmatory Factor Analysis (CFA) to validate the construct of the questionnaire. Confirmatory factor analysis was essential because it allowed for the validation and confirmation of the hypothesized research model based on existing theories or prior empirical findings (Brown, 2006; DiStefano & Hess, 2005). More precisely, CFA was used to assess whether the factor structure in the questionnaire aligned with our theoretical assumptions. Researchers can proceed with further analysis of the correlations between the latent variables only after the structural model of their questionnaire is confirmed through CFA as a good fit for the data. This step ensures that subsequent statistical analyses are based on a valid and reliable measurement system.

Latent variables in this study were subjected to CFA, with model fit indices used to assess the alignment between the model and the data. The indices included the chi-square statistic (χ^2), the comparative fit index (CFI), the Tucker-Lewis index (TLI), the root-mean-square error of approximation (RMSEA), and the standardized root-mean-square residual (SRMR). Specifically, the CFI was utilized to assess the degree of fit between the research model and a baseline model, which posited that there was no correlation among the variables. The CFI values range from 0 to 1, with values closer to 1 indicating a higher degree of congruence between the research model and the empirical data. Typically, a CFI greater than 0.95 denotes a good model fit. Similar to the CFI, the TLI also compares the fit of the research model with a baseline model. However, the TLI exhibits lower sensitivity to variations in sample size and model complexity. This index spans from 0 to 1 in value, with values exceeding 0.95 signifying a robust model fit. The RMSEA estimates the error of approximation in the population based on the sample data collected. Smaller RMSEA values indicate a better fit between the model and the data, with values below 0.05 typically considered

indicative of an excellent model fit. The SRMR is used to measure the standard deviation of the differences and residuals in the correlations among observed variables. Values range from 0 to 1, with lower values suggesting higher consistency between the model and the data. An SRMR value below 0.06 is commonly regarded as indicative of a well-fitting model. These indices were utilized following the guidelines recommended by Meyers et al. (2016).

In addition to model fit indices, this study also checked factor loadings on each observed variable, especially in cases where the model fit was not ideal. Specifically, factor loadings of 0.70 and above indicate that the observed variable strongly reflects the latent construct, loadings between 0.60 and 0.70 suggest a high correlation with the latent variable, while loadings from 0.50 to 0.60 denote a moderate relationship (Bryant & Yarnold, 1995; J.-O. Kim & Mueller, 1978). Items with factor loadings below 0.50 were recommended for consideration to be removed. Furthermore, if the model fit was shown to be insufficient, this study considered implementing modifications suggested by Mplus (Muthén & Muthén, 2017)—adjustments that could include correlating residuals within the same factor, contingent upon their alignment with the theoretical hypothesis.

The model indices of CFA results are presented in Table 3.6. All constructs showed satisfactory fit indices, with CFI values above 0.93, TLI values above 0.92, and SRMR values below 0.05. These results indicated that the measurement models for these constructs were well-specified and fit the data well, thus requiring no further adjustments.

Table 3.6. CFA model indices

Variable	Chi-square	*df*	CFI	TLI	RMSEA	SRMR
Goal Orientation	208.804	101	0.967	0.961	0.062 [0.050, 0.074]	0.036
Self-efficacy	48.883	19	0.974	0.961	0.075 [0.049, 0.101]	0.031

Emotions	54.286	24	0.982	0.973	0.067 [0.043, 0.091]	0.040
Strategies	611.824	254	0.937	0.926	0.071 [0.064, 0.078]	0.043

Figures 3.4 to 3.7 show the factor loadings of each latent variable. The factor loadings for goal orientation indicated that most of the observed variables had high contributions to their respective latent variables (ranging from 0.611 to 0.851 for intrinsic goal orientation and from 0.632 to 0.847 for extrinsic goal orientation), with a strong positive correlation between the two latent variables (r =0.802, $p < 0.01$). A similar pattern was observed in self-efficacy, with factor loadings ranging from 0.814 to 0.932 for traditional reading self-efficacy, from 0.611 to 0.885 for ICT skills self-efficacy, and from 0.724 to 0.851 for multiple source use self-efficacy, along with moderate positive correlations between the latent variables. Regarding emotions, the factor loadings ranged from 0.736 to 0.912 for enjoyment, from 0.872 to 0.959 for boredom, and from 0.798 to 0.882 for anxiety, with a moderate positive correlation of 0.619 between boredom and anxiety. Concerning the strategies, the factor loadings for each variable were excellent, with the vast majority being above 0.75. Overall, the data suggested that the scales were reliable and that the latent variables measured in this study exhibited acceptable levels of central tendency and variability.

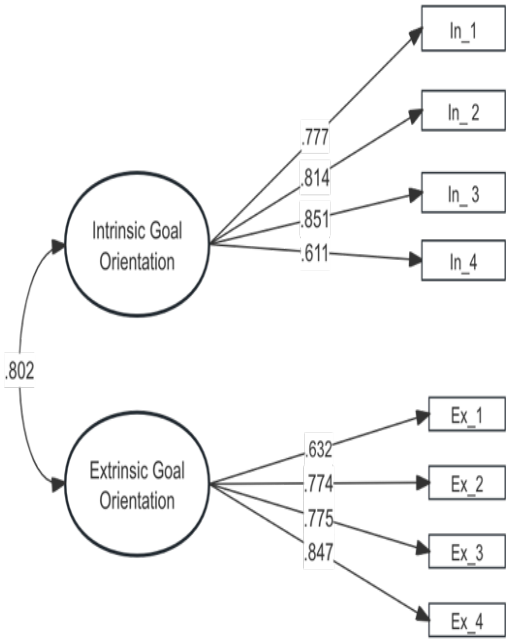


Figure 3.4 Factor loadings of GO

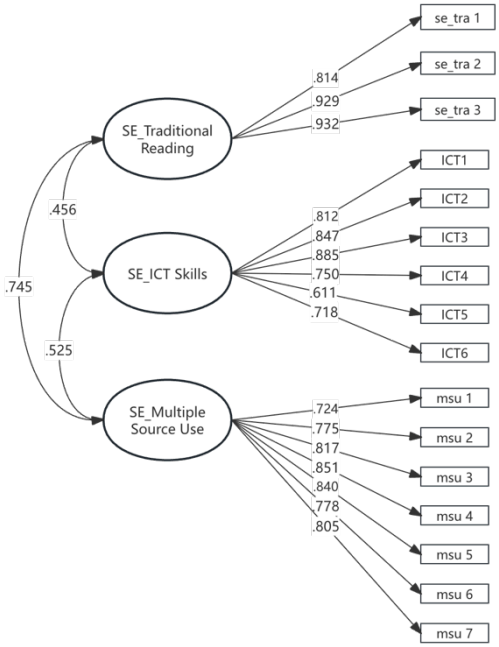


Figure 3.5 Factor loadings of SE

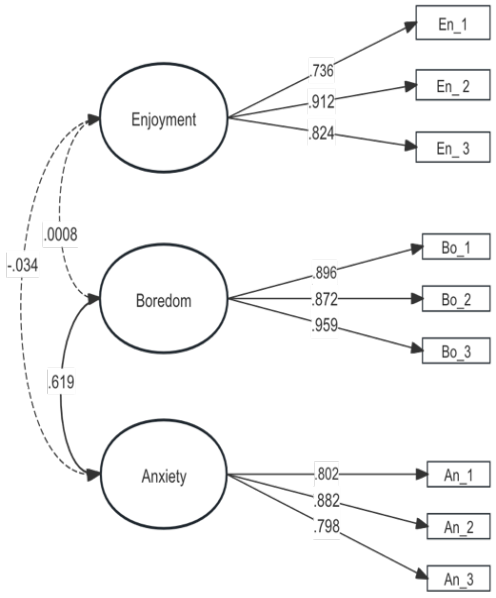


Figure 3.6 Factor loadings of emotions

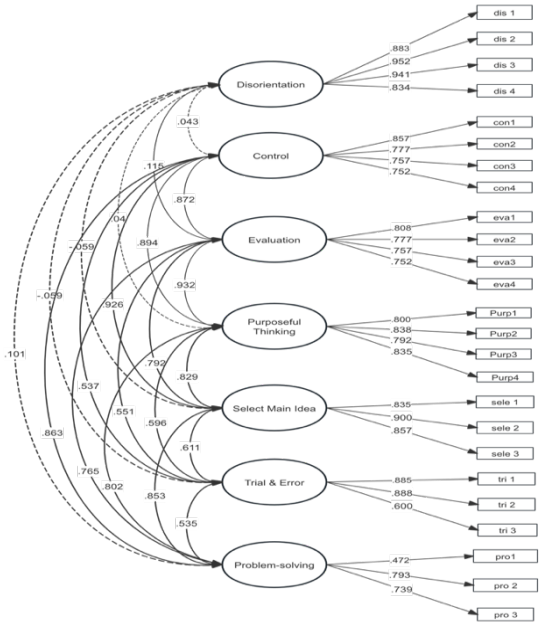


Figure 3.7 Factor loadings of strategies

3.5.3 Latent profile analysis

To answer RQ1, latent profile analysis was employed. This statistical method explains the relationships among multiple observed indicators by grouping them into a limited number of distinct latent classes or profiles. Latent profile analysis assumes that the joint distribution of observed variables can be represented by distinct latent classes, each characterized by a unique probability distribution of responses to observed variables and maintaining local independence within each class (Collins & Lanza, 2010). Fitting an LPA model allows for the identification of latent class membership for individuals in the sample, thereby revealing the response pattern features of these latent classes to the variables. This method affords a more concise explanation of the interrelationships among multiple variables, through fewer latent class variables (Nylund et al., 2007). Figure 3.8 illustrates this concept, where the capital letter *C* within a circle indicates the latent class variable or group membership, and the squares above represent the indicators. The arrows from the latent class variable to the indicators indicate that group membership is determined by participants' responses to the indicators. Specifically, in psychology, LPA offers a person-centered technique that enables researchers to group participants according to varying psychological or behavioral traits, thus providing a more detailed portrayal of the sample.

The optimal number of classes was determined by using several fit indices, including Log Likelihood (LL), the Akaike Information Criterion (AIC), the Bayesian Information Criterion (BIC), the Sample Size Adjusted BIC (ABIC), the Lo-Mandell-Rubin Likelihood Ratio Test (LMRT), and the Bootstrapped Likelihood Ratio Test (BLRT) (Lo et al., 2001). Log likelihood indicates the degree to which a model fits the observed data, with higher values indicating a better fit. Both the AIC and BIC balance model fit against the number of parameters, while ABIC corrects for small sample bias in BIC; lower values of these indices indicate better model fit. The LMRT and BLRT assess whether a *k*-class model provides a better fit than a *k*–1-class model does, with a

significant *p*-value (<0.05) supporting the *k*-class solution (Nylund et al., 2007). In addition, entropy values measure the precision of classification within latent categories, with higher values indicating better classification; typically, values above 0.80 indicate classification accuracy higher than 90% (Lubke & Muthén, 2007). Nevertheless, it is important to note that the final grouping results in LPA are not determined solely by these statistical indices but must also be theoretically validated in the context of the research questions.

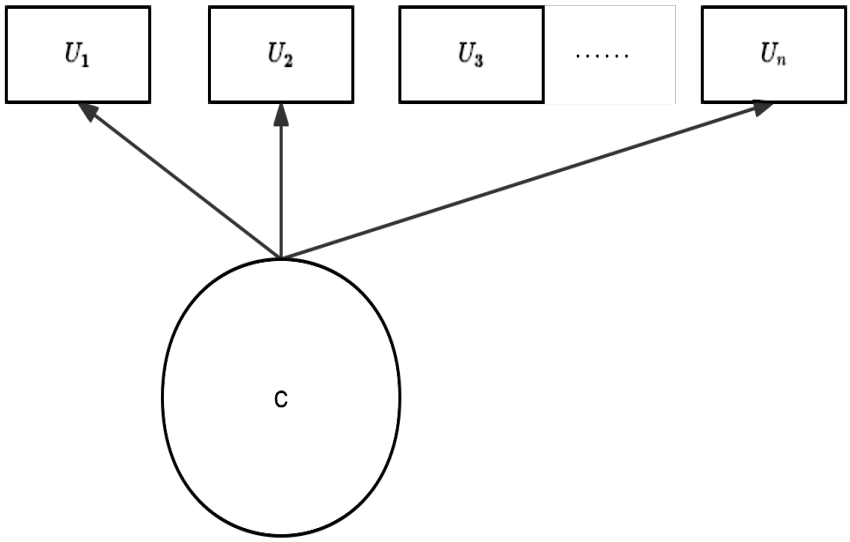


Figure 3.8 The LPA theoretical model

3.5.4 Regression mixture modeling

Regression Mixture Modeling (RMM) is an integrated model that combines latent class groupings with regression analysis. This approach allows for observed values to originate from subpopulations with distinct probability distributions, each potentially having unique regression coefficients (Nylund et al., 2007). Consequently, RMM facilitates a more nuanced fit to the data and a more sophisticated analysis of complex relationships within populations.

Notably, RMM exhibits significant differences from traditional grouped regressions, which rely on observed categorical variables to divide the sample into multiple distinct groups for separate regression analyses. However, this direct use of observed variables for classification raises a critical issue: the categorical variables may not accurately reflect the intrinsic attributes of the sample and are susceptible to measurement error. In contrast, rather than assigning a definitive label to samples as in direct grouping, RMM allows for varying probabilities of sample membership across different categories—thus reducing the impact of measurement errors associated with the direct use of observed categorical variables (McLachlan & Peel, 2000; Vermunt & Magidson, 2002). Consequently, the latent classes identified by RMM more closely represent the intrinsic attribute distribution of the samples (Nagin, 2005). In other words, RMM accounts for the uncertainty in classification results, thereby addressing potential issues caused by classification errors in direct grouping methods. This study involved two common types of RMM: LPA with a predictor variable, and LPA with an outcome variable.

Latent profile analysis with predictors

To examine RQ2, latent profile analysis with predictors, which is also called multinomial logistic regression analysis, was conducted. This method allows for the identification of latent subgroups on the basis of patterns of responses across multiple variables, while considering the effects of covariates on subgroup membership. It estimates classification probabilities and regression parameters simultaneously (Vermunt & Magidson, 2002). The study's theoretical hypothesized model is presented in Figure 3.9. In the figure, the predictor variables are represented by x, and the arrows pointing from the predictor variables to the latent class variable C indicate the influence of these covariates on individual class membership. This visual representation illustrates the conceptual framework behind the analysis and highlights the role of the predictor variables in determining the latent class structure.

At the operational level, Model Maximum Likelihood Estimation (Model ML) was used to perform this multinomial logistic regression analysis. Asparouhov and Muthén (2014) referred to this step as the three-step approach, which is currently considered the best method for handling predictor variables in RMM because it accounts for the uncertainty caused by classification errors during analysis. Because Mplus provides an automated method for this approach, the R3STEP command was utilized in this study.

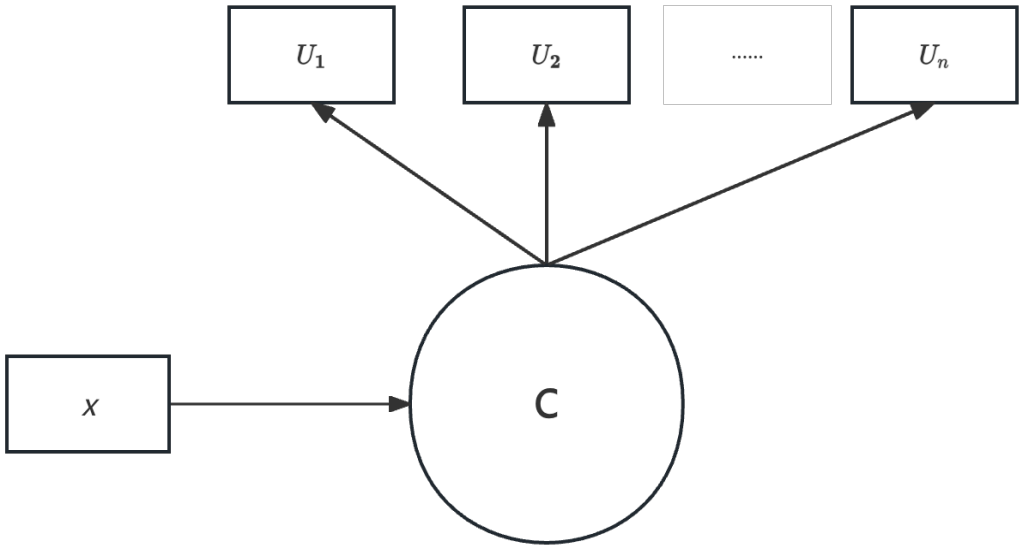


Figure 3.9 Theoretical model for the study's multinomial logistic regression analysis

Latent profile analysis with outcome variables

To investigate RQ3, this study employed the Wald chi-square test, which is also named latent profile analysis with outcome variables. This method allows for the examination of potential differences in outcome variables across latent groups identified through the LPA model (Vermunt and Magidson, 2002). The study's theoretical model for the Wald chi-square test is presented in Figure 3.10. In the figure, the arrows pointing from the latent class variable *C* to the outcome variable *y* indicate that class membership (i.e., the classification variable) predicts the outcome variable.

At the operational level, the BCH command (for the Bose–Chaudhuri–Hocquenghem codes) in Mplus was used for this statistical analysis (Muthén & Muthén, 2017). This method offers several advantages over alternative approaches, such as the three-step approach mentioned earlier. The BCH method provides unbiased parameter estimates by accounting for the classification uncertainty inherent in latent class models, doing so by using weighted class-specific means and variances, where the weights are derived from the posterior class membership probabilities. This approach ensures that the estimates of the outcome variable's means and variances for each latent class are unbiased, even when there is a classification error in the model (Asparouhov & Muthén, 2014).

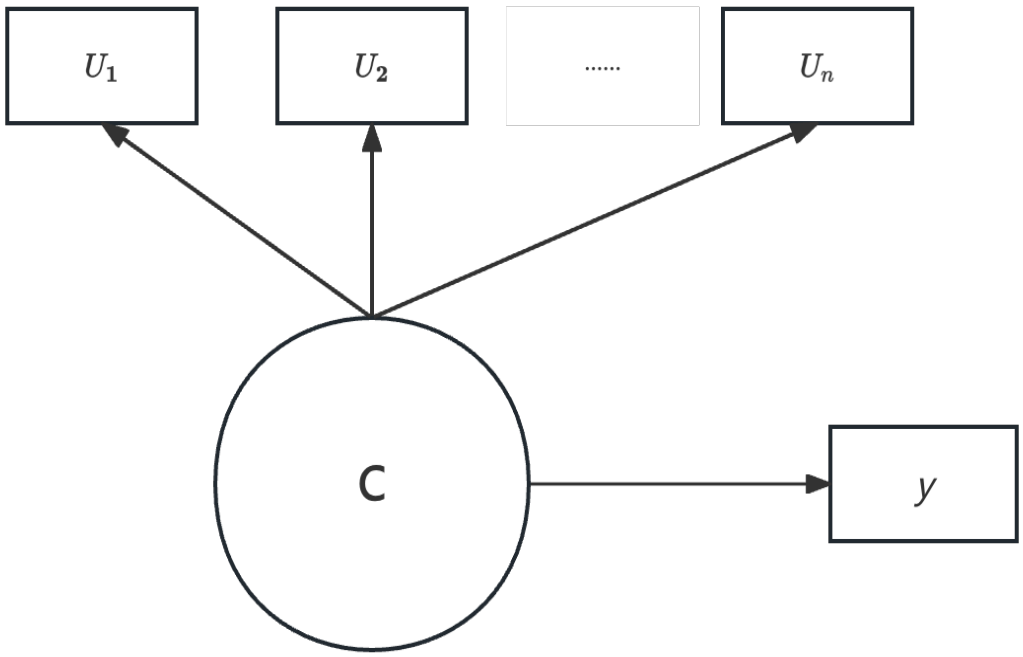


Figure 3.10 The study's theoretical model for Wald chi-square test

3.5.5 Mixture path analysis

To address RQ4, a mixture path analysis was conducted. This approach extends the RMM by combining latent profile analysis and path analysis. A mixture SEM

(structural equation modeling) was not utilized because the available sample size for this study may have been too limited to yield ideal SEM results after segmentation into subgroups. The underlying mechanism of mixture path analysis is to first identify latent subgroups within the overall sample and assign each individual concurrent probabilities of belonging to each subgroup. The approach then estimates the path coefficients between variables within each subgroup (Nylund et al., 2007). In essence, mixture path analysis allows for a moderation-based analysis by subgroup, examining whether the relationships between predictive and outcome variables differ across the latent classes (McLarnon & O'Neill, 2018). The hypothesized model can be seen in Figure 3.11. The exogenous variables, $x1$ to $x3$, are predictor variables or independent variables that may influence the endogenous variable y, which is the outcome variable or dependent variable. The arrows pointing from the exogenous variables to the endogenous variable represent the impact of the exogenous variables on the endogenous variable. Different latent classes may have different path coefficients, indicating that the relationships between variables may vary across different subgroups.

Operationally, to conduct this analysis the study employed the three-step maximum-likelihood (ML) approach, which is currently one of the recommended methods to incorporate auxiliary variables into latent class models. The approach has been demonstrated to reduce potential parameter biases in models and produce smaller biases compared with other approaches (Asparouhov & Muthén, 2014).

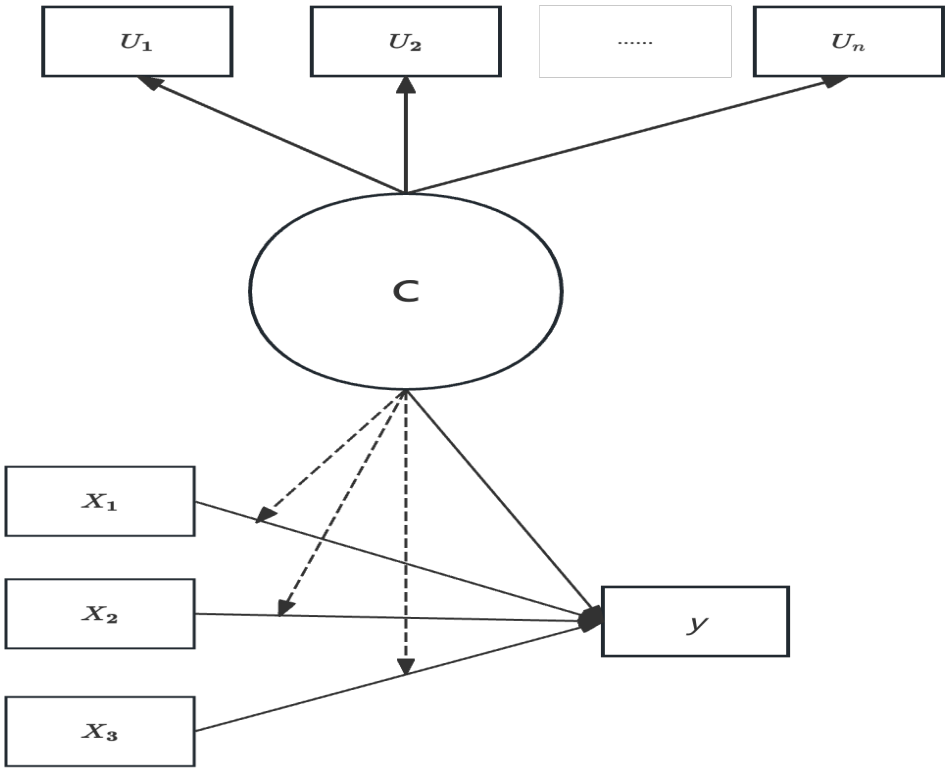


Figure 3.11 Theoretical model for the study's mixture path analysis

3.6 Qualitative Data Analysis

Because this study employed an explanatory mixed-methods design, the qualitative analysis was conducted after the completion of the quantitative analysis. The interview framework adhered to the CAEM guidelines (List & Alexander, 2017), and the questions were developed based on the quantitative results. Detailed interview question examples related to the specific research questions are presented in each chapter.

All interview transcriptions were analyzed using qualitative content analysis, which is defined as "a research method for the subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns" (H. F. Hsieh & Shannon, 2005, p. 1278). This approach condenses raw data

into categories or themes on the basis of valid inferences and interpretations. Unlike other qualitative methods (e.g., thematic analysis, grounded theory, discourse analysis), qualitative content analysis does not exclude deductive approaches but relies primarily on inductive coding (Patton, 2002) and typically uses purposively selected texts that directly inform the research questions (Y. Zhang & Wildemuth, 2005). Its strengths—such as methodological rigor, flexibility, sensitivity to context, and applicability to real-world settings—have made it a preferred choice for both novice and experienced researchers (Selvi, 2019).

This study adopted the structural analysis procedures described by Schreier (2014), which align with H. F. Hsieh and Shannon's (2005) conventional qualitative content analysis. In this approach, the main category and subcategories of the coding framework are developed directly from the text and refined (through segmentation) before the primary coding and interpretation process (Selvi, 2019). This analytic procedure is "more suited in cases when less is known about the topics or themes that may potentially emerge from the data" or when "there is not enough former knowledge about the phenomenon or if this knowledge is fragmented" (Elo & Kyngäs, 2008, p. 109). Because psychological factors and reading strategies have not been extensively explored in the context of online multimodal reading and the goal of analyzing interview data is to provide deeper insights and explanations for the quantitative findings, the structural or conventional version of qualitative content analysis was more appropriate. Qualitative content analysis was conducted using NVivo 15.0. The main phases (adapted from Elo et al., 2014) and the steps of data analysis (adapted from Schreier, 2014) are outlined in Figure 3.12.

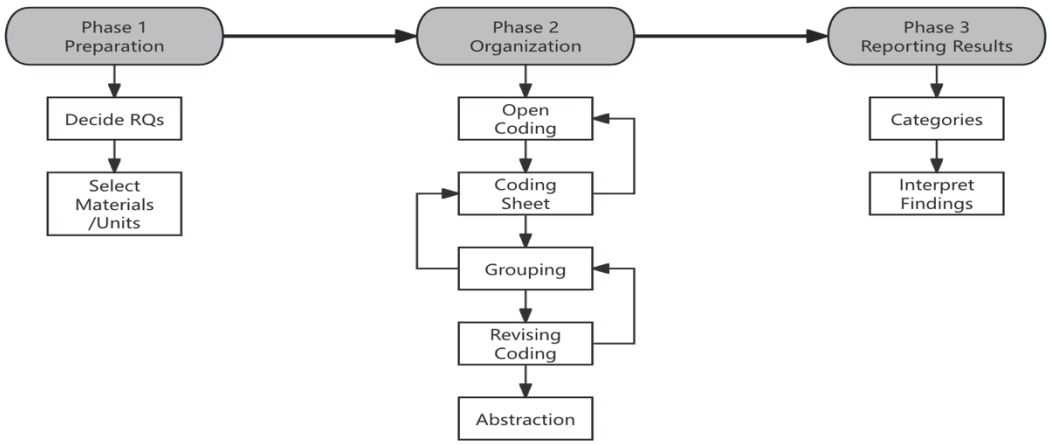
Phase 1 is the preparation stage, in which researchers determine the research questions and define the coding unit. In this study, because the goal of the qualitative content analysis was to explain the quantitative results, the research questions were already well-defined (see details in the corresponding chapter 4 to 6). Regarding the coding

unit, this study followed Schamber (2000), who described it as “a word or group of words that can be coded under one criterion category” (p. 739). Importantly, qualitative content analysis is not strictly exclusive, thus allowing researchers to assign a unit of text to multiple categories simultaneously (Tesch, 1990).

Phase 2, titled “Organization,” consists of five steps of analysis. In this study, the process began with line-by-line open coding of interview materials from three participants in each group, to identify categories relevant to the research objectives. A coding scheme was then developed, including the name, a brief description, and an example for each category, to guide the subsequent full-text coding (Schreier, 2014). Through continuous grouping and comparison, the categories were refined and organized hierarchically. Finally, the entire category system was established to ensure logical clarity (i.e., nonoverlapping categories) and an appropriate level of abstraction that aligned with the study’s analytical goals.

In Phase 3, the categories, along with definitions and examples from the raw data, are presented, with the interpretations integrated with the quantitative findings.

Figure 3.12 Phases and steps of structural qualitative content analysis



The overview of research questions, measurements, and methods of analysis are presented in Table 3.7.

Table 3.7 Overview of research questions, instruments, and analytic approaches

RQs	Quantitative		Qualitative	
	Instruments	Data Analyses	Instruments	Data Analyses
1. What are the characteristics of students' default psychological stances, specifically concerning online reading self-efficacy and emotions, among fourth-grade students in Hong Kong?	Questionnaires	LPA	Interview	Qualitative Content Analysis
2. How do goal orientations of online reading tasks influence the varied default psychological stances of students?	Questionnaires	RMM (LPA with predictors)		
3. What are the differences in online reading strategy use and performance among students with varying default psychological stances?	Questionnaires Online Reading Task Backend Data	RMM (LPA with outcome variables)	Interview & Backend Data	
4. How do different default psychological stances moderate the relationship between students' online reading strategies and their reading performance?	Questionnaires Online Reading Task Backend Data	Mixture Path Analysis		

Chapter 4 Results and Discussion: Profiles of Default Psychological Stances

This chapter addresses Research Question (RQ) 1: What are the characteristics of students' default psychological stances, specifically concerning online reading self-efficacy and emotions, among fourth-grade students in Hong Kong? To answer this RQ, a latent profile analysis was first conducted, followed by a structured semi-group interview for a deeper understanding of the grouping results.

4.1 Latent Profile Analysis

Figure 4.1 illustrates the hypothesized model of LPA in this research. At the center of the figure is an oval representing the "Default Psychological Status Profiles (Groups)," which were the latent (unobserved) subgroups that LPA sought to identify. These profiles were determined by the patterns of responses across a set of observed variables (depicted as rectangles connected to the central oval), including self-efficacy in traditional reading, self-efficacy in ICT skills, self-efficacy in multiple source use, and the emotions enjoyment, anxiety, and boredom. By analyzing students' responses on these observed variables, LPA could determine the optimal number of latent profiles that best described the heterogeneity within the fourth-grade student population in Hong Kong, revealing hidden subgroups with distinct patterns of online reading self-efficacy and emotions that may not have been apparent through traditional variable-centered approaches. Thus, the hypotheses for this statistical analysis were as follows.

Null Hypothesis (H_0): Among fourth-grade students in Hong Kong, there are no distinct default psychological stances that are based on online reading self-efficacy and emotions. All students exhibit similar patterns in terms of their self-efficacy in

traditional reading, self-efficacy in multisource use, self-efficacy in ICT skills, and their emotions enjoyment, anxiety, and boredom.

Alternative Hypothesis (H_1): Among fourth-grade students in Hong Kong, there exist distinct default psychological stances that are based on online reading self-efficacy and emotions. Multiple latent subgroups can be identified, with each subgroup exhibiting different patterns in terms of self-efficacy in traditional reading, self-efficacy in multisource use, self-efficacy in ICT skills, and the emotions enjoyment, anxiety, and boredom.

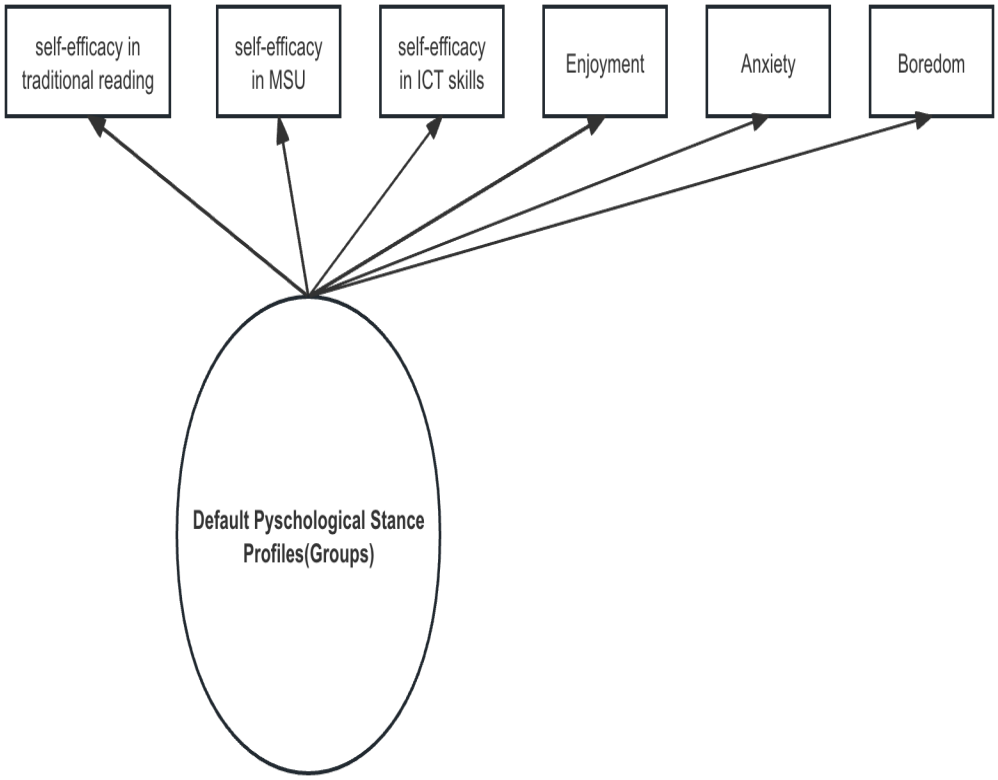


Figure 4.1 Hypothesized model for RQ 1.

The examination of one to four-group solutions was conducted, and the resulting model fit indices are presented in Table 4.1. As expected, the absolute values of LL, AIC, BIC, and ABIC decreased as the number of groups increased. Although the four-group solution exhibited the highest entropy (0.896), the first category had too few individuals

(N = 13), which was not conducive to subsequent statistical analysis. This decision is reasonable, as it is common practice to exclude an LPA group if the number of individuals in that subgroup is fewer than 10% of the total sample (Sinha et al., 2021). Considering that the entropy of the third group also exceeded 0.8 (0.836) and other metrics were also satisfactory, this study ultimately decided that dividing the students' psychological profiles into three groups was the most suitable approach for our analysis.

The mean scores of the six psychological indicators for the three groups are presented in Figure 4.2. The groups were categorized as follows: the Positive Group (G1, N = 96, 34.29%); the Moderate Group (G2, N =111, 39.64%), and the Ambivalent Group (G3, N = 73, 26.07%). The positive group demonstrated high self-efficacy and positive emotions, with high levels of enjoyment and low levels of boredom and anxiety. The moderate group showed moderate levels of self-efficacy and emotional stability across all measures. The ambivalent group exhibited high levels of self-efficacy but experienced emotional ambivalence characterized by high enjoyment but also high levels of boredom and anxiety.

Table 4.1 Comparison of the study participants' online reading psychological profiles

Model	LL	df	AIC	BIC	aBIC	Entropy	LMRT *p*-value	BLRT *p*-value	Number of participants
1class	-2371.020	12	4766.041	4809.658	4771.607	-	-	-	-
2class	-2215.521	19	4469.042	4538.103	4477.855	.790	0.0518	0.0000	86/194
3class	**-2112.999**	**26**	**4277.999**	**4372.503**	**4290.059**	**.836**	**0.0729**	**0.0000**	**96/111/73**
4class	-2030.932	33	4127.864	4247.812	4143.171	.896	0.0254	0.0000	78/135/14/52

Note. LL=Log likelihood; AIC = Akaike information criterion; BIC = Bayesian information criterion; ABIC = sample size adjusted BIC; LMRT = Lo-Mendell-Rubin likelihood ratio test; BLRT = bootstrap likelihood ratio test.

Note. SE_TR=self-efficacy in traditional reading, SE_MS=self-efficacy in multiple source use, SE_ICT=self-efficacy in ICT skills, EN=enjoyment, BO=boredom, AN=Anxiety

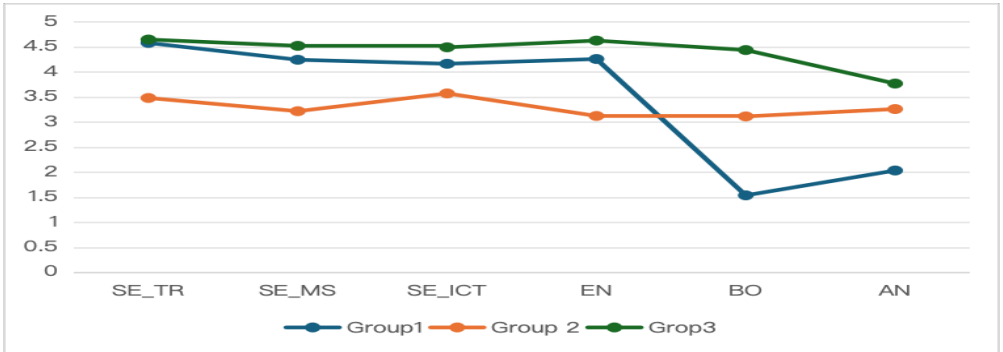


Figure 4.2 Estimated means of the six indicators of the three-group solution

4.2 Interview Responses

The objectives of the qualitative content analysis were to identify:

(1) the characteristics of students' self-efficacy and emotions within each group, thus triangulating the quantitative findings, and

(2) the factors influencing the formation of different psychological default stance profiles.

To address these objectives, the semi-group interviews consisted of two parts: general questions, and targeted questions based on the LPA results. Concerning the general questions, participants were asked to describe their perceptions and experiences related to the measured psychological variables and to provide explanations for their responses. For instance, one question was, "你對自己的紙本閱讀能力有信心嗎？ 為什麼？可以舉例描述一下嗎？Are you confident in your ability to read on paper? Why or why not? Can you give an example to describe it?" The targeted questions were tailored on the basis of the group differences, with variations in how they were asked for each group. For example, additional probing questions were used to explore the contradictory emotions exhibited by students in the ambivalent group (G3). One such question was, "為什麼你們既享受線上閱讀又覺得它無聊呢？ Why do you find online reading enjoyable yet boring at the same time?"

Regarding the coding process, the procedures for structural analysis (Schreier, 2014) begin with open coding to develop a coding scheme for the entire interview protocol. Nevertheless, scholars also emphasize the important role of a deductive approach during the open coding phase, as it may help guide the initial categorization of the data on the basis of prior theoretical frameworks or research questions (Selvi, 2019). Thus, during the study's open coding process, particular attention was given to the sources of self-efficacy and emotions identified in previous studies. Specifically, when coding

responses related to self-efficacy, the sources proposed by Bandura (1977)—namely, mastery experience, vicarious experience, and verbal and social persuasion—were a key focus. Regarding the sources of emotions, after reviewing the literature, no suitable framework was found for reference. Therefore, in this study, the sources of emotions were identified entirely through an inductive approach.

4.2.1 Understanding variations in self-efficacy

According to the LPA results, the positive group (G1) and the ambivalent group (G3) presented with high-level self-efficacy, while the moderate group (G2) showed comparatively average levels of self-efficacy. The following section presents each self-efficacy construct's qualitative content analysis results, considering their task-dependent characteristics.

Self-efficacy in traditional reading (TR)

The coding scheme presented in this study categorized and defined different aspects of students' self-perceived mastery experiences and social persuasions related to traditional reading (TR) self-efficacy (see Table 4.2). Mastery experiences, as defined by Bandura (1997), referred to individuals' interpretations and reflections on their past achievements, which tend to serve as the most influential source of information for forming self-efficacy judgments. In the context of traditional reading self-efficacy, the coding scheme therefore identified four distinct categories of self-perceived mastery experiences: Perceived Past Performance, Familiarities of Paper-based Reading, Strategy Use, and Comparison with Online Reading.

(1) Perceived Past Performance captured the students' evaluations of their previous reading performance. The examples provided demonstrate the students' confidence in their overall Chinese language or particular in reading abilities, such as consistently being the top performer in their grade or having fairly good reading

scores. This category highlighted the importance of the students' subjective assessments of their past successes or failures in shaping their self-efficacy beliefs.

(2) Familiarities of Reading referred to the students' sense of familiarity and comfort with paper-based reading tasks. The examples illustrate the students' experience with reading lengthy texts and engaging in extra practice exercises, which contributed to their familiarity with traditional reading formats. This category suggested that increased exposure and practice with paper-based reading can enhance students' self-efficacy in this domain.

(3) Strategy Use captured the students' attributions of their reading proficiency to their ability to apply strategies during the reading process. This category captured the students' beliefs that their success in reading was due to their knowledge and application of specific reading strategies, such as identifying key information and using techniques to improve their comprehension and reading speed. The coding of this category highlighted the role of internal and controllable attributions in shaping students' self-efficacy beliefs, as students perceived their strategic abilities to be a crucial factor in their reading performance.

(4) Comparison with Online Reading involved the students comparing their experiences and confidence levels between traditional and online reading formats. The example provided shows a student expressing greater confidence in paper-based reading due to his or her slow typing speed and greater control over handwriting. This category underscored the importance of the students' comparative perceptions of different reading modalities when examining their own self-efficacy beliefs.

Social persuasion refers to the support or encouragement one receives from others (Bandura, 1997). In this study, only support from others was identified. This category reflected the students' belief that their confidence in reading was strengthened by the

assistance and guidance they received from teachers and parents when they faced difficulties in understanding or solving reading problems. It underscores the role of external support in shaping students' self-efficacy, as they feel more capable of handling challenging reading tasks knowing that they can rely on assistance from knowledgeable people in their learning environment.

To facilitate a comparison and exploration of the characteristics across the three groups, the coding results for each group have been summarized in Table 4.3, highlighting both the differences and commonalities in the same sources of self-efficacy.

Table 4.2 Coding scheme for the sources of the students' self-efficacy in traditional reading

Source	Category	Definition	Examples
Mastery Experiences	Perceived Past Performance	Evaluation of their past reading performance	-我的中文成績一直是年級第一。My Chinese has always been the best in my grade.
	Familiarity with Paper-based Reading	Sense of familiarity with paper-based reading tasks	-我閱讀速度很快…我平時看得書都比考試長很多。 I read very fast …and the books I usually read are much longer than the ones used for exams. -我每天都要做課外練習題，我很熟悉這些（紙本閱讀題目） I have to do extra practice exercises every day, so I am very familiar with them (the paper-based reading task).
	Use of Strategies	Attributions of their reading proficiency to their ability to apply strategies during the reading process	-我覺得我閱讀能力好的一個原因是因為我會一些閱讀策略。I think one reason I'm good at reading is that I know how to use some reading strategies. -我會找關鍵詞，關鍵句能提升，所以我閱讀速度還不錯。I look for keywords and key sentences to improve, so my reading speed is pretty good.
	Comparison with Online Reading	Comparison between their experiences with traditional and online reading	-我打字很慢，所以我對在紙本上閱讀更有信心，因為手寫是我能掌控的。 I type very slowly, so I feel more confident with paper-based reading because handwriting is something I can control.
Social Persuasion	Support from Others	Confidence enhanced by assistance from teachers and parents when facing difficulties	我不太擔心我的閱讀能力，因為即使我不會，我媽媽也會幫我講解。I'm not too worried about my reading ability, because even if I don't understand something, my mom will explain it to me.

The self-efficacy in traditional reading among students in the positive group (G1) and the moderate group (G2) primarily originated from their mastery experiences. Students in G1 confidently reported consistently achieving excellent reading performance in previous school tests, with statements such as “My Chinese has always been the best in my grade” and “I always get very high scores.” In comparison, students in G2 exhibited confidence but with more modesty, typically stating, “My reading scores are fairly good.” Interestingly, although the ambivalent group (G3) also demonstrated high self-efficacy in traditional reading, none of the students cited their past academic performance as a basis for their confidence when discussing why they felt assured about their paper-based reading abilities.

Furthermore, interviewees from all three groups attributed their confidence in traditional reading to their extensive practicing both in school and at home, which had led to a strong familiarity with different question types in examinations. It is particularly noteworthy that students in the G1 further mentioned engaging in regular extracurricular reading across various genres. The combination of substantial reading and ample practicing had allowed them to develop a clear sense of their own ability to answer questions “quickly and efficiently.” For example, student #3 in G1 mentioned “In addition to the extensive practice on exams, I regularly read different books, so I gradually developed the habit of reading faster... Actually, the books I usually read are much longer than the reading passages in exams.”

Another mastery experience that significantly influenced the students’ self-efficacy in traditional reading was their application of reading strategies. Interviewees in both G1 and G2 provided examples of specific reading strategies they employed, but with a notable difference in focus. Students in G1 concentrated on strategies that directly supported the comprehension process, such as “extracting keywords from questions to locate relevant information,” “identifying topic sentences,” and consciously “reading the text in stages and layers.” In contrast, G2 students emphasized test-taking strategies

that were particularly useful in examination settings, such as reading the questions before the passage and allocating time for each question based on its assigned score. However, students in G3 did not mention any specific strategies and instead exhibited a sense of blind confidence. Some students in this group made statements such as, “I don’t even know why, but I just know I can answer correctly.”

In addition, interviewees in G2 further clearly expressed a partial lack of confidence in typing when completing online reading assessments and emphasized their preference for handwriting, as it provided them with a greater sense of control. For example, student #5 in G2 stated, “When I write by hand, I have a sense of confidence in myself … because I can look back at what I’ve written…. I can clearly see my own handwriting and any revisions I’ve made. However, typing on a computer can sometimes be unresponsive and time-consuming.”

Moreover, it is worth noting that only the G3 students attributed their traditional reading confidence to social support (social persuasion). They made statements such as, “If I can't understand, my mom will help me” or “Our teacher always gives us guidance and teaches us how to read effectively.”

Table 4.3 Comparison results for sources of the students’ self-efficacy in traditional reading across groups

Source	Category	Positive Group (G1)	Moderate Group (G2)	Ambivalent Group (G3)
	Past Performance	Excellent performance	Good performance	/
Mastery Experiences	Familiarity with Paper-based Reading	1. Ample in-class and extracurricular practice, familiarity with question types 2. High frequency and variety of extracurricular reading	Ample in-class and extracurricular practice, familiarity with question types	Ample in-class and extracurricular practice, familiarity with question types

	Use of Strategies	1.Extracting keywords from questions to help locate information 2. Finding topic sentences 3. Reading in stages and layers	1. Reading questions before passages 2. Allocating answering time based on question scores	/
	Comparison with Online Reading	/	Handwriting is more convenient than typing	/
Social Persuasion	Support from Others	/	/	Teacher/Parents provide guidance

Self-efficacy in multiple source use

Table 4.4 presents the coding scheme for the sources of self-efficacy in using multiple sources. The scheme included two main sources: mastery experiences and social persuasion. For mastery experiences, there were two categories: Reading Experience and Efficacy Transfer. The coding for Reading Experience focused on the students' actual engagement and experiences in multiple source reading activities, such as understanding multimodal information, evaluating the reliability of online information, and comparing information from different sources. These codes directly reflected the students' mastery experiences in using multiple sources, thus providing important insights into their self-efficacy. In addition, Efficacy Transfer focused on how the students applied their self-efficacy from other areas to the use of multiple sources. These other areas could include paper-based reading of single texts or other subjects. By analyzing how students' self-efficacy in these areas impacted their confidence in using multiple sources, the coding scheme revealed the mechanism of efficacy transfer. For instance, some students stated, "I don't think there's much difference between reading multiple texts and a single text; it's all about understanding the content," indicating that their self-efficacy in single-text reading transferred to multiple-source reading. In terms of social persuasion, the category of Feedback from Others was identified. The emphasis there was on the feedback the students received from

significant others, such as teachers and parents, regarding their ability to use multiple sources. This feedback could pertain to their performance in finding information or determining the truthfulness of information. For example, a teacher's comment to a student, "It's not that you can't read, you're just not careful enough, especially with detail-oriented tasks like finding information," highlighted how external feedback influenced the students' self-efficacy.

Following this coding scheme, Table 4.5 provides a summary of the results across the three groups.

Table 4.4 Coding scheme for the sources of the students' self-efficacy in multiple source use

Source	Category	Definition	Examples
Mastery Experiences	Reading Experience	Students' engagement in reading activities that involved interacting with and integrating information from multiple sources.	-我覺得這方面能力不錯，因為圖片能幫助我理解。I think I'm pretty good at this because images help me understand. -我其實不太有信心其實，我不知道網路上的信息是真還是假，很難辨別。I'm not very confident, actually, I can't tell if the information online is true or false; it's hard to verify. -我覺得處理多來源信息不難，我經常在網絡上尋找信息。I don't find handling multiple sources difficult. I often search for information online.
	Efficacy Transfer	Judgment in applying the students' self-efficacy from other areas (e.g., single-text paper-based reading or other subjects) to their confidence in using multiple sources.	-我覺得多篇章閱讀和單篇章閱讀沒什麼區別，都是理解文本。I don't think there's much difference between reading multiple texts and a single text; it's all about understanding the content. -没什麼特別的……我覺得处理来自多个来源的信息就像解决数学问题一样。 Nothing special…Dealing with information from multiple sources is just like solving math problems.
Social Persuasion	Feedback from Others	Feedback related to the students' ability to process information from multiple sources.	老師說我並不是不會閱讀，我只是不夠仔細，特別是尋找信息這種細節題。My teacher said it's not that I can't do the reading, I'm just not careful enough, especially with detail-oriented tasks like finding information.

Students' self-efficacy in managing multiple sources, even when positive, may be slightly lower than their self-efficacy in traditional reading. Table 4.5 illustrates that the students in G1 attributed their confidence in managing multiple sources to their regular online information searches. Student #6 in G1 mentioned, "I often search for information online, such as helping my mother plan a trip to Japan... or reading novels," and student #1 added, "I do the same (planning to go to Japan), and I tend to filter useful information …. I particularly enjoy finding good restaurants by reading various reviews and recommendations." In contrast, students in G3 credited their high self-efficacy in multiple sources to the scaffolding provided by multimodal elements in comprehension. Students 2, 4, 5, and 7 in G3 all noted that if they did not understand the text during the exam, the accompanying illustrations could help them grasp the meaning. s2 elaborated on this point, saying, "For instance, when answering a question about the process of global warming, the text contained too many complex details for me to comprehend. However, I could roughly understand the concept because there was a corresponding picture next to it."

In addition to their reading experience, interviewees in G1 and G3 also mentioned their efficacy transfer. The G1 students viewed single-text reading as the foundation for their multitext reading. Despite some differences, they believed they could handle multiple-source reading materials. In addition, they likened multiple-source use skills to those in their subject areas. For example, student #4 in G1 drew an analogy to mathematics, stating, "Dealing with information from multiple sources is just like solving math problems. It's very logical; you put similar things together, and for different things, you find patterns through analogies." However, G3 students simply believed that reading multiple sources was not significantly different from traditional single-text reading.

In contrast to the highly positive G1 and G3 groups, the students in G2, who reported the lowest self-efficacy in this dimension, provided relatively negative descriptions of multiple source use. They mentioned issues such as "lack of practice," feeling

"uncertainty caused by unreliable information online," finding it "difficult to review multiple articles," and expressing concerns about "too much information, diverse expression methods, and difficult to integrate." For example, student #3 in G2 complained,

> "During online reading tests, there are many questions involving information integration. Each one takes a lot of time, and I have to review different passages. I often can't find the information … so sometimes I feel overwhelmed... And I rarely practice (this type of reading)."

Moreover, the self-efficacy in this group was influenced by critical social persuasion from their teachers or parents. Student #9 in G2 said, "I am not a careful person, so I easily overlook or misread information, which makes me feel that my ability to handle information from multiple sources might not be good enough." Students 7 and 8 in this group also echoed this viewpoint. When the researcher asked why they thought they were not careful, they responded, "My mother often criticizes me for being very careless, and I think she's right," or "The teacher says that it's not that I don't understand, but that I'm not very attentive."

Table 4.5 Comparison results for sources of the students' self-efficacy in MSU across groups

Source	Category	Positive Group (G1)	Moderate Group (G2)	Ambivalent Group (G3)
Mastery Experiences	Reading experience	Often search for information online	1. Lack of practice 2. Uncertainty caused by unreliable information 3. Difficulty reviewing multiple articles 4. Too much information, diverse expression methods, difficulty integrating	Multiple modalities of information aid understanding
	Efficacy transfer	1. Based on ability in traditional paper-based reading 2. Drawing parallels to other subjects (e.g., math)	/	Not much different from paper-based reading
Social Persuasion	Feedback from Others	/	Careless (often misread or overlook information)	/

Self-efficacy in ICT skills

Table 4.6 presents the coding scheme for the sources of the students' self-efficacy in ICT skills. Under mastery experiences, there were three categories: Daily Usage, School Training, and Evaluation Performance. Daily Usage referred to the students' everyday experiences with digital platforms, such as using computers to complete assignments, search for information, or find entertainment. School Training referred to the information technology courses provided by the school, in which the students were taught how to use computers, including tasks such as typing, creating documents, and conducting online searches. Evaluation Performance referred to how the students interpreted their scores from school assessments of computer skills, such as achieving high marks in computer exams. In terms of social persuasion, only one category was identified: Support from Others. This referred to the help or encouragement the students received from teachers or parents in developing their computer skills, such as a mother teaching her child how to type faster. Following this coding scheme, Table 4.7 provides a summary of the results across the three groups.

Table 4.6 Coding scheme for sources of the students' self-efficacy in ICT skills

Source	Category	Definition	Examples
Mastery Experiences	Daily Usage	Students' routine experiences of using digital platforms	-我覺得我們的生活離不開電腦，做作業，查資料，玩遊戲都要用到電腦，所以使用電腦對我來說很容易，我每天都要用。 I feel like we can't live without computers. We need them for doing homework, searching for information, and playing games. So, using a computer is easy for me since I use it every day.
	School Training	Information technology courses provided by the school, teaching the students how to use computers	-打字, 創立文檔，上網查資料這些都是很簡單的操作呀，學校的計算機課都教過。Typing, creating documents, and searching for information online are all very simple tasks. We've learned them all in school computer classes.
	Evaluation Performance	Interpretation of in-school computer skills assessment scores	-我每次計算機考試的成績都很好。My scores in every computer skills exam are always very good.
Social Persuasion	Support from Others	Assistance or encouragement the students received from their teachers or parents in developing their computer skills	-我妈妈是文员，她能教我如何更快地打字。My mother works as a clerk, and she can teach me how to type faster.

Concerning self-efficacy in ICT skills, students from all three groups believed that their positive self-efficacy stemmed from their daily use of digital devices (e.g., iPad, tablet, laptop). Notably, their usage showed different purposes. The students in the positive group (G1) said they usually used computers to search for information, and the moderate group students (G2) mainly mentioned using computers for study purposes, such as compiling incorrectly answered questions into an error set using Word. However, the G3 students emphasized their high passion for entertainment, such as playing games and watching videos. Nevertheless, although the students' actual behaviors for using electronic devices were not limited to these activities, all interviewees believed that using electronic devices had indeed become an integral and indispensable part of their daily lives.

Moreover, primary schools in Hong Kong place emphasis on computer literacy. Schools typically offer computer courses, and nearly all interviewees reported that their computer teachers instructed them on how to use computers, including creating documents in Word, typing characters, searching for information, and other related skills. Schools also conduct corresponding assessments. The students' frequent daily use of computers, combined with the schools' relatively lenient assessment standards for computer literacy, contributed to the fact that nearly all of the students reported achieving perfect or near-perfect scores in their computer school assessments. As a result, these students exhibited a high degree of confidence in their capacity to effectively utilize computers. Notably, students in G1 uniquely mentioned that they could obtain support from their parents. For example, student #7 in G1 said, "My mother works as a clerk, and she teaches me how to type faster," and student #2 mentioned, "If I can't find information or don't know how to use a particular software, I ask my father…as he is very knowledgeable about computers."

Table 4.7 Comparison results for the students' self-efficacy in ICT skills, across groups

	Source	Positive Group (G1)	Moderate Group (G2)	Ambivalent Group (G3)
Mastery Experience	Daily usage	Searched for information online	Developed error sets in Word	Used for entertainment
	School Training	Learned basic computer skills	Learned basic computer skills	Learned basic computer skills
	Evaluation Performance	Good performance	Good performance	Good performance
Social Persuasion	Support from Others	Parental teaching	/	/

4.2.2 Understanding variations in emotions

Enjoyment and boredom

By coding the interview data from the students, this study identified the key factors influencing students' enjoyment and boredom during online reading. These two emotions were considered together because, during the open coding process, we found that they were relatively opposing variables. Generally, students who enjoyed online reading did not find it boring (except the students in Group 3). Therefore, in the formal coding process, we combined the sources of these two variables.

The results showed that enjoyment and boredom were influenced primarily by the students' Reading Experience and their views on the reading material's Multimodal Elements, Comparison with Paper Reading, and Genre and Theme. These factors stemmed directly from the characteristics of the online reading materials and reflected the students' subjective feelings toward the content and format of the reading. Specifically, Reading Experience referred to the students' overall experience with online reading, which was a key factor influencing their enjoyment or boredom. Multimodal Elements captured the students' views on the multimodal components of online reading materials. These comments highlighted the role of elements such as

images, audio, and video in shaping the students' emotions. Comparison with Paper Reading involved the students comparing online reading with traditional paper reading and revealed how the differences between online and paper reading, beyond multimodal features, affected the students' emotional experiences. Genre and Theme referred to students' opinions on the type and topic of the reading materials, which reflected how the content of the materials influenced the students' enjoyment and boredom.

Moreover, Family Factors and Reading Scenarios were two additional contributors to influencing the students' reading enjoyment/boredom. These factors reflected the external environment and context in which students engaged in online reading. Specifically, the category of Family Factors coded statements in which the students mentioned how their family environment and parental attitudes impacted their emotions during online reading. Reading Scenarios captured the students' descriptions of how their emotional responses varied depending on the reading context.

Table 4.8 Coding scheme for the sources of the students' emotions of enjoyment and boredom

Category	Definition	Examples
Reading Experience	The overall experience and feelings of the students during online reading that directly affected the extent of their enjoyment or boredom	-我挺喜歡線上閱讀的，其實我就是喜歡閱讀這件事本身，也不是說就特別喜歡線上閱讀，只要是閱讀我都享受。I quite like online reading, but honestly, it's more that I enjoy reading itself. It's not that I have a particular preference for online reading—it's just that I enjoy reading in any form.
Multimodal Elements	Multimedia elements in online reading platforms, such as images, audio, and video, influenced the students' emotions	-我享受線上閱讀的原因之一是我覺得線上閱讀有很多圖，（比純文本）更加生動有趣。One reason I enjoy online reading is that I feel it has more images, which makes it more vivid and interesting compared to plain text. -…沒什麼特別，日常中可以看見很多圖片，所以並不是特別吸引。…nothing special... I can see many pictures in daily life, so it's not very appealing.
Comparison with Paper Reading	Comparisons between online reading and paper reading, and the different characteristics that affected the students' emotional experience	--我還是更喜歡紙本閱讀，線上閱讀沒那麼吸引我，我覺得讀紙質書更有感覺。I still prefer reading on paper. Online reading doesn't attract me as much; I feel more connected when reading physical books.

Genre and Theme	The type and theme of online reading materials that directly affected the students' enjoyment and boredom	--線上閱讀挺無聊的，說明文沒有記敘文有意思，我更喜歡看故事性的內容。Online reading is boring. Expository texts aren't as interesting as narrative ones; I prefer reading content with more of a story.
Family Factors	Family environment and parental attitudes/behaviors that influenced the students' emotional responses to online reading	- 我沒那麼享受線上閱讀，因為我爸爸媽媽覺得看電腦太久了對眼睛不好。I don't enjoy online reading that much because my parents think looking at the computer for too long is bad for my eyes.
Reading Scenarios	Different reading scenarios and purposes that led to different emotional responses	-如果是在學校做線上閱讀我還挺享受的，因為不用寫作業。但是如果是在家裡，我就覺得沒那麼有意思，因為我可以做很多其他事情。If I do online reading at school, I enjoy it because I don't have to do homework, but if I do it at home, I don't find it that interesting because I can do so many other things.

The comparison results for the sources of enjoyment/boredom across the three groups are presented in Table 4.9. According to the LPA results, the students in G1 presented high enjoyment and low boredom. They primarily emphasized that they greatly enjoyed reading, regardless of the form, and considered reading to be something at which they excelled. In contrast, the other two groups did not express their love for reading as clearly as the positive group did. The researchers further inquired about whether multimodal elements would affect the students' emotions during online reading. The students in G1 indicated that they enjoyed online reading because multimodal elements (pictures, animations, etc.) made the text very vivid and helped them understand the content. For example, student #2 said, "I find the pictures in online reading interesting and vivid...they help me understand (the text) and make it easier for me to locate information." Other students in G1 expressed similar sentiments, with Students 3 and 7 even mentioning that the pictures helped enhance their "creativity." In contrast, students in the moderate group did not have the same level of fondness for multimodality. Those students acknowledged that multimodal elements offered additional information and made the experience somewhat more engaging compared with text-only formats, but they emphasized that for them, the fundamental difference between multimodal reading and text-only reading was not substantial, and the overall appeal of multimodal reading remained limited. As student #4 in G2 mentioned, "It is indeed a bit more interesting, but nothing special... I can see many pictures in daily life, so it's not very appealing." With the ambivalent group, their initial attitude was similar to that of the positive group—believing that they enjoyed multimodal reading because the pictures made the text more vivid and helped them understand. However, when the researchers further inquired about why they simultaneously found it boring, they responded that they tended to become lost in the information, and once lost, they had difficulty constructing a coherent understanding. As student #9 said, "Sometimes I just read and read, and then I don't know where I've read... there's too much information...

and the pictures aren't always useful... then I don't want to read anymore, and I find it uninteresting."

Regarding the comparison of online with paper reading, both the students in G1 and those in G3 mentioned that they believed reading on a computer was more convenient because turning pages and looking up words in the dictionary was very easy. However, the students in G2 believed reading online was inconvenient as they struggled with using the Chinese typing system. For example, student #4 said, "I type very slowly, so online reading isn't very convenient for me. I prefer going to the library." Meanwhile, many students in G2 also stated that they preferred the feeling of reading paper-based books and believed that reading online cannot replace the "traditional" experience of physical books. For example, student #7 mentioned, "I still prefer reading physical books... it feels more real... more authentic."

Moreover, genre and theme were also factors influencing the students' enjoyment. The students in G1 stated that one reason they enjoyed online reading was that the online reading texts used in our tests were expository in nature, with particularly clear structures that facilitated reading. However, the students in G3 indicated that while expository texts with factual knowledge may be more practical, they still preferred narrative texts. The theme of the texts also affected the ambivalent group students' feelings. For instance, student #5 in G3 mentioned, "I'm quite concerned about global warming...so I enjoy the theme of environmental protection...but the previous practice materials were about scientists around the world, which didn't interest me as much."

Interestingly, only the students in G2 and G3 indicated that their feelings about online reading were influenced by their parents and the reading scenarios. The G2 students' lack of strong feelings toward online reading, whether positive or negative, also originated from their parents' attitudes. Many students reported that their parents "dislike [them] using electronic devices for extended periods," believing it was "harmful to [their] eyes" and may "distract [them] from doing homework." Student #8

even mentioned, “I'm … actually … quite apprehensive about using electronic devices because I often click the wrong things... My parents get very impatient and criticize me...” Furthermore, the students in G3’s conflicting emotions were influenced by the reading scenario. They expressed that they enjoyed freely engaging in online reading rather than doing so in a test environment. Furthermore, these students stated that they preferred online reading at school, as they found doing other schoolwork potentially more boring; however, at home, they had access to more appealing activities (e.g., watching video games, playing chess, etc.), thus making online reading a dull activity. As student #4 in G3 said, “Using an iPad at school is certainly better than having classes...but at home, there are other more fun activities… so, if I had to do online reading, it would be very boring.” Interestingly, when the researchers inquired about the factor of reading scenarios with the students in G1 and G2, those students did not share the same views. For example, student #6 in G1 explicitly stated, “I have always been strict with myself, whether it’s an exam or regular studying...it makes no difference to me whether I'm at school or at home.” Student #1 in G2 remarked, “I don’t have any particular feelings about it, because I didn’t find online reading very interesting or very boring to begin with...so the scenario doesn’t really matter to me.”

Table 4.9 Comparison results for the sources of the students’ reading enjoyment/boredom across three groups

Factor	Positive Group (G1)	Moderate Group (G2)	Ambivalent Group (G3)
Reading Experience	1. Enjoy reading (regardless of form) 2. Reading is something they are good at	/	/
Multimodal Elements	1. Very vivid 2. Aids understanding 3. Enhances creativity	1. Can provide richer information 2. More interesting than text-only reading, but not very attractive	1. Very vivid 2. Aids understanding 3. Easy to become lost
Comparison with Paper Reading	Convenient	1. The input method is inconvenient 2. Cannot replace	Convenient

		the old style of paper	
Genre and Theme	Expository text has a clear structure	/	1. Expository text is more practical but prefer reading narrative/story-based text 2. The topic influences the feelings
Family Factors	/	1. Parents are reluctant to let children use electronic devices excessively 2. Parents are impatient	/
Reading Scenarios	/	/	1. Time limit during exams, prefers free reading 2. More willing to do online reading at school, while at home there are other more attractive activities

Anxiety

Table 4.10 outlines the coding scheme for the sources of the students' reading anxiety. Specifically, Reading Experience examined how the students' personal online reading skills and experiences influenced their anxiety levels. During coding, particular attention was given to the factors mentioned by students, such as the amount of practice, the type of reading materials, and their familiarity with the reading content. Testing Scenarios included elements such as time pressure, lack of external support, and performance anxiety, all of which arose from the objective conditions and demands of the exam, influencing the students' emotions. The researchers focused on how the students dealt with various exam-related stressors during the coding process. The Technical Issues focused on the technical aspects of the online reading platform, such as network stability and page loading speed. The researcher gave special attention to

the technical problems reported by students, as these were seen to be potential sources of increased anxiety and frustration.

Judging from the quantitative results, the positive group (G1) reported the lowest anxiety, the moderate group reported middle-level anxiety (G2), and the ambivalent group reported the highest anxiety. Their interview protocols gave us clues about the reasons behind these findings. Table 4.11 shows the comparison coding results across the three groups.

Table 4.10 Coding scheme for the sources of the students' emotions in the form of anxiety

Category	Definition	Examples
Reading Experience	Students' mastery of skills and experience during online reading	-我做了很多練習題，看了很多書和報紙，所以考試中閱讀題的很多內容其實我都有些了解，因此並不會太焦慮。I've done a lot of practice questions and read many books and newspapers, so I'm somewhat familiar with much of the content in reading exams. As a result, I don't feel too anxious.
Testing Scenarios	The impacts of time pressure, lack of external support, and grade anxiety on students' emotions during testing	-我一直對自己要求比較嚴格，對待考試和平時作業我都是一個態度，所以我不太會焦慮。I've always held myself to high standards, and I approach both exams and regular assignments with the same attitude, so I don't tend to feel anxious.
Technical Issues	Comparisons between online reading and paper reading, and their different characteristics that affect the students' emotional experience	-真的很煩啊...有時候 Wi-Fi 不穩定...想查看之前的網頁，但是點了好多次都點不進去...特別不穩定。It's really annoying... sometimes the Wi-Fi is unstable… I want to review the previous webpages, but I can't click on them despite trying many times... it's particularly unstable.

Concerning the testing scenarios, the students in G1 dismissed the influence of the exam setting and even expressed their preference for the online reading test environment. They appreciated not having to write by hand, as typing allowed them to save time, which in turn provided them with more adequate time to review and refine their answers. For instance, student #5 in G1 remarked, "I don't believe there's a significant impact... because even during regular practice exercises, I also impose time constraints on myself...not having to write by hand allows me to save considerable time for reviewing..." This sense of having sufficient time to approach the exam with ease stemmed from the extensive practicing that the G1 students routinely engaged in; furthermore, a substantial amount of reading had equipped them with a certain level of background knowledge, enabling them to tackle the subjects covered in the expository texts more adeptly. As student #5 in G1 noted, "I engage in lots of practice ... I frequently read books and newspapers, so I'm already familiar with much of the content presented in the exams."

Moreover, the students in G2 mentioned that exams were more stressful than regular practice due to their desire to achieve good grades and time limitations. For example, student #3 in G2 said, "There's nothing much to say; exams are definitely more nerve-wracking than regular practice... the scores I get during practice don't really have any impact on me, but exams are different..." Student #4 also noted, "I'm very worried about not being able to finish the questions...typing is particularly a waste of time… so I get nervous..." Moreover, G2 students noted that they would pay attention to the speed at which other students answered questions. "Once I'm much slower than others, I become anxious and worry that I won't be able to complete the questions," said student #8. Interestingly, such speed-based comparisons in the exam setting were not observed in the other two groups.

In fact, G2 and G3 interviewees further attributed their anxiety from time limitations to disorientation caused by multimodal elements and hyperspace. Student #7 in G2

described a noticeable feeling of stress that occurred when he was unable to find specific information during the assessment. He said,

> "If I can't find the information, I feel nervous... I'm afraid that I won't have enough time and that I won't do well on the exam... Even though sometimes the more nervous I get, the harder it is to find what I need, there's nothing I can do about it."

Similarly, student #7 in G3 also stated,

> "There are too many pages... I have to look at both pictures and text... I search and search but can't find what I need, which wastes a lot of time... The time for answering questions is very tight, and I worry about not being able to finish the questions..."

Furthermore, the G3 students uniquely expressed that their anxiety stemmed from not being able to obtain support from teachers and parents. As student #5 in G3 mentioned, "I'm still quite anxious because it's an exam... it's still different from regular practice. When I don't understand something during regular practice, I can ask my teacher or parents, but during exams, I'm completely on my own." In other words, disorientation led to time loss, causing G2 and G3 students to feel anxious in the time-limited testing environment.

Technical issues affected only the G2 students, who reported problems such as unstable Wi-Fi and internet crashes contributing to their anxiety. For example, student #4 in G2 said, "It's really annoying...sometimes the Wi-Fi is unstable…I want to review the previous web pages, but I can't click on them despite trying many times...it's particularly unstable." Student #7 also mentioned, "...I think the reading platform has a lot of problems... if I accidentally click the wrong thing or the computer crashes, my previous answers are lost... I have to redo everything, which is super, super time-consuming..."

Table 4.11 Comparison results for the sources of the students' anxiety across the three groups

Source	Positive Group (G1)	Moderate Group (G2)	Ambivalent Group (G3)
Testing Scenarios	1. Ample time allows for thorough checking 2. Typing saves time compared with handwriting	1. Exams are more stressful than regular practice time 2.Typing wastes time 3. Becoming lost then wastes question-answering time 4.Paying attention to classmates' pace in answering questions	1. Becoming lost wastes question-answering time 2. Being unable to obtain external support (from teachers or parents)
Reading Experience	1. Practicing frequently and being well-prepared 2. Reading regularly to have sufficient prior knowledge	/	/
Technical Issues	/	1. Unstable WIFI 2. Unexpected crashes in the answering platform	/

4.3 Combining the LPA with the Interview Responses

The LPA revealed that the participants could be categorized into three groups: positive (G1), moderate (G2), and ambivalent (G3), based on their psychological profiles of online reading self-efficacy and emotions. The most striking difference between the positive and ambivalent groups lay in negative emotions. While both G1 and G3 groups shared similar confidence in traditional reading, multiple-source use, and ICT skills, and exhibited high enjoyment in online reading, the ambivalent group also experienced higher levels of boredom and the highest anxiety of the three groups. The moderate group displayed mid-level self-efficacy beliefs and emotions across all measures.

The interviews triangulated the LPA results and elucidated how the different profiles were shaped. Overall, the online reading self-efficacy of the positive group (G1) was primarily shaped by mastery experiences. Specifically, the students' confidence in

traditional reading stemmed from extensive practice, strong past performance, and a wide range of extracurricular reading. These students also recognized the importance of strategies in reading comprehension and clearly provided examples of effective strategies. Their confidence in using multiple sources was derived from their habitual online reading practices, as well as the transfer of skills from traditional paper-based reading to digital contexts. Their high self-efficacy with ICT skills was a result not only of their regular searching for information online, which had gradually developed their computer skills, but also of their school's computer courses, which had taught them basic computer skills and earned them excellent grades. Interestingly, for the positive group, the only identified source of social persuasion was parental instructional support specifically related to ICT skills.

In terms of emotions, clearly these students genuinely enjoyed reading—their broad reading experience and proactive habit of searching for information online made reading an enjoyable activity for them. The rich multimodal elements and clear structure of the materials also prevented them from finding online reading boring. Furthermore, these students held themselves to high standards, both in practice and in exams, which enabled them to approach online reading assessments with greater ease and resulted in lower anxiety levels.

In the moderate group (G2), their self-efficacy in online reading also stemmed primarily from mastery experiences. In traditional reading, these students reported solid, although not outstanding, performance in Chinese relative to those in G1, and they participated in extensive in-class and extracurricular practicing. As had the G1 students, the G2 students acknowledged that mastering strategies enhanced their confidence, but their examples primarily emphasized test-taking strategies rather than comprehension strategies. Moreover, their self-efficacy in traditional reading stemmed from the sense of control that they felt with handwritten tasks, which they perceived as easier to manage than online reading assessments. In terms of multiple source use, the G2

students were the most keenly aware of the differences between processing information from multiple sources and that from a single text, particularly in an online environment. Their confidence level was only moderate because they felt undertrained for online reading assessments, uncertain about the reliability of online information, and overwhelmed by the volume of content, which they found difficult to read and synthesize. Frequent feedback from parents and teachers labeling them as "not careful" when completing tasks further undermined their confidence in managing multiple sources because that demands greater cognitive effort. Concerning self-efficacy in ICT skills, aside from lacking parental support, the G2 students' sources of confidence were not significantly different from those of G1 students—both groups used computers regularly for learning purposes and benefited from school instruction and positive feedback.

Regarding emotions, the G2 students exhibited a "go-with-the-flow" attitude. On one hand, the everyday presence of visual information left these students only moderately drawn to multimodal elements, and they preferred the tangible experience of reading physical books. Moreover, their parents' reluctance about their children's use of electronic devices and low tolerance of the children's trial-and-error approach to technology further reduced the students' enjoyment of online reading. In terms of anxiety, factors such as becoming lost during tests, being a slow typist, and encountering unstable testing systems likely made them anxious. Notably, although these students sought to perform well in exams, they adopted a mindset of "not forcing it." As a result they experienced anxiety, albeit not at a particularly elevated level.

Interestingly, the ambivalent group (G3) displayed a sense of "blind confidence" in terms of their self-efficacy. Regarding traditional reading, they did not derive confidence from past performance, nor did they mention mastering reading or test-taking strategies—they simply noted that they practiced often. In fact, their confidence was rooted in the belief that teachers and parents would assist them when they

encountered difficulties—and ironically, that reliance on external support increased their anxiety during exams because they could not rely on help in a test environment. Their blind confidence also extended to their self-efficacy in multiple-source use. The G3 students claimed that multimodal elements aided their comprehension, while at the same time they ignored the difficulties that might arise in integrating those elements. This lack of awareness was further reflected in their belief that there was little difference between reading from multiple sources and a single source. Despite having a high level of self-efficacy, the G3 students differed significantly from the other two groups in their ICT skills because they used electronic devices primarily for entertainment rather than for learning.

Regarding their emotions, multimodal reading undeniably appealed to the G3 students, and the convenience of typing responses added to their enjoyment. However, their sense of boredom also tended to be high, in response to the reading genre and subject matter. These students had a stronger preference for narrative texts, and they were less interested in the expository content often found in online reading. That said, the multimodal elements still managed to capture their attention to some extent. In addition, the G3 students' emotional responses to online reading were influenced by the reading context—if another more engaging option was available, online reading became boring. Furthermore, their high anxiety primarily arose from the exam setting. This included the pressure of limited time, the disorientation from navigating large, nonlinear information, and the helplessness of being unable to seek external support when facing difficulties.

4.4 Discussion

This chapter has employed the LPA, a person-centered method that can uncover hidden subgroups within a population (Collins & Lanza, 2010), to identify the heterogeneity in students' online reading self-efficacy and emotional experiences. This approach not

only addressed the gap in the predominantly variable-centered research on the role of self-efficacy (e.g., Louick et al., 2016; Peura et al., 2021; Prat-Sala & Redford, 2010) and emotions (e.g., Hamedi et al., 2020; Prinz-Weiß et al., 2023; Zaccoletti et al., 2020a, 2020b) in learning, but it also extended the specific research context to online multimodal reading. The multimodal and hypertext features of online reading present new challenges to students' self-efficacy beliefs and emotional experiences (Afflerbach & B. Cho, 2009). However, the existing research has focused primarily on the cognitive aspects of online reading, with limited exploration of its motivational and emotional foundations. Therefore, the results of this chapter fill that research gap by revealing the mechanisms behind the formation of different default stance profiles, offering a new perspective on understanding the diversity in students' online reading experiences.

The study categorized participants into three groups: positive (G1), moderate (G2), and ambivalent (G3), with each displaying distinct psychological traits in terms of self-efficacy and emotions. This finding diverges from the default stances proposed by the CAEM model (List & Alexander, 2019) and offers a new perspective for understanding individual differences in students' online reading experiences. According to the CAEM model, the theory classifies students into four stances—Disengaged, Affective Engagement, Evaluative, and Critical Analytic—based on their level of emotional involvement and judgments of ability. The model assumes a linear progression in these two dimensions, wherein emotional involvement and ability judgments increase progressively across the stance types (List & Alexander, 2017, 2018, 2019). However, the empirical results of this study challenge that theoretical assumption.

4.4.1 Comparison of the positive and moderate profiles

The study found that although the positive group (G1) and the moderate group (G2) exhibited different combinations of self-efficacy and emotional patterns, those differences appeared to be more a matter of degree rather than type—suggesting that

students' psychological profiles in online reading may exist on a continuum. This finding is somewhat inconsistent with the CAEM model's classification of student stances. Our interview data further clarified the mechanisms behind the formation of these different profiles.

The self-efficacy of the students in the positive group stemmed primarily from mastery experiences, which are the most powerful source of self-efficacy (Usher & Pajares, 2008). Their rich experience in traditional reading, ICT skills training, and strong performance not only in Chinese but also in other subjects enabled them to tackle online reading tasks confidently. In the interviews, it became clear that this confidence was intertwined with their positive emotions, creating a virtuous cycle. This finding aligns with studies by other scholars, who also have demonstrated a significant positive correlation between academic self-efficacy and positive emotions (e.g., Liu et al., 2018; Y. Wang et al., 2021; S. Zhu, Yao, & X. Zhu, 2024).

By using a person-centered approach, our study further extends these results to the field of online multimodal reading. The research also found that G1 students were minimally affected by the reading environment or task characteristics. They mentioned consistently holding themselves to high academic standards and maintaining a positive mindset. This aligns with previous research showing a strong link between a positive attitude and academic resilience, because an optimistic outlook helps students navigate challenges more effectively (Fallon, 2010; S. Yang & Wang, 2022). Furthermore, as one G1 student expressed it, "There's no special reason—I simply enjoy the act of reading itself." Thus, it is reasonable to infer that this consistent and positive emotion may be rooted in these students' strong sense of autonomy and intrinsic motivation. Such thinking aligns with the idea that, when individuals are driven by intrinsic interest and personal values, they tend to exhibit higher levels of engagement and are able to maintain positive emotional experiences across different contexts (Deci & Ryan, 1985;

Ryan & Deci, 2000) (specific empirical evidence and further discussion are provided in the next chapter).

Furthermore, the differences in attribution styles between G1 and G2 students warrant attention. The G1 students were more inclined to attribute their reading performance to internal, controllable factors (such as effort, strategies, and reading experiences), an attribution style that helped them to maintain their sense of self-efficacy (Han, 2021; P. H. Hsieh & Schallert, 2008). Such an approach to attribution is likely shaped by the ability to regulate emotions, which provides students with a sense of balance in their academic lives and allows them to evaluate their learning processes more objectively (Namaziandost et al., 2023). In contrast, the G2 students tended to attribute their failures to uncontrollable factors (such as unstable Wi-Fi or platform glitches), although they also acknowledged some controllable factors (such as slow typing speed). However, this attribution style may reduce their motivation to confront challenges and exert effort (Weiner, 2010) while it simultaneously lowers their anxiety, thus resulting in a more "laid-back" psychological profile. In addition, the G2 students' parents tended to hold negative attitudes toward electronic devices, which further diminished the students' interest and enjoyment in online reading. This qualitative finding aligns with X. Yang et al.'s (2024) quantitative results. In fact, parental expectations and values significantly shape children's subjective value judgments of learning tasks, which in turn affect their emotional experiences and level of engagement (Fan & Williams, 2010; Senechal & LeFevre, 2002; Q. Wang & Coddington, 2014). When students perceive a lack of parental support or sense their parents' concerns, they may find it more difficult to derive enjoyment and meaning from online reading. As one G2 student mentioned, "My parents think electronic devices are bad for my eyes, so I don't really that much enjoy reading on an iPad."

4.4.2 The ambivalent profile in online reading

In the ambivalent group (G3), on one hand the students reported high self-efficacy, indicating an optimistic view of their online reading abilities, while on the other hand they experienced more negative emotions, such as boredom and anxiety. This inconsistency between self-efficacy and emotions suggests that students' emotional experiences in online reading may be more complex and cannot be easily classified along a linear dimension (List & Alexander, 2018). In fact, the contradictory psychological profile of the ambivalent group of students may result from the interaction of multiple factors. The "blind confidence" of G3 may reflect an inaccurate self-assessment, which is common in younger children (Bjorklund et al., 2009). Their overconfidence can lead to a lack of self-regulation (Dunlosky & Rawson, 2012), causing students to feel lost in online reading tasks that require significant cognitive and metacognitive effort (Anggraini et al., 2022; M.-H. Cho & Shen, 2013; Pekrun et al., 2002) and ultimately impacting their reading performance (this is discussed in more detail in Chapter 6).

Moreover, the G3 students showed a significant reliance on external support, as reported in the interviews. It is important to note that help-seeking in learning is not a sign of dependency but rather a strategy for self-regulation and motivation (Fong et al., 2021). However, when students are unable to assess their own abilities and exhibit blind confidence, they fail to trigger the necessary self-regulatory processes (Dunlosky & Rawson, 2012) and may progress to maladaptive help-seeking behaviors. When external support was not readily available (e.g., during the test), the G3 students often felt helpless and frustrated, which led to the emergence of negative emotions. This finding echoes the view of Dueñas et al. (2021), who found that academic help-seeking behaviors were closely linked to learners' emotions, and thus it provides further specific evidence on the relationship between negative emotions and maladaptive help-seeking behaviors.

Furthermore, the G3 students' emotional experiences were influenced by the themes and genres of their reading text. This result echoes the hypothesis in Phase I of the CAEM, which posits that the themes and topics of sources influence students' default stances (List & Alexander, 2018). However, such personal preferences were only observed among the G3 students. Qualitative data showed that when faced with topics of interest or familiar genres, the G3 students demonstrated higher engagement and positive emotions, but when the reading materials exceeded their prior knowledge or background experience, they reported more negative emotions, which hindered their ability to activate self-regulation to solve the problem (Dunlosky & Rawson, 2012). This determination reflects how readers differentially allocate their resources for processing based on their expectations about the genre of a text (Zwaan, 1994). From the interviews, it was evident that the G3 students did not find searching for information online enjoyable, nor did they mention engaging in frequent reading outside of class, thus implying that they may not have had sufficient prior knowledge. Thus, this finding not only echoes Smith et al.'s (2021) contention that less-skilled readers are more influenced by background knowledge, but it also aligns with Cheng et al.'s (2023) results, which show that students with lower background knowledge are more prone to negative emotions. This discovery may also explain why preferences for themes and topics were not as apparent in the G1 and G2 students.

Chapter 5 Results and Discussion: The Effects of Goal Orientations on Psychological Profiles

This chapter addresses Research Question 2: How do students' goal orientations of online reading tasks influence their varied psychological profile stances? The theoretical basis for this chapter arose from the combination of Phases 1 and 2 of the CAEM (List & Alexander, 2017). To explore this question, two goal orientation variables (i.e., intrinsic goal orientation and extrinsic goal orientation) were included as predictors to examine how they influenced the profiles of the students' online reading default psychological stances. Then, a structured semi-group interview was examined for a deeper understanding of the group differences in two goal orientations.

5.1 LPA with Predictors: Multinomial Logistic Regression Analysis

Figure 5.1 presents the hypothesized model of LPA with predictors in this research. This method, also known as multinomial logistic regression analysis, enables an exploration of how varying degrees of goal orientation may influence students' psychological profiles. The model's central component consisted of the default psychological stance, established in Chapter 4. The predictors—intrinsic and extrinsic goal orientation—were hypothesized to affect the likelihood of an individual belonging to a specific psychological stance profile. The arrows linking the predictors to the default profiles represent this relationship, indicating that intrinsic and extrinsic goal orientations serve as explanatory factors for group membership. The hypotheses for this statistical analysis were as follows:

Null Hypotheses (H_0):

H0-1: An individual's intrinsic goal orientation cannot significantly predict his or her membership in a specific psychological stance profile.

H0-2: An individual's extrinsic goal orientation cannot significantly predict his or her membership in a specific psychological stance profile.

Alternative Hypotheses (H_1):

H1-1: An individual's intrinsic goal orientation can significantly predict his or her membership in a specific psychological stance profile.

H1-2: An individual's extrinsic goal orientation can significantly predict his or her membership in a specific psychological stance profile.

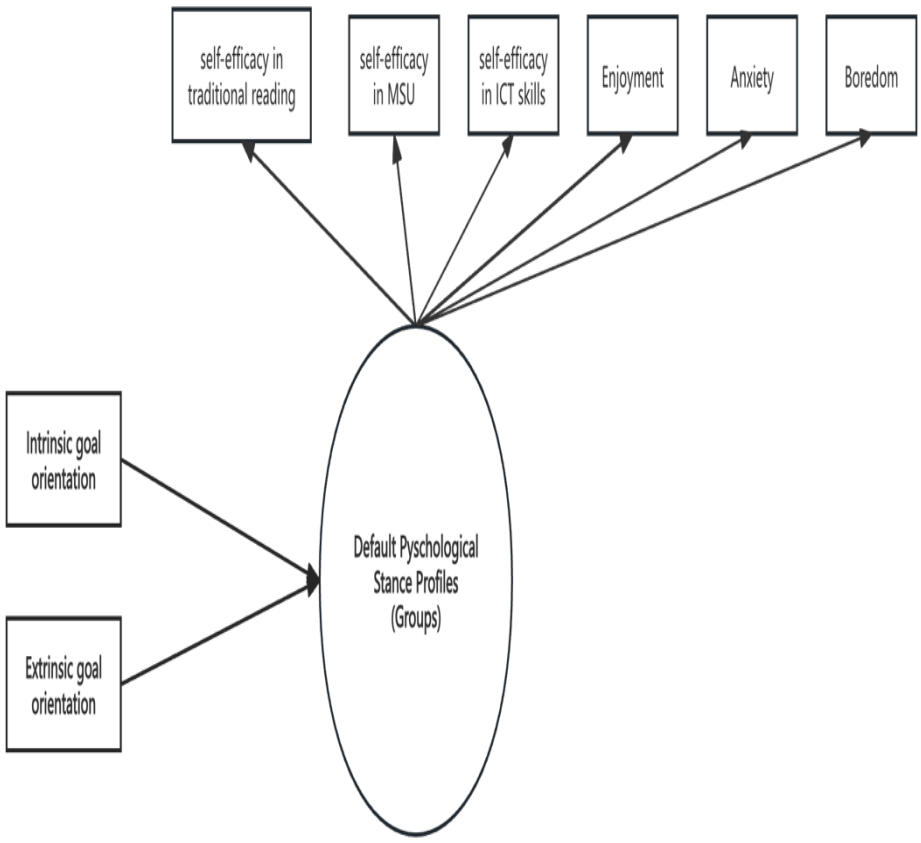


Figure 5.1 Hypothesized model for RQ 2.

Using the positive group (G1) as the reference group, the results in Table 5.1 indicate that the students' goal orientations significantly impacted their psychological profiles.

Table 5.1 The students' psychological default stance profiles, predicted by goal orientations

Predictors	Group	*β*	SE	*p*	Odds ratio
Intrinsic Goal Orientation	G2	–3.115	0.811	0.000	0.044
	G3	–0.872	0.448	0.052	-
Extrinsic Goal Orientation	G2	–3.374	0.857	0.000	0.034
	G3	0.035	0.405	0.932	-

*Using G1 as the reference group

Specifically, intrinsic goal orientation significantly affected the profiled groups. For every one-unit increase in their intrinsic goal orientation, the students were 22.73 (1/0.044) times more likely to be classified in the positive (G1) group rather than the moderate (G2) group. Similarly, although the odds ratio for the ambivalent group (G3) was not significant, the coefficient (β = –0.872) and its marginal significance (p = 0.052) suggest that higher intrinsic goal orientations may have tended to decrease the likelihood of students being classified in the ambivalent group (G3), compared with the positive group (G1).

Extrinsic goal orientation also significantly affected the group assignments between the moderate group (G2) and the positive group (G1). The odds ratio of 0.034 indicated that for each unit increase in their extrinsic goal orientation, the odds of the students being classified into the G1 were 29.41 (1/0.034) times the odds of their being classified into the G2. However, again the effect on the ambivalent group (G3) was not statistically significant (p = 0.932), indicating that extrinsic goal orientation did not have a significant impact on the likelihood of the students being classified into the ambivalent group (G3) compared with the positive group (G1). Overall, enhancing goal orientations for online reading, whether intrinsic or extrinsic, tended to foster a more positive psychological profile among students in the moderate group.

To gain more information about the differential effects of goal orientations, this study employed a Wald chi-square test for further analysis. The results, as presented in Table 5.2 and Table 5.3, reveal the lack of significant differences in both intrinsic and

extrinsic goal orientations between G1 and G3, thus explaining why goal orientations did not play a crucial role in differentiating these two groups. However, significant differences were observed between G1 and G2, with G1 students consistently exhibiting higher levels of goal orientations than G2 students did.

Table 5.2 Group differences in intrinsic goal orientations

	Mean	S.E.	G1 vs. G2	G2 vs. G3	G3 vs. G1
Class 1	4.178	0.067			
Class 2	3.215	0.083	0.936***	-0.899***	0.064
Class 3	4.114	0.133			

Table 5.3 Group differences in extrinsic goal orientations

	Mean	S.E.	G1 vs. G2	G2 vs. G3	G3 vs. G1
Class 1	4.416	0.061			
Class 2	3.292	0.088	1.124***	-0.963***	0.191
Class 3	4.255	0.118			

5.2 Interview Responses

Because this study sought to link differences in the students' goal orientations among the three groups with their psychological default stance profiles, the objectives of the qualitative content analysis were to identify:

(1) the differences in the goal orientations among the three psychological default stance profiles, and

(2) how the students' goal orientations impacted their psychological default stance profiles.

The interview framework was designed using the definitions and characteristics of the two types of goal orientation. Because achievement goal theorists usually examine the reasons underlying why students participate in, select, and engage with various learning activities (Benita et al., 2014; Meece et al., 2006), an example interview question in the

study was, “你進行線上閱讀的目的是什麼 What is your purpose for engaging in online reading?” With a specific focus on intrinsic goal orientation, this study examined attitudes toward the challenges encountered during online reading (Meece et al., 2006; Pintrich et al., 1993). The interviewer asked, for instance, “當你在線上閱讀中遇到挑戰時，你是什麼感受/態度 How do you feel or what is your attitude when you face challenges while reading online?” Regarding extrinsic goal orientation, the author focused on questions related to rewards and competition (Benita et al., 2014; Pintrich et al., 1993), such as, “如果進行線上閱讀能獲得獎勵，你們會更願意進行線上閱讀嗎 Would you be more inclined to read online if there were rewards involved?”

Given the highly targeted nature of the interview questions, this study used scholars’ definitions of intrinsic and extrinsic goal orientation (Benita et al., 2014; Meece et al., 2006; Pintrich et al., 1993) as theoretical references during the open coding process (Selvi, 2019). That coding then served as a basis for further deductive refinement and comparison. For the specific coding scheme, please refer to Table 5.4 and Table 5.5.

Table 5.4 Coding scheme for intrinsic goal orientation

Category	Definition	Example
Purpose	Focusing on developing personal abilities, mastering new skills, attempting to accomplish challenging things, and trying to understand learning materials	我喜歡在網絡上學習新知識 I enjoy learning new knowledge online.
Challenge-faced Feelings	Deriving satisfaction from the inherent qualities of the task, such as how interesting and challenging it is	如果我完成了一道很有挑戰性的題目我會覺得自己非常厲害，很開心 If I complete a very challenging problem, I feel great about myself and very happy.
Challenge-faced Solutions	Responses when faced with reading challenges reflecting their approaches to overcoming difficulties in the reading process	遇到不理解的地方我會告訴自己不要緊張，慢慢來 When I encounter something that I don’t understand, I tell myself not to worry and to take it slowly.

Table 5.5 Coding scheme for extrinsic goal orientation

Category	Definition	Example
Rewards	Deriving satisfaction from rewards or praise	如果有獎勵，我肯定會更認真 If there are rewards, of course, I will be more serious.
Comparison with Others	Focusing on demonstrating high ability relative to others, striving to be better than others, and using social comparison standards to judge ability and performance	如果我比別人優秀，我會很高興….我可以炫耀 I'm happy if I'm better than others... I can show off.
Recognition from Others	Deriving a sense of accomplishment from being recognized by others	獲得別人的讚揚是對我努力的一種認可 Receiving praise from others is a recognition of my hard work.
Gaining Good Grades	Valuing the importance of obtaining good grades as a measure of success and achievement	如果閱讀測試與我的學校表現評估有關，我會特別關注它 If this reading test is related to my school performance evaluation, I will pay special attention to it.

5.2.1 Intrinsic goal orientation

The results of the comparisons of the three groups are presented in Table 5.6. In general, nearly all participants in the study held the belief that engaging in online reading facilitates the acquisition of new knowledge. For instance, when asked about their goals for reading online, Student #5 in G1 stated, "I simply want to enhance my reading abilities...and learn new things." Likewise, student #2 in G2 expressed that "the information available online is more abundant, allowing me to understand many things I was previously unaware of." Moreover, student #9 in G3 mentioned, "Searching for

information through online reading is very convenient...and the content is quite practical, which I find to be quite helpful for me."

When urged to further investigate their attitudes toward the challenges faced during online reading, they all believed that in online multimodal reading, the most challenging point was integrating information from different web pages. That was followed by predicting the location of useful information within the nonlinear reading structure, such as "determining which hyperlink is most likely to provide certain information." However, it is worth noting that the three groups displayed different attitudes toward these challenges. The G1 students demonstrated the most positive attitudes, stating that they "enjoy challenges" and believing that "failure is the mother of success" and that challenges are a "source of achievement." For example, student #3 in G1 said,

> "If I complete a really difficult task, I feel a sense of accomplishment … I feel like I have finally solved this problem... If I can't do it, it's normal…. just find the reason, and I'll know how to do it in the future."

Interestingly, although the students in G3 also expressed that they enjoyed challenges, they believed that they rarely encountered challenges in their daily lives. As student #4 in G3 stated, "Actually, I still quite like challenges... but I feel like I don't really encounter challenges in my daily life... I think problems that can be easily solved don't count as challenges." However, students in G2 indicated that they had no particular feelings about challenges: "It's just like that... I'm laid-back (佛系)... Maybe I'll have some sense of achievement when I overcome difficulties during exams, but it's not much different from usual..." (student #1), or "I think exams and daily life are pretty much the same. There's not much sense of achievement in either... I've done so many (exercises)." (student #7).

These different attitudes toward challenges were also reflected in the students' approaches to solving challenges. Interviewees in all three groups stated that they would

adjust their reading or problem-solving strategies when encountering difficulties, such as by "adjusting the order of question-answering," "reallocating time for each question," "carefully rereading," or "expanding the scope of reading." However, many students in G1 emphasized that they would engage in positive self-talk when faced with challenges. For example, student #5 in G1 mentioned, "I think encountering challenges is a very normal thing... I will constantly tell myself that I can do it, take it slow, and not rush." However, certain students in G2 expressed that giving up on challenges is acceptable. As student #9 in G2 expressed, "If I can't do it or understand it, I'll just give up... I don't want to make myself feel too miserable..." Notably, students in G2 and G3 both indicated that if they encountered difficulties, they would seek help from teachers, parents, or peers when allowed. For instance, student #4 in G3 noted, "If I really can't do it, I'll ask my mom... Either teachers or parents are fine. They all know more than I do…… and can definitely solve (my difficulties)."

Table 5.6 Comparison of intrinsic goal orientation among the three groups

Category		Group 1	Group 2	Group 3
Purpose	Learning new knowledge			
Challenges	Feelings	1. Enjoying challenges 2. Failure is the mother of success 3. Sources of sense of achievement	No particular feelings	Enjoy challenges / Rarely encounter challenges
	Solutions	1.Adjusting strategies 2.Engaging in positive self-talk	1.Adjust strategies 2.Giving up is the norm 3. Seek external help	1.Adjust strategies 2.Seek external help

5.2.2 Extrinsic goal orientation

Regarding extrinsic goal orientation, the interviews focused on the students' perspectives on rewards, competition, recognition, and academic achievement. The

comparison results for three groups are presented in Table 5.7. Without exception, almost all interviewees acknowledged that if there were rewards, they would take reading tasks more seriously. All three groups of students believed that rewards could increase their motivation to complete online reading tasks, but rewards were not essential. Student #2 in G1 mentioned, “If there are rewards, of course, I will be more serious... But even if there aren’t, I will still do my best—after all, learning is my own responsibility.” Student #8 in G3 believed, “I will be happier and more attentive if there are rewards... But I don’t read for the sake of getting rewards, because if rewards are always required... It doesn’t feel quite right.” Notably, students in G1 also noted the importance of appropriate rewards, as the rewards considered by teachers and parents may not necessarily be what students need. Student #4 in G1 gave an example, “I remember one time the teacher rewarded our elite class by letting us play rugby, but it was actually scorching hot.” Students in G2 also had similar statements. For example, student #3 in G2 mentioned, “I think I’m not a child anymore, and there are actually very few rewards that can attract me... Stickers and snacks are too childish... I prefer rewards like being exempted from homework.”

When asked about their attitudes toward being compared with others, the students in G1 and G2 acknowledged that comparing themselves with others was a way of assessing their own ability. For instance, student #4 in G1 noted, “I think comparing with others can help me understand what level I am really at... because the exams are sometimes difficult and sometimes easy... (Comparing with others) can more objectively reflect my ability.” In addition, students in G1 exhibited highly competitive awareness. This was reflected in statements such as “I’m happy if I’m better than others... I can show off” and “If my grades are better than others, I will have a sense of satisfaction.” In contrast, some students in G2 said that they had a sense of inferiority and believed that they were not doing well enough when they were being compared with others, so they avoided deliberately making comparisons. In contrast to the students in G1 and G2, the students in G3 directly reported that they did not deliberately

compare themselves with their classmates. They felt that “it’s meaningless” or that “doing one’s best is the most important” and that “everyone is unique.”

Concerning their attitudes toward gaining recognition from others, the G1 students assigned the highest emphasis to the importance of receiving others’ recognition, because they believed that was “an affirmation of their efforts” (Students #1, #3, #4, #6, #7, #8) and “a source of their confidence and motivation” (Students #1, #2, #4, #7, #8). In comparison, the G2 students placed less value on others’ recognition. Student #5 in G2 expressed, “Although gaining recognition from others is a happy thing, I think it’s most important to have an objective judgment of oneself... After all, praise from others is often just a form of politeness.”

Moreover, when asked about issues related to achieving good grades, the G1 students reported that good grades held considerable importance. Student #1 in G1 stated, “I care a lot about my grades... especially exams related to further education... If I don’t do well, I'm doomed.” Student #6 in G1 also said, “If this reading test is related to my school performance evaluation, I will pay special attention to it.” In contrast, students in G2 believed that “although exam scores are important, learning is not just for exams” (Students #2, #4, #5, #7). Therefore, they treated exam scores with a more “even-minded attitude” (Students #2, #9) and felt that “as long as it’s not too bad, it’s okay” (Students #5, #7, #9). The students in G3 mostly believed that their “grade(s) [are] not the only path to success.” For example, student #2 in G3 said, “Actually, even if you don’t score particularly well, it doesn’t matter... There are many ways to get into a good school during the primary to junior high school transition, such as having outstanding specialties...” However, those students also did not deny that “achieving a good grade is still very helpful for oneself” (Students #1, #2, #3, #6, #7, #9), despite “it’s not [a] prerequisite” (Students #2, #4, #5).

Table 5.7 Comparison of the students' extrinsic goal orientation among the three groups

Category	Group 1	Group 2	Group 3
Rewards	1. Rewards provide more motivation 2. Appropriate rewards are important 3. Rewards are not essential	1. Rewards provide more motivation 2. Appropriate rewards are important	1. Rewards provide more motivation 2. Can't rely on rewards for learning
Comparison with Others	1. Showing off 2. Gaining a sense of satisfaction 3. Assessing one's own abilities	1. Assess one's own abilities 2. Avoid comparing, as they may have a sense of inferiority	Be your best self without comparisons
Recognition from Others	Place great importance	Relative apathy	Place great importance
Perception of Good Grades	Place great importance	1. Learning is not just for exams 2. Hope for a good grade, but won't insist on it	1. Not the only path to success 2.Helpful but not a must-have

5.2.3 Relationship between intrinsic and extrinsic goal orientations

To further understand the relationship between intrinsic and extrinsic goal orientations, the researcher inquired about which goal orientations the respondents valued more. The students in G1 and G3 clearly stated that they believed having an intrinsic drive was more important, after all, because "learning is one's own business." However, the students in G1 did not believe that intrinsic and extrinsic goal orientations were separate; on the contrary, they considered the relationship between the two as being very close. For example, student #3 in G1 mentioned,

> "If the questions are similar to the articles I usually read and the exams I take, I will learn more knowledge…. and then when I read other articles, it will be easier for me, and I will be able to achieve better grades."

Student #8 also noted, "Actually, sometimes when I read extracurricular books, I sometimes ask myself questions that might be asked in exams to see if I can answer them." Student #4 stated it more clearly,

> "Although I search for information online because I want to know some knowledge… I actually learn a lot of things while reading these materials... Sometimes the exam happens to be related to the content I have read, and I feel that it is easier for me to do the questions and achieve better grades... So, then I love to read extracurricular more."

However, the students in G3 did not provide similar explanations and instead simply repetitively emphasized "we should not [be] relying on rewards" or "grades are not the most important, but learning is the most important." Interestingly, the students in G2 clearly stated that they valued extrinsic goals more, especially the rewards they received. For example, student #7 mentioned, "I definitely care more about rewards... I have practiced so much regularly…. if there are no rewards, it's not much different from regular practice and won't feel special."

5.3 Discussion

Our quantitative results showed that the positive group (G1) exhibited the highest levels of both intrinsic and extrinsic goal orientations. Moreover, the higher the goal orientations, the more likely the students from the moderate group (G2) were to be categorized into G1. However, goal orientation did not significantly predict the psychological default stance of the ambivalent group (G3). This result aligns with the relationship between Phase 1 and Phase 2 in the CAEM (List & Alexander, 2018, 2019),

although differences remain in the case of G3. Our Qualitative results provided further explanation for this outcome.

5.3.1 Effects of the students' intrinsic goal orientations on their psychological default stances

In terms of intrinsic goal orientation, the most significant difference between the first two groups was in their attitudes toward challenges. The G1 students expressed a more positive, even "excited" attitude when facing challenges, whereas the G2 students reported feeling somewhat indifferent. The G1 students' perception of challenges as opportunities for success and sources of achievement not only enhanced their self-efficacy but also helped them better regulate their emotions. In fact, viewing challenges as opportunities for success reflected a belief in their own abilities, thus suggesting that they saw themselves as capable of overcoming obstacles. This aligns with Bandura's (1997) self-efficacy theory, which asserts that when students believe in their capacity to handle challenges, they are more likely to take action. Through repeated successful experiences, or what Bandura called "mastery experiences"—the most influential factor in shaping self-efficacy—students foster positive self-efficacy development. As one student (student #2) remarked, "I don't think challenges are something to fear. As long as I learn from each experience, if I don't succeed this time, I'll succeed next time." Such a close relationship between intrinsic goal orientation and self-efficacy also aligns with previous empirical research (Bell & Kozlowski, 2002; X. Chen & Hu, 2021; M.-H. Cho & Shen, 2013; Song et al., 2015).

Furthermore, the relationship between the students' intrinsic goal orientation and positive emotional profile observed in this study echoes prior variable-centered research (Goetz et al., 2016; Lou & Noels, 2017; Schweder, 2020). In our follow-up interviews, we also found that the G1 students' responses to challenges not only reflected their strong intrinsic goal orientation but also indicated a growth mindset

(Dweck, 2006). This mindset helps individuals maintain positive emotions in the face of difficulties, enhancing their enjoyment and reducing anxiety (Cheong et al., 2023). The G1 students explicitly mentioned that, when encountering difficulties, they not only adjusted their reading strategies but also engaged in positive self-talk, reminding themselves to "stay calm" and that "facing challenges is normal." These findings are consistent with those of Rudolph et al. (2024), who found that students with a growth mindset demonstrate greater emotional regulation self-efficacy and take a more proactive approach to managing their emotions. In comparison, the G2 students did not exhibit particularly strong reactions to challenges. While they acknowledged taking some actions when encountering difficulties, they viewed giving up on challenges as "no big deal" and were more inclined to seek external help rather than relying on their own efforts to resolve problems. In addition, they did not demonstrate an awareness of emotional regulation. Such a neutral attitude made these students more appropriately classified within the moderate group.

Notably, although the G3 students self-reported a slightly lower intrinsic goal orientation on the survey than G1 students did, the difference was not statistically significant. However, the G3 students' intrinsic goal orientation did not have a significant impact on their psychological stance, which contrasted with findings from prior research using variable-centered approaches (Dull et al., 2015; Geitz et al., 2016; Goetz et al., 2016; Lou & Noels, 2017; Schweder, 2020). On one hand, the G3 students claimed to enjoy challenges but also indicated they rarely encountered them—a seemingly contradictory response that was closely tied to their overconfidence. Their inability to accurately assess their own abilities led to a reduced capacity to identify challenges, thus reflecting the Dunning–Kruger effect (the unskilled-and-unaware problem) (Erat et al., 2022). From this perspective, the G3 students' self-efficacy did not effectively connect with their intrinsic goal orientation. On the other hand, because the G3 students lacked sufficient challenge-identification skills and had limited experience in dealing with challenges, they were likely to struggle with self-regulation

(Dunlosky & Rawson, 2012). Considering that their emotions were easily influenced by external factors, such as the topic, genre, or environment of reading, the enjoyment they derived from learning goals and challenges failed to effectively regulate their anxiety and boredom.

5.3.2 Effects of the students' extrinsic goal orientations on their psychological default stances

In line with previous variable-centered research, this study found that the students' extrinsic goal orientation also influenced some of their profiles, which were shaped by self-efficacy and emotions (Alhadabi & Karpinski, 2020; Bell & Kozlowski, 2002; Benita et al., 2014; Ford et al., 1998; Phillips & Gully, 1997). However, this study revealed that participants' extrinsic goal orientation more effectively promoted positive self-efficacy and emotions, in contrast to the weak negative association suggested by earlier research (Benita et al., 2014; Phillips & Gully, 1997). This phenomenon can be understood as extrinsic goals providing clear direction and standards, which help students with self-assessment and emotional regulation (Locke & Latham, 2005). In the context of online reading, with its more complex content than that of single-modal reading, the students found it more difficult to judge and evaluate their own learning processes and outcomes. Extrinsic goals, such as exam scores, and comparisons with others, offered the students a clear and concrete point of reference. The interview results further elucidated these findings.

There were no notable differences among the three groups regarding their attitudes toward rewards – –all groups recognized the value of rewards, particularly in terms of attention allocation—which aligns with findings from neuroscientific research (e.g., Anderson et al., 2011; Ernst & Spear, 2009). However, none of the interviewees deemed rewards indispensable, as "learning is a personal responsibility." Indeed, prior research has shown that material rewards are key factors in promoting enjoyment and

facilitating learning decisions (Hidi, 2016; Mayes et al., 2009), but they can also have adverse effects on students, such as impairing long-term memory (Kuhbandner et al., 2016) and undermining intrinsic motivation (Deci et al., 1999; Greene & Lepper, 1974; Ryan & Deci, 2000), particularly for younger students. It is evident that the study's students recognized the advantages of rewards while also maintaining a critical awareness of their potential downsides. Moreover, the G1 and G2 students demonstrated a heightened awareness of the need for rewards to be appropriate, specifically emphasizing that external rewards must align with their individual goals. This is consistent with Locke and Latham's (2005) statement that the motivational impact of rewards depends on their compatibility with goals. Overall, the mechanism by which rewards operate is complex (Hidi, 2016). The interviewees maintained a relatively objective perspective on rewards, although the G1 and G2 students were more adept at discerning which types of rewards were most suitable for them than the G3 students were.

Notably, the groups differed significantly in how they regarded reading achievement. The G1 students placed great importance on obtaining good grades and closely linked their performance to their prospects, viewing grades as the most critical factor influencing their future success. In addition, some G1 students admitted to comparing their grades with those of others, in order to boast and gain a sense of satisfaction. Undoubtedly, the G1 students aligned with the performance-approach goal orientation, which is characterized by the desire to attain favorable judgments of competence (Elliot & Church, 1997). In fact, prior research has generally considered the patterns associated with performance-oriented goals to be positive, as this goal orientation is linked, albeit modestly, to self-efficacy, positive emotions, and academic achievement (Elliot, 1999; Harackiewicz & Sansone, 2000; Senko & Dawson, 2017). Compared with previous research, this study further revealed that when individual differences were taken into account, the students with a strong performance-approach goal orientation could form a close connection between psychological profiles shaped by self-efficacy and emotions.

For the G1 students, placing high importance on exam performance and closely linking it to their future prospects reflected their confidence and high expectations regarding their academic abilities (Kaplan & Maehr, 2007). In addition, as discussed in the previous section, the G1 students' sense of self-efficacy stemmed from their consistently strong performance in Chinese, over time. When they viewed achieving high scores and outperforming others as the primary measure of their competence—and their actual performance supported this self-assessment—it reinforced their self-efficacy in Chinese reading. The sense of accomplishment and satisfaction gained from comparing themselves with others motivated these students to engage more actively in such reading tasks, thereby fostering positive emotions (Luo et al., 2011; Senko & Dawson, 2017).

In contrast, the G2 students hoped to achieve good grades but were not as fixated on them, believing that success does not rely solely on academic performance. Although these students compared their reading performance with others to assess their own level, they generally adopted an avoidance-oriented attitude toward such comparisons. In other words, the G2 students' extrinsic goal orientation is better understood through the lens of performance-avoidance goals, as described by Elliot & Church (1997). These goals are driven by a fear of failure and low confidence in one's own abilities, often associating it with a sense of helplessness and suboptimal academic performance (Alhadabi & Karpinski, 2020; P.-H. Hsieh et al., 2007; Lau & Lee, 2008b; Ranellucci et al., 2015). This suggests that in order to foster a more positive online reading psychological default stance in G2 students, it is necessary to encourage a shift from a performance-avoidance goal orientation to a performance-approach goal orientation.

Interestingly, the extrinsic goal orientation of the G3 students did not fit neatly into either the performance-approach category or the performance-avoidance category. As the G2 students had, the G3 students acknowledged that achieving good grades was helpful, but they emphasized that it was not a must-have. At the same time, the G3

students strongly believed that individuals should not be compared with others, yet they expressed a clear need for external recognition. This reflects the complexity and diversity of the goal orientation theory, as previous meta-analyses and empirical studies have demonstrated that different elements of goal orientation can combine in various ways across students and form unique patterns (Luo et al., 2011; Senko & Dawson, 2017). To be more specific, the G3 students' emphasis on grades is understandable, especially within the highly academic, performance-driven culture of East Asia (Cheng & Lam, 2013). Their ambivalent attitude toward comparison and the desire for external recognition may reflect an internal struggle between the individualized self and the relational self (S. Chen et al., 2006). On one hand, their rejection of comparison reflected the development of an individualized self, as seen in statements like "I am unique," and "Everyone has their own strengths." On the other hand, their need for recognition underscored the importance of the relational self. Such conflict illustrated the G3 students' unique interpretation of goal orientation and may explain why it did not significantly influence the G3 students' psychological default stance profile.

5.3.3 Group differences in valuing intrinsic and extrinsic goal orientations

To better understand how differences in goal orientations influenced the students' psychological default stances, we further inquired about their views on intrinsic versus extrinsic goal orientations. Whereas both the G1 and G3 students indicated that they viewed intrinsic goal orientation as more important, G1's responses more closely aligned with the theoretical framework of intrinsic goal orientation. Specifically, the G1 students focused on personal development, mastering new skills, tackling challenging tasks, and understanding learning materials (Meece et al., 2006). In contrast, the G3 students primarily reiterated that they should not rely on rewards and that life is not solely about academic achievement. Based on the interview results, therefore, this study speculates that this difference may stem from the level of autonomy that students experience during online reading.

Given the G3 students' strong emphasis on gaining recognition from others, it is reasonable to infer that these students may have been more influenced by external expectations and evaluations during their learning process, thus reflecting a heightened need for relational recognition (Ryan & Deci, 2000). Although building relationships with peers, parents, and teachers is generally linked to greater inner drives (Aunola et al., 2013; Guay et al., 2019; Jang et al., 2016; Yu et al., 2016), the self-determination theory believes that individuals need to foster autonomy and competence alongside fulfillment of their need for relatedness (Ryan & Deci, 2017). When individuals become overly concerned with external recognition they may feel that their actions are controlled by outside forces/values, which weakens their sense of autonomy (Deci & Ryan, 2000). This dynamic may in turn diminish the positive effects of relatedness on intrinsic goal orientation. Indeed, our finding aligns with this argument. The students in G3 placed excessive value on external recognition and tended to view it more as an expectation, in an effort to avoid relying on rewards or grades, rather than as a genuine pursuit of personal growth and mastery. Therefore, even though these students appeared to have a high intrinsic goal orientation (self-reported questionnaire score = 4.114), that goal orientation did not seem to foster a positive psychological default stance effectively. Instead, the students exhibited heightened levels of anxiety.

In contrast, the G1 students not only had a clear understanding of their inner needs in online reading, they were also able to effectively integrate intrinsic and extrinsic goals. For instance, they believed that "the content [they] read outside of class might appear on exams, which enhances [their] background knowledge and helps improve [their] grades. As a result, [they] are more motivated to engage in independent reading." Thus, it is reasonable to infer that when extrinsic motivation is presented in a way that supports autonomy, it can actually enhance intrinsic interest (Deci et al., 1994; Ryan & Deci, 2000, 2020), creating a positive cycle. For the G1 students, linking extracurricular reading to exam performance was not merely a case of instrumentalizing reading. Rather, they recognized the intrinsic value of reading itself and viewed it as a means to

achieve their personal goals. This form of autonomous extrinsic regulation may, in turn, have strengthened their interest in online reading. In fact, the positive effects of a close collaboration between intrinsic and extrinsic goal orientations have also been confirmed in some extant studies. For example, Dull et al. (2015) found that a combination of intrinsic and extrinsic goals, rather than a focus on one alone, led to better learning outcomes. Moreover, the qualitative results of this study specifically revealed that such combination also had a positive impact on students' confidence and emotions in online reading.

Interestingly, only the G2 group explicitly expressed a stronger preference for extrinsic goal orientation and particularly emphasized the importance of rewards. The reason may be that while the G2 students had some confidence in their online reading abilities, their intrinsic goal orientation was not strong enough to foster greater confidence and interest. For these students, external rewards may have provided them with more immediate and tangible affirmation, which could enhance their motivation to engage in learning (Ryan & Deci, 2000, 2020) and foster a more positive psychological default stance. As one student remarked, "Of course, I will be more serious when there's a reward." In addition, the G2 students experienced moderate levels of anxiety and boredom during their studies, which might have diminished their overall learning experience and outcomes (Al-Obaydi et al., 2024; Carey et al., 2017; Zaccoletti et al., 2020a). External rewards may help mitigate these negative emotions by adding a sense of positive anticipation and excitement to the reading process (Greene & Lepper, 1974; Hidi, 2016; Howard et al., 2021). Moreover, the interviews revealed a laid-back attitude among G2 students, often expressed as "If it's too hard, I'll just give up." This attitude likely stemmed from a relaxed approach to learning outcomes and lower personal expectations. In that context, external rewards offer a clear, attainable target that can reignite their motivation to strive for success (Locke & Latham, 2005).

However, it is important to recognize the potential drawbacks of overrelying on external rewards (Ryan & Deci, 2020). An excessive focus on rewards can undermine one's intrinsic goal orientation (Deci et al., 1999; Greene & Lepper, 1974; Ryan & Deci, 2000), in our case shifting students' attention away from the inherent value of learning and toward the rewards themselves—which may ultimately hinder their long-term learning outcomes (Kuhbandner et al., 2016). Therefore, when providing rewards, it is essential to be mindful of these potential negative effects and to adopt measures to mitigate them. For example, rewards can be integrated with students' autonomy, competence, and sense of belonging (Howard et al., 2021; Ryan & Deci, 2017, 2020). Furthermore, diversifying the types of rewards and avoiding an overemphasis on singular metrics, such as grades, can be a feasible approach. Creating a collaborative learning environment rather than a competitive one can also support more positive outcomes (Ryan & Deci, 2020). In other words, although rewards can be an effective motivator for G2 students, they should be used carefully and thoughtfully to avoid undermining the students' intrinsic learning goals.

Chapter 6 Results and Discussion: Individual Differences in Online Reading Strategies and Performance

This chapter addresses Research Questions 3 and 4: What are the differences in students' online reading strategy use and their performance, in students with varying psychological profiles (RQ3)? Also, how do different psychological profiles moderate the relationship between students' online reading strategies and their reading performance (RQ4)? The theoretical foundation for these two research questions was based on Phases 2 and 3 of the CAEM model (List & Alexander, 2017).

Concerning RQ 3, the various types of online reading strategies and student online reading performance were treated as outcome variables to investigate potential

differences among students coming from diverse groups of default psychological stances. Thus, the Wald chi-square test was employed. To provide additional insights into the individual differences in online reading strategies, data extracted from backend data, including the duration that students spent on online reading and the number of times that students clicked on multimodal elements (i.e., dictionary button, hyperlinks, images), were also analyzed by this method. The hypothesized model can be seen in Figure 6.1. The specific research hypotheses were as follows.

Null Hypotheses (H_0):

H0-1: There are no significant differences among the three groups of students (positive, moderate, ambivalent) in terms of their use of online reading strategies.

H0-2: There are no significant differences among the three groups of students in terms of their online reading performance.

H0-3: There are no significant differences among the three groups of students in terms of their online reading duration (backend data).

H0-4: There are no significant differences among the three groups of students in terms of their number of clicks on multimodal elements (backend data).

Alternative Hypotheses (H_1):

H1-1: There are significant differences among the three groups of students in terms of their use of online reading strategies.

H1-2: There are significant differences among the three groups of students in terms of their online reading performance.

H1-3: There are significant differences among three groups of students in terms of their online reading duration (backend data).

H1-4: There are significant differences among three groups of students in terms of their number of clicks on multimodal elements (backend data).

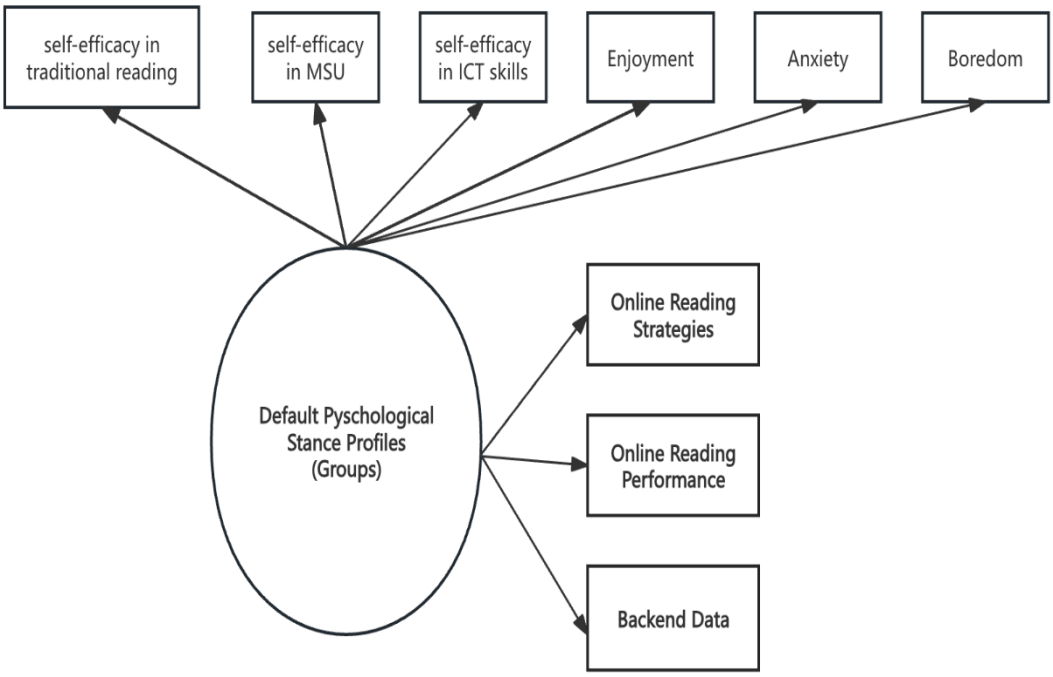


Figure 6.1 Hypothesized model for RQ 3

Regarding RQ 4, mixture path analyses were conducted. The online reading strategies—metacognitive, behavioral, and procedural—were analyzed at the domain level, with strategies from each domain being examined separately. Group differences were also considered in the analysis. Figure 6.2 demonstrates a theoretical model using the metacognitive domain as an example, and the research hypotheses are presented below.

Null Hypotheses (H_0):

H0-1: There are no significant differences among the three groups of students (positive, moderate, ambivalent) in their path from Evaluation to Online Reading Performance.

H0-2: There are no significant differences among the three groups of students in their path from Purposeful Thinking to Online Reading Performance.

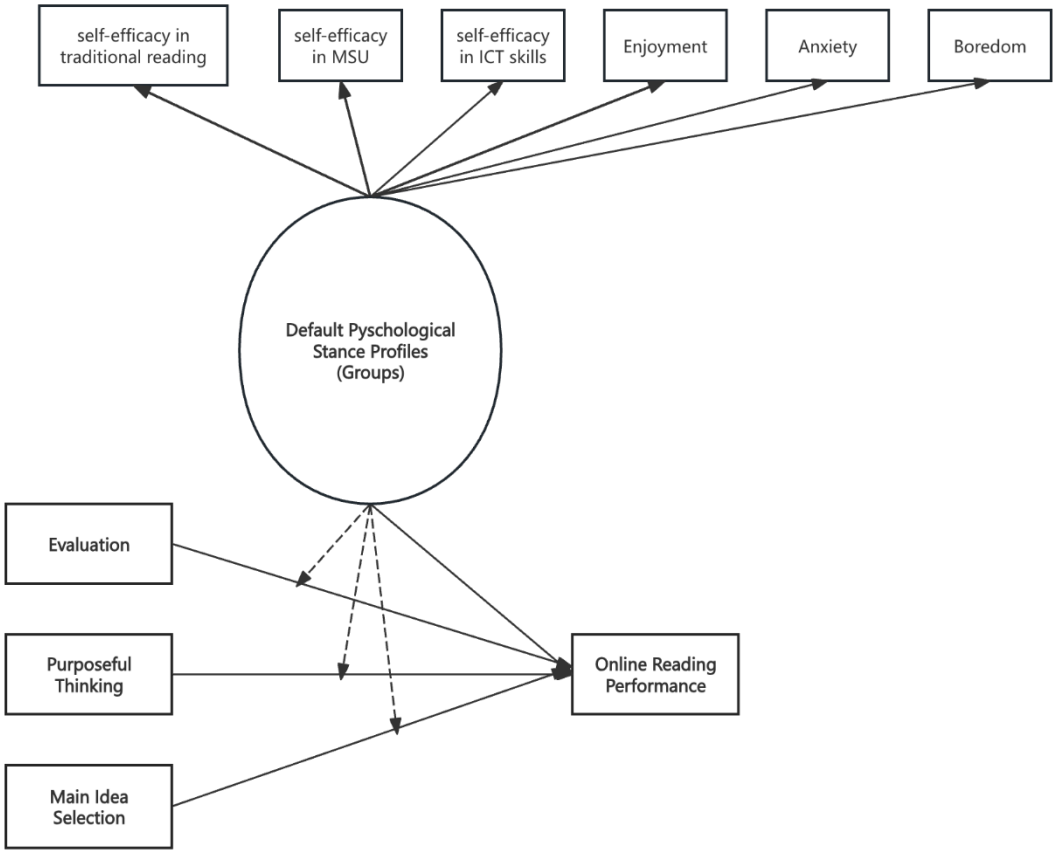
H0-3: There are no significant differences among the three groups of students in their path from Main Idea Selection to Online Reading Performance.

Alternative Hypotheses (H_1):

H1-1: There are significant differences among the three groups of students in their path from Evaluation to Online Reading Performance.

H1-2: There are significant differences among the three groups of students in their path from Purposeful Thinking to Online Reading Performance.

H1-3: There are significant differences among the three groups of students in their path from Main Idea Selection to Online Reading Performance.



Note. Using the metacognitive domain as an example.

Figure 6.2 Hypothesized model for RQ 4

6.1 Group Differences in Online Reading Strategies and Reading Performance

Overall, the positive group of students (G1) demonstrated better strategy usage skills than the moderate group (G2) did, yet their strategy usage was generally less effective than that of the ambivalent group (G3) in most online reading strategies, except in disorientation and main idea selection (Table 6.1). In the self-reported scores for the behavioral, metacognitive, and procedural domains, G3 students reported higher scores than G1 students did, and G1 students reported higher scores than G2 students did.

Table 6.1 Group comparison of the student groups' use of online reading strategies

Indicator	G1	G2	G3	Wald Chi-square Test Results		
	Mean (SE)	Mean (SE)	Mean (SE)	G1 vs. G2	G2 vs. G3	G3 vs. G1
Disorientation	3.608 (0.045)	3.127 (0.054)	3.638 (0.058)	G1>G2**	G2<G3**	Not sig.
Control	4.197 (0.075)	3.323 (0.063)	4.490 (0.089)	G1>G2**	G2<G3**	G1<G3**
Select Main Idea	4.340 (0.078)	3.348 (0.078)	4.563 (0.097)	G1>G2**	G2<G3**	Not sig.
Evaluation	4.106 (0.089)	3.108 (0.083)	4.502 (0.104)	G1>G2**	G2<G3**	G1<G3**
Purposeful Thinking	4.184 (0.076)	3.245 (0.076)	4.490 (0.101)	G1>G2**	G2<G3**	G1<G3**
Trial & Error	4.289 (0.083)	3.609 (0.086)	4.543 (0.093)	G1>G2**	G2<G3**	G1<G3**
Problem-solving	3.813 (0.092)	3.295 (0.069)	4.374 (0.110)	G1>G2**	G2<G3**	G1<G3**
Behavioral Strategies	3.902 (0.048)	3.225 (0.044)	4.064 (0.062)	G1>G2**	G2<G3**	G1<G3**
Metacognitive Strategies	4.210 (0.070)	3.234 (0.070)	4.518 (0.093)	G1>G2**	G2<G3**	G1<G3**
Procedural Strategies	4.051 (0.067)	3.452 (0.064)	4.458 (0.084)	G1>G2**	G2<G3**	G1<G3**

Interestingly, despite the positive (G1) group's report of less proactive strategy usage, their online reading scores were significantly higher than those of the ambivalent group (G1–G3 = 4.801, $p < 0.01$) and significantly surpassed those of the moderate group (G1–G2 = 6.171, $p < 0.01$) as well. Contrary to the ambivalent (G3) group's self-reported confidence in strategies on the questionnaire, their average reading score was the lowest among the three groups (G1 = 20.138; G2 = 15.337; G3 = 13.967) (see Table 6.2).

Table 6.2 further reveals where group differences existed in regard to the different multimodal/multiple texts-related questions. In this table, reading question types are broadly classified into three categories according to the competence indicators developed by ePIRLS (Mullis et al., 2017): location, comprehension, and evaluation. Within each category, the questions are further subdivided by the online multimodal reading features, including pictures, hyperlinks, webpages, and so on. Specifically, "Location (Picture-related)" indicates that the information to be located was found within a picture, while "Location (Hyperlinks-related)" suggests that the information needed to be located was in the hyperlinks. "Comprehension (Picture-related)" means that students needed to understand the information in the picture or comprehend the content by combining the picture with the text. "Comprehension (Multi texts-related)" indicates that students needed to comprehend information across multiple webpages, whereas "Comprehension (Single text-related)" means that the scope of understanding was within a single passage. "Evaluation (Hyperlinks-related)" signifies that students needed to predict or evaluate the usefulness of hyperlinks, while "Evaluation (Credibility-related)" implies that students needed to make comprehensive judgments about the credibility and reasonableness of the information online.

The results across the different question types exhibited a consistent pattern in overall performance, with students in the positive group scoring significantly higher than those in the other two groups. In most of the question types, there were no significant differences between the moderate and ambivalent groups. However, two notable exceptions were the Location (Hyperlinks-related) questions and Evaluation (Credibility-related) questions. In the Location (Hyperlinks-related) questions, students in the moderate group (G2) performed significantly worse than those in the ambivalent group (G3) did (0.593 for G2 vs. 0.750 for G3), while no significant differences were observed between the positive (G1) group and the ambivalent group (G3). Regarding the Evaluation (Credibility-related) questions, significant differences were found

among all three groups, with the positive group achieving the highest mean score (2.069), followed by the moderate group (1.640) and then the ambivalent group (1.219).

Table 6.2 Group comparison of the student groups' online reading performance

Performance/ Question Type	G1	G2	G3	Wald Chi-square Test Results		
	Mean (SE)	Mean (SE)	Mean (SE)	G1 vs. G2	G2 vs. G3	G3 vs. G1
Online Reading Performance	20.138 0.662	15.337 0.654	13.967 0.828	G1>G2**	Not sig.	G1>G3**
Location (Picture-related)	3.527 (0.148)	3.025 (0.134)	2.757 (0.191)	G1>G2**	Not sig.	G1>G3**
Location (Hyperlinks-related)	0.857 (0.040)	0.593 (0.051)	0.750 (0.056)	G1>G2**	G2<G3**	Not sig.
Comprehension (Picture-related)	3.429 (0.178)	2.506 (0.164)	2.402 (0.228)	G1>G2**	Not sig.	G1>G3**
Comprehension (Multi texts-related)	3.809 (0.722)	2.116 (0.469)	1.954 (0.398)	G1>G2**	Not sig.	G1>G3**
Comprehension (Single text-related)	5.250 (0.282)	3.320 (0.227)	2.919 (0.326)	G1>G2**	Not sig.	G1>G3**
Evaluation (Hyperlinks-related)	2.007 (0.114)	1.445 (0.094)	1.314 (0.128)	G1>G2**	Not sig.	G1>G3**
Evaluation (Credibility-related)	2.069 (0.114)	1.640 (0.111)	1.219 (0.137)	G1>G2**	G2>G3**	G1>G3**

6.2 Group Differences in Multimodal Element Interactions, Based on the Backend Data

Because self-reported questionnaires may not objectively reflect students' actual reading behaviors, this study also obtained backend data on the students' actual test-taking behaviors as compensation, with a particular focus on their reading patterns involving multimodal elements. Specifically, this study collected four types of data: the students' test completion duration (seconds), and the number of times they clicked on the dictionary, hyperlinks, and images (including GIFs). Table 6.3 lists the number of students who clicked on three multimodal elements in three profiled groups. The descriptive statistics show that the students in the positive group (G1) had the highest interaction rates with the two multimodal elements: the dictionary button, and hyperlink, followed by the moderate group (G2), and then the ambivalent group (G3). Regarding images, the interaction rate was highest in the moderate group (G2). Further chi-square tests using Fisher's exact test (2xC) showed no intergroup differences in interactions with each type of multimodal element ($p = 0.092$ for dictionary button clicks, $p = 0.995$ for hyperlink clicks, $p = 0.564$ for image clicks).

Notably, the results reveal that out of all of the students, only 95 (33.92%) were observably engaged with the multimodal elements. To be more specific, 35 students from the first group, accounting for 36.46% of the first group, 41 students from the second group, representing 36.93% of the second group, and 19 students from the third group, making up 26.03% of the third group, interacted with these three multimodal elements. However, according to the Fisher's exact test's (2xC) results, there were also no intergroup differences in the number of overall multimodal elements clicks ($p = 0.262$).

Table 6.3 Number of students who clicked on multimodal elements in each of the three groups

Multimodal Element	G1	G2	G3	Total

Dictionary Buttons Click	45/96 (46.86%)	34/111 (30.63%)	21/73 (28.76%)	100/280 (35.71%)
Hyperlink Clicks	50/96 (52.08%)	46/111 (41.44%)	30/73 (41.10%)	136/280 (48.57%)
Image Clicks	47/96 (48.96%)	50/111 (45.05%)	33/73 (45.21%)	130/280 (46.43%)

To further investigate whether there were differences in the duration and frequency of interactions with each type of multimodal element across different groups, Wald chi-square tests were again conducted. The results presented in Table 6.4 show no significant differences in test completion duration among the three groups, with the positive group averaging 35 minutes, 50 seconds, the moderate group 35 minutes, 42 seconds, and the ambivalent group 30 minutes, 9 seconds. This means that in the test environment, the three groups of students did not exhibit statistically significant differences in the lengths of time they were engaged with the online reading texts. Nevertheless, when considering the mean values, the ambivalent group (G3) spent the least amount of time, approximately 5 minutes less than the other two groups.

Concerning the number of clicks on multimodal elements, significant differences were observed between the positive group (G1) and the moderate group (G2) in dictionary button clicks. Moreover, the positive group (G1) showed significantly more interactions with webpage clicks than the ambivalent group did, while there were no noticeable differences among the three groups in terms of image clicks.

Table 6.4 Group differences in the test duration and clicks of multimodal elements

Indicator	G1	G2	G3	Wald Chi-square Test Results		
	Mean (SE)	Mean (SE)	Mean (SE)	G1 vs. G2	G2 vs. G3	G3 vs. G1
Test Completion Duration	2149.841 (206.135)	2143.422 (313.124)	1808.802 (281.312)	Not sig.	Not sig.	Not sig.

Dictionary Clicks	0.962 (0.145)	0.572 (0.112)	0.586 (0.159)	G1>G2**	Not sig.	Not sig.
Webpage Clicks	3.809 (0.722)	2.116 (0.469)	1.954 (0.398)	Not sig.	Not sig.	G1>G3**
Image Clicks	1.285 (0.288)	1.426 (0.517)	1.321 (0.369)	Not sig.	Not sig.	Not sig.

From the backend data results presented above, this study discovered that there were no significant differences in the frequency of interaction with multimodal elements among the students from different groups in general. However, according to the descriptive statistics, the positive group appeared to have been more engaged during the online reading test. Moreover, it is worth noting that the group-based relationship with multimodal interaction derived from the backend data analysis could not fully reflect the complete picture of students' interaction with multimodal elements during the reading process, because the students' interaction with multimodal elements did not rely entirely on mouse clicks on the multimodal elements; prolonged visual fixation and contemplation also constituted a form of interaction. In addition, the number of clicks did not represent the quality of the interaction, because students in an online reading environment may engage in high-frequency clicking due to disorientation or distraction. Given the unavailability of additional eye-tracking data, the researcher proceeded with in-depth analyses of the specific answering processes of students who interacted with multimodal elements, using the backend data within the interviewed group as triangulation. This analysis included examining the time spent on each question, the questions for which points were lost, and the timing of clicks on individual multimodal elements. In addition, to provide a more detailed explanation of the quantitative results the study combined that analysis with targeted interview questions related to strategies. For details, please refer to Section 6.4.

6.3 Mixture Path Analysis

To further investigate the relationships between the students' online reading strategies and their performance, the fourth research question was addressed using mixture path

analysis. Considering the limited sample size after categorization, the study conducted three mixture path analyses according to the three strategy dimensions. The indices of model fit for each mixture path model reached saturation (CFI = 1.00, TLI = 1.00, SRMR< 0.000), indicating that the model adequately represented the underlying structure of the data.

For the relationships between behavioral strategies and online reading performance, disorientation and control served as the two independent variables. In the moderate group (G2) and the ambivalent group (G3), the "Disorientation" strategy demonstrated a statistically significant negative effect on online reading performance, with $\beta = -0.276$, $p < 0.01$, and $\beta = -0.296$, $p < 0.01$, respectively. In contrast, the "Disorientation" strategy showed no statistically significant effects on online reading performance in the positive group (G1), and the "Control" strategy registered no effects on online reading performance across all groups ($p > 0.05$) (see Table 6.5). Regarding the effects of metacognitive strategies (see Table 6.6), the "Main Idea Selection" strategy exhibited a significant positive effect on online reading performance in the ambivalent group (G3) ($\beta = .438$, $p < 0.01$), whereas the strategy did not show significant effects in the positive group (G1) or the moderate group (G2) ($p > 0.05$). In addition, neither evaluation nor purposeful thinking demonstrated a significant effect on performance in any of the three groups. Of the procedural strategies (see Table 6.7), only the *"*Trial and Error*"* strategy showed a significant positive effect on online reading performance in the moderate group (G2) ($\beta = 0.227$, $p < 0.05$). This strategy, along with "Problem Solving," showed no significant effects in either the positive group (G1) or the ambivalent group (G3). Overall, therefore, only three online reading strategies significantly impacted online reading performance, and these effects were observed mainly in the moderate group (G2) and the ambivalent group (G3). Interestingly, none of the online reading strategies showed significant effects in the positive group.

Table 6.5 Mixture path analysis results for the behavioral strategies' effects on online reading performance

Group	Strategy	β	S.E.	p-value
Group 1 (Positive Group)	Disorientation	-0.075	0.109	0.491
	Control	0.067	0.121	0.582
Group 2 (Moderate Group)	**Disorientation**	**-0.276**	**0.083**	**0.001****
	Control	0.005	0.111	0.963
Group 3 (Ambivalent Group)	**Disorientation**	**-0.296**	**0.068**	**0.000****
	Control	0.125	0.120	0.299

Table 6.6 Mixture path analysis results for the metacognitive strategies' effects on online reading performance

Group	Strategy	β	S.E.	p-value
Group 1 (Positive Group)	Evaluation	-0.147	0.130	0.259
	Purposeful Thinking	0.191	0.164	0.245
	Main Idea Selection	0.111	0.132	0.400
Group 2 (Moderate Group)	Evaluation	-0.057	0.149	0.701
	Purposeful Thinking	0.051	0.131	0.699
	Main Idea Selection	0.092	0.121	0.446
Group 3 (Ambivalent Group)	Evaluation	-0.360	0.294	0.161
	Purposeful Thinking	0.012	0.284	0.786
	Main Idea Selection	**0.438**	**0.155**	**0.005****

Table 6.7 Mixture path analysis results for procedural strategies' effects on online reading performance

Group	Strategy	β	S.E.	p-value
Group 1 (Positive Group)	Problem Solving	-0.010	0.108	0.925
	Trial and Error	0.129	0.107	0.225
Group 2 (Moderate Group)	Problem Solving	-0.106	0.140	0.449
	Trial and Error	**0.227**	**0.091**	**0.020***
Group 3	Problem Solving	0.053	0.581	0.565

(Ambivalent Group)	Trial and Error	0.113	0.123	0.358

6.4 Qualitative Insights into Strategy Effects Across Profiles

Building upon the quantitative analysis provided earlier, this section addresses three key questions: (1) Why did Disorientation affect the performance of students in the moderate and ambivalent groups? (2) Why was the online reading performance of students in the ambivalent group influenced by Selecting the Main Idea? (3) Why did Trial and Error only impact the online reading performance of the moderate group students?

6.4.1 Why did disorientation affect the performance of students in the moderate (G2) and ambivalent groups (G3)?

Backend data analysis

In order to measure "Disorientation," this study first coded the backend data of all interviewees in terms of their multimodal clicks and mis-clicks. A mis-click was defined as a click that is irrelevant to question-answering. For example, Figure 6.3 is a screenshot of student #2's (G2) part of the backend data records. The first clicked button is "食物鏈" (food chain), while the questions close to this click are "地球的理想溫度" (the ideal temperature of the Earth) and "英國的極端天氣" (extreme weather in the UK), which are irrelevant to "食物鏈." Thus, this kind of click was labeled as a "mis-click." The second button click, "全球暖化" (global warming), which corresponds to the third question "「全球暖化」的超連結" (hyperlink of Global Warming), could be labeled as a "correct click." In addition, not only did this study calculate the number of points-lost questions that were related to locating information, but it also identified the answering duration for each locating-information-type question. The time spent answering this question can directly indicate whether the student experienced disorientation. Given that the average response time for the entire group was 33 minutes

and 90 seconds, and the reading test consisted of 25 questions, the theoretical average time per question was 1 minute and 35 seconds. Therefore, during the coding process, this study defined any question with a response time exceeding two minutes as a "time-consuming question." Whereas the students may have experienced disorientation with other types of questions, the multitude of contributing factors made it impractical to conduct a detailed analysis in this section.

題號	問題	答題時間
1	本網頁哪個標題有提到地球的理想溫度?	0:41:54
button click	點擊button:食物鏈	0:42:49
2	根據圖2，英國的極端溫度帶來甚麼不良影響?	0:46:35
button click	點擊button:全球暖化	0:46:45
3	網頁中「全球暖化」的超鏈接，有助於我們瞭解甚麼內容?	0:47:17
4	請結合網頁中這句話：「全球暖化是『温室效應』過度而造成的現象」和圖3，解釋温室效應如何加劇全球暖化現象。	0:51:22

Figure 6.3 Screenshot of backend data records for student #2 (G2)

Tables 6.8, 6.9, and 6.10 present the types of multimodal clicks, the mis-clicks, the number of points-lost questions, and the time-consuming questions for each of the three groups of students who attended the interview. In the positive group (G1), only one student had a mis-click (student #1), and two students mistakenly answered the locating information-related questions (student #1 & #8). Six of the nine students spent more than two minutes on at least one locating-type question, but most of them took less than two minutes and 20 seconds. Only students #1 and #9 spent more than three minutes on these questions. Interestingly, these students spent more time on locating-type

questions that were related to pictures than on those related to hyperlinks. In the moderate group (G2), two-thirds of the students exhibited mis-clicks, with students #1 and #7 recording five and nine mis-clicks, respectively. Meanwhile, seven-ninths of the students lost points on location questions, with the point losses relatively evenly distributed between hyperlink-related and picture-related location questions. As occurred with G1, six G2 students spent more than two minutes on such questions. However, on average, the second group invested more time in these questions. For instance, students #2 and #7 spent approximately seven to eight minutes in total on time-consuming questions, while student #6 devoted 4 minutes to a single picture-related location question. In the ambivalent group (G3), five-ninths of the students exhibited mis-clicks, while seven-ninths lost points on location questions. Numerically, this pattern was relatively similar to that in G2. However, while the G2 students' point losses were fairly evenly distributed between hyperlink-related (HL) and picture-related (PL) location questions, G3 students' point losses were concentrated on PL questions. Moreover, eight-ninths of the students in G3 spent significant time on location questions. For instance, student #1 spent nearly 12 minutes on two location questions; student #3 spent 7 minutes on a single question; and students #2, #6, and #7 each spent approximately 5 minutes on location questions. This observation highlights a distinct pattern in G3 students' interactions with picture-related location questions, both in terms of point losses and time investments.

Overall, the analysis of the backend data revealed distinct patterns in the three groups of students' performance on "disorientation." The students in G1 demonstrated minimal errors and efficient time management, with only slight challenges in picture-related questions. Those in G2 exhibited increased instances of mis-clicks and point losses, evenly distributed between hyperlink and picture-related questions, while they also showed longer average completion times. The students in G3 presented the most pronounced difficulties, particularly on picture-related questions, which is where they concentrated all of their point losses and invested significantly more time. The

progression from G1 to G3 indicates an escalating level of difficulty in handling locating-type questions, with a notable emphasis on the challenges posed by picture-related tasks.

Table 6.8 Multimodal click types, mis-clicks, points-lost questions, and time-consuming questions, for each of the nine interviewed students in Group 1

G1 Student #	Duration	Score	Multimodal Click			Mis-click	Points-lost Question	Time-consuming Question
			Image	Button	Webpage			
01	37min49s	20	1	/	/	1	2PL	1 PL (5min 24s)
02	34min22s	27	/	/	/	/	/	1 PL (2min 06s)
03	33min22s	28	/	/	2	/	/	1PL (2min 19s)
04	32min56s	30	/	/	3	/	/	1PL (2min 13s)
05	25min06s	28	1	3	/	/	/	/
06	39min03s	23	1	/	2	/	/	/
07	39min47s	28	/	/	1	/	/	/
08	33min49s	23	1	/	1	/	1PL 1HL	1PL (2min 01s)
09	39min35s	22	2	/	2	/	/	1PL (3min43s)

Note. PL=picture-related location question; HL=hyperlink-related location question

Table 6.9 Multimodal click types, mis-clicks, points-lost questions, and time-consuming questions for each of the nine interviewed students in Group 2

G2 Student #	Duration	Score	Multimodal Click			Mis-click	Points-lost Question	Time-consuming Question
			Image	Button	Webpage			
01	30min50s	16	2	/	3	5	1HL 1PL	/

02	38min32s	25	/	3	/	2	1PL	1PL (4min41s) 1PL (3min31s)
03	32min07s	15	1	/	4	1	1HL 2PL	1PL (2min51s)
04	23min35s	18	1	1	/	/	/	1PL (2min14s)
05	31min14s	26	/	2	1	1	/	1PL (2min22s)
06	28min27s	23	5	1	/	/	1PL	1PL (4min)
07	26min15s	18	1	/	8	9	1HL 1PL	1PL (7min29s)
08	34min07s	22	/	1	/	/	1PL	/
09	31min09s	23	1	/	/	1	2HL	/

Note. PL=picture-related location question; HL=hyperlink-related location question

Table 6.10 Multimodal click types, mis-clicks, points-lost questions, and time-consuming questions for each of the nine interviewed students in Group 3

G3 Student #	Duration	Score	Multimodal Click			Mis-click	Points-lost Question	Time-consuming Question
			Image	Button	Webpage			
01	38min40s	15	/	/	/	/	/	1PL (7min13s) 1PL (4min40s)
02	29min41s	18	/	/	2	/	2PL	1PL (5min11s)
03	20min39s	11	/	/	/	/	1PL 1PL	1PL (7min00s)
04	22min28s	15	3	1	/	3	1PL	1PL 2min40s
05	28min56s	18.5	/	1	/	/	2PL	/
06	32min52s	15	7	1	/	2	1PL	1PL (4min44s)
07	22min49s	17.5	1	/	6	3	2PL	1PL (3min18s) 1PL (2min13s)
08	20min57s	19	2	1	/	1	1PL	1PL (2mins13s)
09	40min	21	1	1	/	1	/	1PL (2min38s)

Note. PL=picture-related location question; HL=hyperlink-related location question

Backend data analysis combined with interview responses

The qualitative findings from the backend data corroborated the quantitative results, which indicated that "Disorientation" significantly impacted the online reading performance of only the G2 and G3 students. When probed about disorientation, many

of the students in the G2 and G3 groups recounted experiences of feeling “lost” during the interview.

Disorientation caused by the overload of information online

The G2 students explicitly reported difficulties in reviewing multiple articles, citing “too much information, diverse expression methods, and challenges in integration” as key issues in online reading. For example, student #7 in G2 articulated, “Sometimes there’s an overwhelming amount of information... Despite multiple attempts, I struggle to find what I need... especially encounter the hyperlinks...and the disconnected information... I’m unsure if it’s my inadequacy, but it often seems irrelevant, leaving me perplexed.” This student’s experience highlights the cognitive overload and disorientation that can occur when one is faced with an abundance of information presented in various formats across multiple sources. The presence of hyperlinks and disconnected information further compounds the difficulty in navigating and synthesizing relevant content.

To discover the sources of disorientation, interviewers asked whether it stemmed from the text’s logical content or from multimedia elements such as videos, images, and web structure. Student #3 in G2 attributed their confusion to the multitude of web pages, stating, “It’s challenging to determine where to locate specific information.” This response suggests that the sheer number of web pages and the lack of a clear, linear structure can contribute to students’ feelings of being lost and overwhelmed. The absence of a well-defined path or hierarchy of information makes it difficult for students to identify and prioritize the most relevant content, thus causing a sense of disorientation.

Disorientation caused by anxiety

The disorientation caused by anxiety during online reading assessments was a notable challenge for G2 and G3 students. The heightened pressure and stakes of the exam setting appeared to exacerbate their feelings of being lost and overwhelmed while navigating the online texts. Student #3 in G3 clearly expressed this feeling, saying, "Nervousness sometimes causes me to forget previously read information... I struggle to identify key points and feel at a loss." This anxiety-related confusion seemed to affect the student's ability to effectively understand and remember the information he or she had read, leading to a sense of frustration and uncertainty. Similarly, student #7 in G2 described a noticeable feeling of stress that occurred when he was unable to find specific information during the assessment. He mentioned,

> "If I can't find the information, I start to feel nervous... I'm afraid that I won't have enough time and that I won't do well on the exam... Even though sometimes the more nervous I get, the harder it is to find what I need, there's nothing I can do about it."

Such difficulty in identifying important details within the digital texts further increased the students' anxiety, creating a cycle of stress and confusion. The pressure to do well and the worry about overlooking essential information seemed to interfere with their thinking and made it harder for them to navigate the online content, ultimately influencing their overall performance. These experiences emphasized the significant effect that anxiety can have on students' ability to successfully interact with online reading materials in assessment situations.

Disorientation caused by undervaluing visual information

In addition, the concentration of G3 students' point losses and time consumption on picture-related location questions can be partly explained by their misconceptions about multimodal elements. Interviews revealed that the G3 students often undervalued the role of visual information in conveying meaningful content. For instance, when asked

about potential distraction by image content, student #9 responded, “Images don’t attract my attention... I merely glance at them, believing that the knowledge resides in the text.” This statement reflected a common belief among the G3 students that images serve a secondary or supplementary role in the learning process rather than being integral to understanding the material. Student #5 echoed this view, stating, “Images are merely aids to understanding, only to be consulted when the text is incomprehensible.”

This view suggests that students may only turn to visual information as a last resort when they encounter difficulties with the written content. By relegating images to a subordinate position, students may miss out on crucial information and connections that are more effectively conveyed through visual means. These misconceptions about the value and role of multimodal elements in online reading can lead to an overreliance on textual information and a neglect of the rich visual resources available. Consequently, students may struggle to locate and integrate information from images, and that may cause them to increase their time consumption and potentially lose points in assessment situations. This dynamic may explain why the students in G3 had lost a significant number of points on picture-related locating questions, as well as why they spent considerably more time on such questions.

Overall, the analysis of the backend data and qualitative interviews collectively responded to why disorientation predominantly affects the performance of the G2 and G3 students in online reading tasks. These two groups exhibited increased instances of mis-clicks, point losses, and longer completion times in location types of questions. The G2 students reported difficulties in reviewing multiple articles, citing issues with information overload and integration. This pattern may explain why G2’s scores on hyperlink-related location questions were significantly lower than those of the G1 and G3 students (see Table 6.2). In addition, both the G2 and G3 students emphasized that exam-related anxiety affected their ability to search effectively. Nevertheless, G3

students still demonstrated the most pronounced challenges, especially in picture-related tasks, in which they concentrated all of their point losses and invested significantly more time. A key reason for this was that the G3 students tended to undervalue visual information in multimodal content. In contrast, the G1 students demonstrated minimal errors and efficient time management, with only slight challenges in picture-related questions.

6.4.2 Why students in the ambivalent (G3) group's online reading performance were influenced by selecting the main idea

Backend data analysis

The questionnaire employed three items to measure the students' ability to select main ideas: (1) summarizing paragraphs using keywords, (2) distinguishing key information, and (3) utilizing clues such as titles and hyperlinks to aid in summarizing and extracting the main idea. The first item measured the students' ability to capture the main point of a paragraph by using representative keywords, which is essential for understanding and condensing information effectively. The second item directly assessed the students' skill in distinguishing between more important and less important information in each text/web page. The third item evaluated the students' ability to use contextual clues, such as titles and hyperlinks, to aid in summarizing and identifying the most significant points in a text. Such clues serve as signposts for readers, helping them navigate and prioritize information more efficiently.

Thus, this section discusses the study's employment of comprehension questions as indicators to measure the individual's ability to select main ideas. Whether it was picture-related comprehension (PC), multitext-related comprehension (MC), or single-text-related comprehension (SC), the questions were closely linked to the strategies of main idea selection mentioned in the questionnaire. For instance, the fourth question in

the reading task (PC) required students to “結合網頁中這句話：「全球暖化是『温室效應』過度而造成的現象」和圖 3，解釋温室效應如何加劇全球暖化現象 Combine the sentence on the webpage: ‘Global warming is a phenomenon caused by the excessive greenhouse effect’ and Figure 3 to explain the greenhouse effect and how it exacerbates global warming.” To answer this question, respondents had to not only comprehend the relevant textual discussion of global warming but also synthesize the information conveyed by the greenhouse effect and global warming presented in the figure. In a similar vein, MC questions also demanded a robust ability to select main ideas. Question 18 in the reading task stated, “結合網頁一至三的內容，下列哪些是人類保護大自然的正確行動? Based on the content of web pages one to three, which of the following are correct actions for humans to protect nature?” and necessitated that students summarize information from multiple websites. Finally, the SC questions, which were akin to the ability tested in paper-based reading, required students to summarize information from a single web page. For example, Question 23 asked the students to “根據網頁內容，試分別説明加拿大、澳洲和香港保護生態的措施。Explain the ecological protection measures in Canada, Australia, and Hong Kong based on the content of the web page.” Although these types of questions did not exclusively measure the ability to select main ideas, they still relied heavily on the students possessing this skill.

Tables 6.11, 6.12, and 6.13 present the number of questions with points lost and the time-consuming questions for each interviewee in regard to PC, MC, and SC by their psychological default stance groups. The participants in the positive group (G1) had relatively fewer questions with lost points across all question types. Most participants lost points on 0–2 questions per type, which indicated relatively good performance in picture-related, multitext, and single-text reading comprehension (average lost points/total comprehension questions: 4.8/12). In addition, although the G1 students spent significant time on many questions, they answered some of those time-consuming questions correctly—especially the MC questions. The moderate group (G2)

participants had approximately the same numbers of PC and SC type questions with lost points as the G1 students did, again mostly 0–2. However, for the MC type questions, the G2 participants had slightly more questions with lost points than the G1 students did—ranging from 1 to 4. This suggests the G2 students may have faced more challenges in multitext reading comprehension than the G1 students did. The average number of points lost out of the total comprehension questions was 6.3 out of 12. The ambivalent group (G3) participants had noticeably more questions with lost points across all types of questions than the G1 and G2 students did. In the PC questions, the G3 participants typically lost points on 2–4 questions; in MC questions, they lost points on 2–5 questions; and in SC questions, they lost points on 1–2 questions. This indicates that the G3 participants experienced significant difficulties in picture-related, multitext, and single-text reading comprehension (average lost points/total comprehension questions: 7.3/12).

Further analysis revealed that the G3 students had a particularly high number of questions with lost points in MC type questions, suggesting that they faced greater challenges in multitext reading comprehension. This may be closely related to the ability to select main ideas. When processing multitext materials, accurately identifying and extracting key information is crucial for comprehension. If participants lack these abilities, they may struggle to effectively integrate information from different sources and thus lose more points in multiple-text comprehension. Meanwhile, the author found that the lost points in single-text comprehension for the G1 and G2 students were mostly from a 3-point question requiring main-idea summarization. Specifically, all of the G1 interviewees scored 2–3 points on this question, while 2/3 of the G2 students scored 2 points and 1/3 scored only 1 point. In contrast, 5/9 of the G3 students scored 0 points and 4/9 scored 1 point, indicating that the G3 students had a weak ability to summarize key information and main ideas within a single text. Furthermore, table 6.13 shows that nearly all of the questions for which the G3 students lost were also time-consuming. This suggests that the G3 students faced a dilemma in comprehension questions and

that they still answered incorrectly despite spending considerable time. This backend data analysis aligns with the quantitative results, showing that the G3 students faced significant difficulties in main idea selection. Enhancing their strategies for this task could significantly improve their online reading performance.

Table 6.11 Number of comprehension-related questions that had points lost and/or were time-consuming, by each G1 student interviewee

G1 Student #	Duration	Score	Points-lost Question				Time-consuming Question
			PC	MC	SC	Total	
01	37min49s	20	3	2	/	5	1PC(4min46s)* 1PC(2min58s)* 1SC(3min40s)
02	34min22s	27	2	2	1	5	1SC(6min52s) 1MC(2min42s) 1PC(2min02s)*
03	33min22s	28	2	2	1	5	1SC(7min12s) 1PC(3min27s)*
04	32min56s	30	2	3	/	5	1SC(5min13s) 1PC(4min19s)* 1PC(2min00s)* 1MC(2min28s)
05	25min06s	28	1	2	2	5	1SC(5min19s)* 1PC(9min00s) 1PC(2min57s)*
06	39min03s	23	3	2	/	5	1MC(6min46s)* 1PC(6min44s) 1PC(3min59s)*
07	39min47s	28	2	2	1	5	1MC(10min53s) 1PC(6min41s)* 1PC(2min29s)* 1MC(4min26s)
08	33min49s	23	1	1	1	3	1SC(8mins16s)* 1PC(4min51s) 1PC(2min15s)* 1MC(2min31s)

09	39min35s	22	2	3	1	6	1PC(5min08s)* 1PC(3min27s) 1SC(3min11s)* 1MC(2min25s)

Note. PC=Picture-related comprehension; MC=Multitext-related comprehension; SC=Single-text-related comprehension; *=The time-consuming question is also the point(s)-lost question.

Table 6.12 Number of comprehension-related questions that had points lost and/or were time-consuming, by each G2 student interviewee

G2 Student #	Duration	Score	Points-lost Question				Time-consuming Question
			PC	MC	SC	Total	
01	30min50s	16	3	4	1	8	1SC(3min57s)* 1PC(3min11s)*
02	38min32s	25	2	2	1	5	1SC(4min22s)* 1PC(4min05s) 1PC(3min16s)* 1MC(2min23s)*
03	32min07s	15	3	4	1	8	1PC(7min32s)* 1PC(3min13s)* 1MC(3min47s)* 1SC(2min31s)*
04	23min35s	18	2	1	/	3	1PC(4min18s)* 1PC(3min51s)*
05	31min14s	26	1	1	2	4	1PC(5min55s)* 1PC(4min45s)*
06	28min27s	23	2	4	/	6	1PC (5min53s)* 1PC(3min24s)*
07	26min15s	18	3	4	2	9	1PC(2min48s)* 1PC(2min10s)* 1SC(2min48s)*
08	34min07s	22	2	4	1	7	1PC(5min58s)* 1PC(2min04s)* 1MC(2min01s)* 1SC(2min45s)*

09	31min09s	23	2	4	1	7	1PC(3min55s)* 1PC(3min29s)* 1SC(4min31s)*

Note. PC=Picture-related comprehension; MC=Multitext-related comprehension; SC= Single-text-related comprehension; *=The time-consuming question was also the point(s)-lost question.

Table 6.13 Number of comprehension-related questions that had points lost and/or were time-consuming, by each G3 student interviewee

G3 Student #	Duration	Score	Points-lost Question				Time-consuming Question
			PC	MC	SC	Total	
01	38min40s	15	3	2	1	6	1PC(3min40s)* 1MC(2min59s) 1MC(2min41s)*
02	29min41s	18	3	3	1	7	1PC(5min30s)* 1PC(2min39s)* 1MC(2min00s)*
03	20min39s	11	3	5	1	9	1PC(3min26s)* 1PC(2min06s)*
04	22min28s	15	3	4	1	8	1PC(6min56s) 1PC(2min40s)*
05	28min56s	18.5	3	2	1	6	1MC(4min23s)* 1PC(2min30s)* 1PC(2min21s)*
06	32min52s	15	2	5	2	9	1PC (5min06s)* 1PC(4min06s)*
07	22min49s	17.5	2	2	2	6	1PC(3min03s)* 1MC(2min47s)*
08	20min57s	19	2	4	1	7	1PC(3min14s)* 1PC(2min20s)* 1SC(2min39s)*
09	40min	21	4	4	/	8	1PC(6min51s)*

Note. PC=picture-related comprehension; MC=Multi texts-related comprehension; SC=Single-text-related comprehension; *=The time-consuming question was also the point(s)-lost question.

Backend data analysis combined with interview responses

The researchers first conducted interviews with the G3 students specifically targeting their strategies for main idea selection. When asked, "Do you experience difficulties when selecting main ideas?" and "How do you usually select main ideas during reading?", these students appeared relatively confident and provided concrete strategies, such as "[I] look at the central sentence and understand its meaning" (students #2 & #5), "[I] focus on the opening and closing sentences of each paragraph" (student #3), and "[I] make predictions based on the title" (student #7). The students' clear responses regarding their strategy for selecting the main idea made the researchers curious about the reasons for the students' loss of points on this type of question. Specifically, what were the reasons that the students lost a significant number of points, in spite of having mastered the strategy? To explore this inquiry, the interviewer further probed whether the students had encountered any difficulties or obstacles when applying those strategies in the online reading environment.

Impact of multimodal elements on strategy use for main idea selection

The interviewees in G3 all emphasized that the multimodal nature of online reading increased the difficulty of selecting the main idea. As student #2 reported, "If it's just about finding key information in the text and making comparisons, I think it might not be that difficult...but when it involves images or tables, I'm not quite sure where I should be looking for the key information." Student #7 shared a similar statement:

> "I feel like the methods I used before to find key information don't always work, especially when images are involved….When there's text in the images, I don't know how to extract the key information from that. The information in the images feels scattered, and there's no clear topic sentence or anything like that."

These comments suggest that the students in G3 not only struggled with strategies for extracting main ideas from multimodal sources such as images, but they also exhibited weak strategy transfer ability. Interestingly, their statements contrasted with those of the G1 students, who indicated that although image information was less structured and clear than text information was, the captions of images or tables helped them identify key information (Students #3, #5, & #8).

In addition, the previously mentioned undervaluing of visual information by G3 students was also identified as an obstacle to selecting the main idea in a multimodal environment. As Student #5 in G3 commented,

> "Maybe I focus more on the written content when reading, and I tend to overlook the information in the images. There might be useful information in the images that I missed, but I still feel that images are just supplementary, and reading the text alone is enough."

This view was met with nods of agreement from the majority of interviewees when I asked if other students in G3 held similar views. Such undervaluing of visual information revealed a low sensitivity to nontextual elements, which was likely related to their overreliance on purely text-based reading formats.

Overall, the students' insufficient ability to extract information from multimodal elements, along with their tendency to overlook those elements, contributed collectively to their difficulty in identifying key information in picture-related comprehension questions, and that in turn affected their performance. This struggle highlighted their lack of adaptability in a multimodal reading environment.

Impact of a nonlinear reading environment on strategy use for main idea selection

In addition to multimodal elements, the nonlinear reading environment constructed from multiple web pages also became a factor affecting the G3 students' ability to

employ strategies for main idea selection. As can be seen in Table 6.13, the G3 students encountered significant difficulties with the MC questions. This prompted the researchers to ask more targeted questions about multiple-text reading, such as "In our exam, you may need to identify, integrate, and compare the main ideas from parts of 2–4 different articles. Do you find this difficult?" The students' responses fell into two categories: one group indeed found it challenging, stating "these are harder than usual" (students #2 & #7), while the other group felt that it was "similar to the single-text reading" (students #3, #5, #6, #8, & #9).

Those G3 students who found the task of main idea selection and comprehension from multiple online texts to be difficult explained that searching for information across multiple web pages was much harder than locating it in a single article, largely due to the sheer volume of information and the ease of becoming lost. This challenge was further attributed to the inconvenience of taking notes during online reading. For example, student #7 mentioned,

> "I find (MC) a bit hard because on the iPad, I have to click back and forth, and I can't take notes, so I might forget things I read and feel much more difficult to relocate. This makes online reading harder than traditional reading on paper."

Similarly, student #1 also raised the issue of note-taking difficulty, "On a paper test, I can use a pen to underline, especially to highlight keywords or sentences, or mark symbols, but on the iPad, that's not possible at all... And traditional reading doesn't require me to handle so much information."

However, the majority of students in G3 believed that "reading across multiple texts is similar to reading a single text." This perception was reflected in their webpage-clicking behavior. As shown in Table 6.13, seven out of nine interviewees did not engage in cross-page clicking when answering MC questions. Specifically, when the researcher used Question 11 as an example and asked why they did not revisit the first webpage

in a task requiring the summarization of main ideas from two pages, student #3 explained, “I have a good memory, so I can recall the earlier content.” However, such confidence in his working memory did not help student #3 successfully answer the MC questions, as he lost points on all of them. This information collectively suggests that a significant portion of the G3 students did not review prior pages when answering questions that required cross-page integration, but instead relied solely on their memory and the content of the current passage to respond.

Generally, the nonlinear nature of online reading environments, filled with vast amounts of information, makes it difficult for students to take notes effectively, thus often causing them to become disoriented. As a result, the students in G3 struggled to extract and summarize information across different webpages. Furthermore, for most of the G3 students, a lack of awareness regarding the unique demands of multitext reading, coupled with an overconfidence in their working memory, also hindered their ability to effectively apply the strategies for selecting main ideas. These two factors also help explain why the G3 students reported the highest levels of self-efficacy and self-assessed strategy use in online reading yet received the lowest scores.

Impact of psychological factors on strategies for main idea selection

Moreover, the G3 students exhibited a notably contradictory mindset toward the MC questions, which mirrored their default psychological stance profile. For example, student #7 exaggerated, saying,

> “In general, images are more engaging than pure text, but every time I encounter an MC question, I feel like my mind…is about to explode. It’s so frustrating. I keep going back and forth between the pages but still can’t find the answer, and then I have to write so much.”

This negative sentiment was widely echoed by other G3 interviewees, who described MC questions as "annoying and boring." Such negative feeling often led them to avoid investing time in MC questions. Students #3 and #9 shared similar views, explaining that they would randomly guess an answer for MC questions to save time, and if it was a short-answer question, they would skip it entirely and come back to it later. These statements were consistent with the backend data. The online reading task included five MC questions, which accounted for a substantial portion of the total score. However, of the nine students interviewed, only four spent more than two minutes on any MC question, and of the four, three devoted significant time to just one question. In addition, the students' negative attitude toward the MC questions also contributed to some experiencing increased anxiety. As student #9 remarked,

> "There are too many of these questions, and they carry a lot of weight in the exam. I don't want to do them, but if I skip them, I won't get any points. Then I start worrying about my exam results, and I get anxious… and once I'm anxious, I can't focus on reading… It's a vicious cycle."

The negative emotions associated with MC questions led the G3 students to reduce the time and effort they invested in this question type, further impairing their ability to extract key information from multimodal texts. This ambivalent psychological state created tension. On one hand, they found multimodal texts to be engaging and dynamic, while on the other, the texts' complexity, coupled with the pressure of the question format, triggered strong feelings of boredom and impatience. These emotional fluctuations made it difficult for them to focus on applying effective strategies to tackle MC questions. As a result, their "select the main idea" strategy became more haphazard, with some students even choosing to skip questions entirely. In other words, their internal struggle not only diminished their motivation but also heightened their psychological burden of dealing with complex tasks in a multimodal environment, thus creating a vicious cycle between emotional distress and ineffective strategy use.

6.4.3 Why did trial and error impact the online reading performance of the moderate group students (G2)?

Because the backend data did not clearly capture behaviors related to trial and error, this study relied on interviews to provide explanations and supplementary insights into this issue. According to the LPA results, the G2 students were categorized as the moderate group because they did not exhibit significant positive or negative tendencies in terms of self-efficacy and emotional responses and instead displayed a "neutral" or even "indifferent" attitude. This characteristic was also evident in the student interviews. For example, student #3 mentioned, "I prefer something more enjoyable, so I started reading from the beginning, but when I got to the middle, there was too much content, and I couldn't understand it...then I lost interest and didn't want to continue." This attitude reflected that the G2 students lacked the intrinsic goal orientation to overcome challenges and tended to give up or respond passively when faced with difficulties. Furthermore, student #3 added, "When my interest fades, even while doing tasks, I just don't care much." This suggests a lack of sustained effort and strategic adjustments during tasks. Other G2 students expressed similar views. For instance, student #1 said, "As I read further, I began to lose confidence, my stance started to waver. Trying different answers, none seemed quite right, and if I really can't figure it out, I won't spend time trying—it just gets too tiring." This statement further illustrates the G2 students' indifferent attitudes toward task performance. When facing difficulties in reading, they lacked the confidence and motivation to actively engage, and that led to fatigue and frustration during trial and error, thus making them more likely to give up. This "go-with-the-flow" attitude made them unwilling to put in additional effort to solve complex reading tasks, and they opted instead to stop and avoid deeper exploration.

In addition, the G2 students' tendency to give up was also related to their habitual reliance on external assistance. During the interviews, when asked, "What would you

do if you cannot find information or do not understand something?" many students responded with "Ask my parents" (students #1, #2, #9) or "Wait for the teacher to explain" (students #1, #4, #5, #6, #9). This dependence on external support diminished their willingness and ability to actively solve problems when faced with challenges in reading. Rather than engaging in independent exploration, reflection, and comprehension, they preferred to wait for others' explanations, and that attitude further eroded their perseverance in reading, making them more likely to give up in the face of difficulties instead of actively seeking internal solutions. Consequently, the G2 students' "trial and error" approach was unsustainable—not only because of their indifferent mindset, but also due to their lack of motivation for independent learning. Their reliance on external help when confronted with challenges ultimately limited their performance in reading tasks.

In summary, the low impact of "trial and error" on the G2 students' online reading performance can be attributed to their relatively indifferent attitude toward reading and their reliance on external help. The G2 students lacked a clear positive tendency toward self-efficacy and emotional responses, and that resulted in insufficient motivation when they were faced with challenges, making it difficult for them to persist in completing tasks. When they encountered difficulties during the process, they often felt fatigued and impatient, and they ultimately opted to give up. Furthermore, their habit of relying on external assistance diminished their willingness for independent exploration, leading them to wait passively for help rather than actively overcoming obstacles. Therefore, if these students could be guided to adopt a more proactive approach to using "trial and error" strategies to find solutions when faced with difficulties, their online reading performance could be significantly improved.

6.5 Discussion

6.5.1 Group-based patterns of individual differences in online reading strategies and performance

In terms of their online reading performance, the students with different profiles exhibited significant group differences. Specifically, the students in the positive group (G1) achieved the highest performance, significantly outperforming the other two groups. Although there was no statistically significant difference between the performance of the moderate group (G2) and that of the ambivalent group (G3), G2's test scores were slightly higher than those of G3. In addition, more pronounced group differences emerged in the students' self-reported online reading strategies. Notably, the G3 students exhibited the highest confidence in their use of strategies, despite having the weakest test performance. This finding underscores the previously mentioned phenomenon of overconfidence, with the G3 students failing to accurately assess their objective abilities (Bjorklund et al., 2009). In contrast, the self-reported questionnaire scores of the G1 and G2 students were better aligned with their actual profiles. The G1 students reported significantly higher self-assessments than the G2 students did, thus indicating a relatively strong mastery of strategies. Meanwhile, G2's self-reported strategy-use scores were consistent with their profile, hovering around the moderate range of 3.5. These findings provide empirical support for the CAEM model (List et al., 2019; List & Alexander, 2017), and particularly the hypothesis that the students' psychological default stances in Phase 2 influenced their source use behaviors in Phase 3.

Interestingly, the backend data revealed no statistically significant differences among the three groups in terms of total time spent on the test, although a trend was observed of G1 > G2 > G3 in average time investment. This finding differs from those of H. Y. Lee and List (2021), who, within the CAEM framework, found that the total time

students devoted to text access was associated with their objective performance on multiple-text tasks. This discrepancy may be attributed to differences in the test environments. In H. Y. Lee and List's (2021) study, students navigated multimodal texts without time constraints, and the test adopted a post-task measure, wherein students first freely learned from multimodal texts before they completed a performance task within a limited timeframe. In contrast, the current study required the students to complete test questions directly by reading multimodal texts within a strictly time-limited environment. Under such conditions, the students' orientation toward achieving good results likely motivated them to complete the test as diligently as possible (Yeom & Jun, 2020). Consequently, despite psychological differences, the time-limited nature of the testing environment may have minimized observable differences in actual reading time investment. This finding also resonates with the observations of Bachman and Palmer (2010) and Forzani et al. (2021), who emphasized the unique role of psychological mechanisms in specific testing environments. These findings suggest that the application of the CAEM model may need to account for contextual factors, such as different reading environments or more granular individual differences (Tsai, 2009; Yeom & Jun, 2020). Furthermore, the results imply that the relationships between default stance, reading behaviors, and performance differences require further exploration and discussion. In the next section, we further discuss these key issues while taking individual differences into consideration.

6.5.2 Effects of disorientation on the online reading performance of the G2 and G3 students

In this study, disorientation was the only strategy that demonstrated a significant influence on the students in both the G2 and G3 groups, whereas other strategies with significant effects were only impactful for one specific group. For the two lower-performing groups (G2 and G3), strategies to mitigate disorientation were particularly effective, even though such strategies were not universally beneficial for all participants.

This finding suggests that disorientation may be a key factor in distinguishing online reading ability, especially considering that the students in G2 and G3 showed no statistically significant difference between their overall performances. The strong influence of disorientation also aligned with previous research, which has consistently identified it as one of the most significant challenges in online reading (Al-Obaydi et al., 2024; Anggraini et al., 2022; K. T.-C. Chen, 2019; Coiro & Dobler, 2007; Gilleece & Eivers, 2018).

The impact of disorientation on the G2 and G3 students' performance can be attributed to several factors. First, both groups struggled with information overload and integration challenges in the online reading environment, often having felt overwhelmed by the volume and diversity of content. They experienced navigation difficulties across multiple web pages and hyperlinks, which often contributed to a sense of being "lost" in the digital space. This challenge was closely tied to the inherent characteristics of online reading, because the nonlinear hypertext structure demands that students engage interactively with content (Coiro, 2021; Schurer et al., 2023). Such an environment places greater cognitive demands on readers, thus requiring enhanced skills for processing and integrating information (H. Huang et al., 2009). To be more specific, the disorientation is particularly evident in learners' inability to construct an effective reading path (Afflerbach & Cho, 2009; B. Cho & Afflerbach, 2017). This study's backend data analysis revealed that the G2 students lost considerable points on hyperlink-related location questions, thus suggesting that they may have struggled to use the cues provided by hyperlinks to appropriately predict target information and plan their reading paths accordingly (B. Cho et al., 2018; Pressley & Afflerbach, 1995). This issue was also reflected in the G2 and G3 students' performance on multitext comprehension questions. Despite dedicating considerable time to such questions (see Table 6.11), they were still unable to answer them correctly. In contrast, the G1 students rarely lost points on hyperlink-related location questions. Notably, when they invested significant time in multitext comprehension tasks, they were often able to answer these

questions correctly. The few points they did lose were primarily tied to multitext comprehension questions on which they spent minimal time, suggesting that their errors were more a result of insufficient engagement rather than of an inability to navigate or comprehend the material.

In addition, the G3 students' tendency to undervalue visual information and focus predominantly on text was another key factor contributing to their disorientation. As is shown in Table 6.10, all nine of the interviewed G3 students lost points, specifically on picture-related location questions. This aligned with their interview responses, in which they indicated that they viewed images as being merely supplementary to the text and assigned them to a secondary role in the reading process. However, the nature of multimodality lies in the interplays between different modes, which work together to construct and convey meaning (Mills & Unsworth, 2017). Consequently, when designing multimodal literacy assessments, researchers intentionally emphasize the relationship between text and visuals. For example, the ePIRLS competency framework referenced in this study explicitly includes questions designed to measure skills such as "Describing the effect of the graphic elements on the website" and "Describing the relationship between text and graphic(s)" (Mullis et al., 2017). In fact, numerous studies have explored the various relationships between text and other modes in multimodal reading contexts, including but not limited to complementary relationships (Mason et al., 2022), contrasting relationships (Otto et al., 2019), interpretational and representational relationships (Carney & Levin, 2002), and redundancy relationships (Zabalbeascoa, 2008). The G3 students' overconfidence, combined with their belief that online multimodal reading is no different from single-modal paper-based reading, limited their ability to engage effectively with visual information in multimodal contexts. Their misconception prevented them from accurately identifying the role of visual elements and recognizing the challenges to comprehension that these elements may present. Their overconfidence not only impaired their ability to navigate multimodal texts but also contributed directly to their disorientation (Bjorklund et al.,

2009). This pattern exemplifies the Dunning–Kruger effect, or the "unskilled-and-unaware" problem (Erat et al., 2022), as discussed earlier.

Moreover, the students in G2 and G3 reported heightened test anxiety in digital environments, which exacerbated their disorientation and hindered their information recall and processing. As a result, both groups—but particularly G3—exhibited inefficient time management, spending disproportionate amounts of time on specific questions, especially those involving visual elements (see Table 6.10). That finding aligns with previous variable-centered research, which identified anxiety as a key factor influencing reading performance (e.g., Carey et al., 2017; Xie & Huang, 2024; Zaccoletti et al., 2020; X. Zhu et al., 2022). This study further confirms that, in a person-centered context, even when students possess a psychological profile composed of multiple emotions and self-efficacy levels, anxiety (at least from the students' self-reported perspective) emerges as the most significant factor impacting their performance in reading tests (Zaccoletti et al. 2020b), especially in cognitively demanding online reading tasks (Afflerbach & Cho, 2009; B. Cho & Afflerbach, 2017; H. Huang et al., 2009; Tsai, 2009). The impact of anxiety on disorientation can be attributed to its disruption of the goal-directed attention system and its tendency to heighten attention to threat-related stimuli (Eysenck et al., 2007). The additional cognitive load poses a significant challenge for anxious students who struggle to allocate attentional resources effectively (Xie & Huang, 2024) and thus leads to greater disorientation and impaired performance. Unlike the G1 students, who demonstrated an awareness of how to regulate their emotions proactively, the students in G2 and G3 lacked such ability. The testing environment's time constraints and performance pressures likely further heightened their anxiety (Bachman & Palmer, 2010; Yeom & Jun, 2020), creating a vicious cycle. As a student described it, "The more anxious I feel, the harder it is to find the information, and then I feel even more anxious." After all, negative emotions are highly contagious (Joiner & Katz, 1999; Joiner, 1994).

6.5.3 Effects of main idea selection on the online reading performance of the G3 students

From the backend data and interview results, it is evident that although the G3 students could clearly articulate some strategies for selecting main ideas, they still lost the most points of the three groups on questions assessing this skill in the online reading test (see Table 6.13). This phenomenon can be attributed to the G3 students' weak strategy transfer skills, as they struggled to effectively apply strategies that they had previously mastered in single-mode (paper-based) reading to the online reading context. The transfer of strategies from paper-based reading to online reading has been well-documented in previous research (Forzani et al., 2021; P.-H. Hsieh & Dwyer, 2009; Y. Lee, 2022; Park et al., 2020; Park & Kim, 2011), particularly in the domain of metacognitive strategies (Anderson & Pearson, 1984; Cain et al., 2004; B. Cho & Afflerbach, 2017). Nevertheless, this study revealed significant differences in the effectiveness and ability of strategy transfer among groups with varying default psychological stances.

According to our interview data, the presence of multimodal elements not only increased the difficulty of locating information but also complicated the process of selecting relevant information. In a multimodal context, learners must actively select, organize, and integrate both visual and textual information to form a coherent mental representation (Mayer, 2024). The G3 students, however, tended to underestimate the value of visual information, and that hindered their ability to flexibly adjust their reading strategies. This starkly contrasted with the G1 students, who explicitly mentioned strategies such as "using prominent images" or "titles in tables" to identify key information. Those differences can be attributed to variations in goal-oriented text processing between the two groups (McCrudden & Schraw, 2007) and means that when

learners study multimodal text without a clear awareness of the task demands, they engage in general coherence-oriented processing (i.e., deriving meaning primarily through the text). Similarly, in an eye-tracking study, Zhao et al. (2020) found that students generally allocated more cognitive resources to a global understanding of the text before shifting their attention to task-specific visual information. Moreover, in our study, the G3 students overlooked the role of images in conveying meaning and exhibited a conflicted psychological response to online reading. On one hand, they found multimodal texts visually appealing, but on the other hand, the complexity of integrating multimodal information from different web pages, combined with exam pressure, triggered strong feelings of frustration and impatience. From that finding, we can reasonably infer that such emotional fluctuations made it difficult for the G3 students to reallocate resources to process visual information after they had addressed a text-based global understanding. This finding further reinforces the significant role of emotions in self-regulated learning (Villavicencio & Bernardo, 2013).

The nonlinear reading environment created by multiple web pages also affected the G3 students' ability to apply main idea selection strategies, as was reflected in their significant struggles with cross-page information integration. Some students attributed this difficulty to the inconvenience of taking notes during online reading, thus highlighting their lack of proficiency in digital note-taking skills. This finding is consistent with previous research showing that electronic note-taking strategies have a significant role in online reading comprehension (Hagen et al., 2014; Y. Lee, 2022). Nevertheless, most of the G3 students perceived multitext reading as being similar to single-text reading—a misconception that was evident in their nearly complete absence of webpage-clicking behaviors. According to Kruger and Dunning (1999), individuals who overestimate their own performance often lack the metacognitive skills necessary to adjust their learning behaviors or make informed decisions. Thus, it is reasonable to infer that the G3 students' lack of awareness regarding the unique demands of multitext reading, coupled with their overconfidence in their working memory, further hindered

their ability to effectively apply metacognitive strategies, such as main idea selection, in cross-text reading tasks (Destan & Roebers, 2015). Although previous studies have suggested that unrealistic optimism can facilitate the completion of novel and challenging task (Bjorklund et al., 1992; Shin et al., 2007), the G3 students' contradictory psychological default stance—characterized by overconfidence combined with susceptibility to environmental or content-based influences—prevented them from benefiting from such optimism. Instead, this overconfidence, paired with their emotional volatility, likely contributed to their failure to recognize the need to adapt their strategies and invest additional effort when faced with the challenges of multitext reading (Dunlosky & Rawson, 2012).

Notably, other metacognitive strategies, such as evaluation and purposeful thinking, had no impact on the G3 students' online reading performance. Unlike the task of identifying the main idea, these strategies demand significantly greater cognitive effort. As noted by Afflerbach and Cho (2009), evaluation and purposeful thinking are higher-order metacognitive strategies that require readers to continuously monitor their understanding and adjust their strategies on the basis of their reading goals. For the G3-students who were already struggling with locating information and identifying key ideas, employing these advanced strategies would have become exceedingly difficult. This finding also aligns with the assumptions of the CAEM model (List & Alexander, 2017, 2018, 2019), which suggests that performance in multitext reading is influenced by cognitive resources, motivation, and emotional factors. Without positive psychological support and the ability to process and integrate basic information, the G3 students were likely to have been unable to allocate the cognitive resources needed to engage in higher-order metacognitive strategies.

6.5.4 Effects of trial and error on the online reading performance of the G2 students

The exclusive effectiveness of the trial and error strategy in the G2 group highlights the impact of psychological differences on reading behaviors, as anticipated by the CAEM framework (List & Alexander, 2017, 2018, 2019). Previous studies have shown that the trial and error strategy helps students actively explore and monitor their understanding and adjust their strategies (Anggraini et al., 2022; Coiro & Dobler, 2007; H. Huang et al., 2009), thus making trial and error a particularly important strategy when students encounter difficulties. For instance, during online reading, students can overcome obstacles by trying different approaches, such as rereading or adjusting their reading scope (Afflerbach & Cho, 2009). However, the psychological default stance of the G2 students was relatively moderate or perhaps even indifferent. Specifically, they lacked a strong intrinsic goal orientation toward challenges and learning new knowledge in online reading. Instead, they exhibited an extrinsic goal orientation, placing value on rewards but showing little concern for performance outcomes. Such a mindset was reflected in their response to difficulties, often adopting an attitude of easily giving up (Kaplan & Maehr, 2007), as expressed in "If I don't understand it, it's fine just to let it go." This lack of enthusiasm and willingness to put in effort may also help explain why the G2 students experienced disorientation. Their indifferent and unmotivated psychological state made them less inclined to adopt a trial-and-error strategy when they could not locate information, because they preferred to avoid "making things difficult" or "feeling uncomfortable." Thus, they became reluctant to activate alternative strategies to understand the text better. In comparison, the G3 students' disorientation was more rooted in anxiety stemming from their strong focus on external recognition. This anxiety likely prevented them from allocating sufficient cognitive resources to process the information they read (Eysenck et al., 2007; Zaccoletti et al., 2020a).

Furthermore, the G2 students' reliance on external assistance may have further undermined their use of the trial and error strategy. When encountering obstacles during reading, they were more likely to wait for help from teachers or parents rather than actively exploring solutions independently. In fact, numerous studies have shown that Chinese parents tend to exert greater control over their children than parents in Western countries do, and that parenting style can influence students' academic performance and behavioral issues (Qin et al., 2009; Q. Wang et al., 2007). This phenomenon was also reflected in the interview responses. Some G2 students mentioned that their parents often displayed impatience when they made mistakes while using an iPad and even took over the task themselves rather than allowing the students to solve the problem themselves. Such behavior has led these students to a lack of interest in reading on electronic devices, as they prefer the sense of control they experience with paper-based reading. The loss of autonomy and control in using electronic devices further weakens their sense of self-efficacy in online reading, which in turn reduces their engagement in this context (Alley, 2019; Gutiérrez & Tomás, 2019; Ryan & Deci, 2017). Although Chinese parents generally exhibit a more authoritarian approach to parenting than parents in Western countries do (Ng et al., 2014), the low parental tolerance for mistakes described by the G2 students was not observed in the interviews with G1 students. Nevertheless, the G3 students also exhibited an overreliance on external support. However, we speculate that this group was more likely than the G2 students were to receive encouragement-based excessive assistance, which may have contributed to their overconfidence. Thus, it is evident that the ways that parents provide support and manage their children play a significant role in shaping their reading psychology (X. Chen & Hu, 2021; S. Zhu, Yao, & X. Zhu, 2024). Future research could further explore this issue in a more systematic manner.

Chapter 7 Conclusions

This chapter summarizes the major findings addressing the research questions, discusses the implications of the results, identifies the limitations of this thesis, and proposes directions for future research.

7.1 Major Findings

This study, grounded in the CAEM model (List & Alexander, 2017, 2018), employed a person-centered approach to investigate the psychological characteristics, strategy use, and assessment performance of Hong Kong fourth-grade students in the context of online reading. Specifically, to address the first research question, latent profile analysis (LPA) was used to examine the online reading default psychological stances—defined by the self-efficacy and emotions—of 280 students. The analysis identified three distinct profiles: positive (G1), moderate (G2), and ambivalent (G3). Of these, the moderate group represented the largest proportion of students, followed by the positive group, and then the ambivalent group. Students in the positive group exhibited high levels of self-efficacy, enjoyed online reading, and reported low levels of anxiety and boredom. In contrast, the moderate group demonstrated moderate self-efficacy and a neutral emotional state that was characterized by neither strong enjoyment nor significant feelings of anxiety or boredom. The ambivalent group, however, displayed the most complex profile, with the highest levels of self-efficacy and enjoyment but also the highest levels of boredom and anxiety. These findings are consistent with the CAEM model's proposition that students exhibit distinct default stances (List & Alexander, 2017, 2018). However, our LPA results suggest that these psychological profiles are more complex than those hypothesized in the CAEM model. Rather than following a clear, linear progression, students' psychological mechanisms appear to be multifaceted and, at times, contradictory.

The study's semi-structured interviews provided further insights into the factors underlying these profiles. The students' self-efficacy was shaped primarily by mastery experiences (e.g., prior academic performance, familiarity with specific reading tasks, frequency of daily use) and social persuasion (e.g., encouragement, criticism, and support from parents or teachers). In contrast, their emotional responses were influenced by intrinsic factors directly tied to online reading, such as past reading experiences, multimodal features, and the themes or topics of the content. In addition, external factors, including the reading environment and family atmosphere, also played a crucial role in shaping the students' emotional responses to online reading.

To examine the second research question, multinomial logistic regression analysis was used to explore whether intrinsic and/or extrinsic goal orientations significantly predicted the formation of the three default stance profiles. The results showed that, when using the positive group as the reference, increases in both intrinsic and extrinsic goal orientations were more likely to help the students in the moderate group develop a positive group profile. However, changes in these goal orientations had no significant effect on the ambivalent group. The interview findings provided valuable qualitative insights into these results. In terms of an intrinsic goal orientation, the students in the positive group demonstrated a noticeable enjoyment of challenges, a willingness to embrace failure, and the ability to use positive self-talk and adjust their reading strategies when facing difficulties. In contrast, the students in the moderate group displayed a more neutral attitude toward challenges. While they occasionally attempted to adjust their strategies, they were more prone to giving up and relying on external assistance when encountering obstacles. In terms of an extrinsic goal orientation, the students in the positive group valued rewards but also placed a strong emphasis on the sense of satisfaction and superiority they gained through comparisons with others. They were highly driven by external recognition and the pursuit of high academic performance. In comparison, the moderate group students appeared to prioritize material rewards while avoiding direct comparisons with others, likely to escape

feelings of inferiority. Although they expressed a desire for good grades and external recognition, they placed less value on these outcomes than the positive group did. In the case of the ambivalent group, their intrinsic and extrinsic goal orientations did not differ statistically from those of the positive group, but the interviews revealed key qualitative differences. In the positive group, intrinsic and extrinsic goal orientations were closely aligned, forming a consistent and mutually reinforcing relationship. Conversely, the students in the ambivalent group seemed not to have fully internalized intrinsic goals for online reading. Instead, their high valuation of intrinsic goals appeared to stem from an awareness that highlighting intrinsic motivation is the "correct" or "positive" stance. This finding aligned with their extrinsic goal orientation, in which they downplayed the importance of academic achievement but emphasized gaining recognition from others.

The third research question was examined using the Wald Chi-square test to determine whether significant differences existed among the groups in their use of strategies and their online reading performance. To mitigate potential limitations of the self-reported questionnaire, backend data—such as multimodal clicks and task completion duration—were also analyzed as supplementary measures. The findings revealed that the ambivalent group reported the highest scores for strategy use on the self-reported questionnaire, yet they performed the worst in online reading tasks. Given their high level of self-efficacy in their default psychological stance, it is reasonable to infer that this group exhibited traits of overconfidence. In contrast, the positive group achieved the highest online reading performance, followed by the moderate group. A similar pattern was observed for strategy use, with the positive group demonstrating a more effective application of strategies, compared with the moderate group. That said, no statistically significant differences were observed among the three groups in terms of multimodal clicks or task completion duration.

To further investigate whether the relationship between strategies and online reading performance differed across the groups, mixture path analyses were conducted to address the fourth research question. The results indicated that disorientation emerged as the most significant strategy because it negatively predicted online reading performance in both the moderate and ambivalent groups. In addition, main idea selection was found to influence online reading performance exclusively within the ambivalent group, while trial and error had an effect solely within the moderate group. Interestingly, no strategy significantly predicted online reading performance in the positive group. Triangulation of these quantitative findings was achieved through an analysis of backend data and interview protocols. Specifically, the middle-click data revealed that the positive group exhibited the fewest mis-clicks and rarely lost points on location questions, despite spending slightly longer on certain image-based location questions. Conversely, both the moderate and ambivalent groups struggled significantly with information-location questions, with many students failing to answer correctly even after spending extended periods of time searching.

The interview findings provided further insights into these patterns. In the ambivalent group, the combination of multimodal elements and the nonlinear structure of online reading posed significant challenges for locating information. Moreover, the test environment induced considerable anxiety, which hindered the students' ability to allocate cognitive resources effectively. Many students in this group experienced a vicious cycle of "the harder it is to find, the more anxious I get; the more anxious I get, the harder it is to find," and that ultimately exacerbated their difficulties. In the moderate group, their generally low intrinsic and extrinsic goal orientations, coupled with average self-efficacy and a lack of strong preferences, often led them to give up when they were unable to locate information, resulting in lost points. This behavior aligned with the finding that trial and error was effective exclusively for the moderate group, and it reflected their limited attempts to persist in the face of challenges. Further analysis of time allocation and error patterns on comprehension questions revealed

significant difficulties for the ambivalent group in those measurements. Although the interviews showed that these students had a basic understanding of main idea selection strategies in paper-based reading, they struggled to transfer that knowledge to the online reading context. Their failure of a successful transfer can be attributed to the objective challenges posed by the multimodal and nonlinear nature of online reading. Moreover, their overconfidence hindered their ability to accurately assess the difficulty of tasks, allocate cognitive resources effectively, and regulate anxiety appropriately.

7.2 Pedagogical Implications

The above results indicate that both the moderate and ambivalent groups not only underperformed in online reading but also exhibited unique psychological needs. For the G1-profile students, because their default psychological stance is highly positive, and no strategy was found to impact their online reading performance significantly, teachers should pay more attention to sustaining their current psychological stance. For G2-profile students, teachers and parents should focus on fostering their intrinsic and extrinsic goal orientations. For G3-profile students, however, efforts should be directed toward addressing their tendencies toward overconfidence and anxiety while guiding them to genuinely internalize intrinsic goal orientations.

7.2.1 Suggestions for the positive group (G1)

According to both our quantitative and qualitative findings, the students in the high-performing (positive) group exhibited stronger intrinsic and extrinsic goal orientations than those in the moderate group did. Even more importantly, they appeared to integrate these orientations in a mutually reinforcing way, forming a positive motivational cycle. This suggests that instruction should build on this group's advantageous motivational traits to further enhance their learning engagement and online reading proficiency.

To leverage the positive students' high level of intrinsic goal orientation, educators can design challenging yet autonomy-supportive reading and writing tasks within online platforms. For instance, allowing students to choose from a range of digital reading materials, set personalized goals, and receive timely, formative feedback can enhance their perceived task value and foster a sense of ownership. This aligns with the core tenet of autonomy in the Self-Determination Theory (Deci & Ryan, 2000). At the same time, given their strong extrinsic goal orientation, online learning environments can incorporate visual achievement systems—such as badges, leaderboards, and progress trackers—and provide opportunities for public sharing and peer evaluation. These features can support students' needs for recognition and social comparison (Pintrich, 2000; Dweck, 2006), thereby sustaining motivation and engagement over time. Furthermore, digital tools such as online writing journals or AI-generated feedback can be used to facilitate their metacognitive reflection and motivational self-regulation. For example, students can be guided to regularly reflect on their reading strategies, monitor progress toward goals, and evaluate feedback, thus deepening their awareness of both the purposes and processes of learning (Zimmerman, 2000).

7.2.2 Suggestions for the moderate group (G2)

The regulation of students' goal orientations is closely tied to their teachers' ability to effectively manage the classroom environment. Research consistently shows that students' inner drive for learning declines significantly with age (Gottfried et al., 2001). This decline, along with negative changes in self-perception, is often attributed to a misalignment between adolescents' evolving developmental needs and their social environments, particularly the classroom (Eccles et al., 1993). To address these challenges, the TARGET framework (Ames, 1992) has been proposed as a prominent model for fostering goal orientation in educational settings. This framework identifies six key instructional strategies—task, authority, recognition, grouping, evaluation, and time—that can be used to enhance students' goal orientation. The effectiveness of the

TARGET framework has been supported by evidence from numerous longitudinal studies (e.g., Lau & Lee, 2008; Lüftenegger et al., 2014).

To foster G2-profile students' intrinsic goal orientation, classroom tasks should be designed to highlight the inherent value and meaning of specific activities, thus enabling the students to experience the satisfaction and enjoyment of completing them. For instance, teachers can select engaging reading multimodal materials that connect to the students' lived experiences, guiding them to achieve both emotional resonance and cognitive growth through reading. For G2-profile students, it is also particularly important to ensure that tasks are appropriately challenging by adhering to the principles of the Zone of Proximal Development (ZPD) (Moll, 1990; Murayama & Elliot, 2009). We have shown that when tasks are overly difficult, these students are more likely to disengage and give up easily.

Addressing these students' needs regarding authority involves providing students with opportunities to actively participate in classroom decision-making, thereby fostering a sense of autonomy (Ryan & Deci, 2017). Actively promoting the students' sense of autonomy is especially critical for G2-profile students, who have expressed a preference for traditional paper-based reading due to the greater sense of control it affords them. Teachers could, for example, allow students to select multimodal reading materials from a curated list, thereby enabling them to choose topics that align with their individual interests (Flowerday & Schraw, 2000). During discussions and classroom exchanges, teachers should also create an inclusive and open environment, ensuring that all students have the opportunity to share their perspectives and feel a meaningful sense of involvement in classroom decision-making processes.

For incorporating recognition, teachers should prioritize the quality of students' thought processes rather than merely assessing the correctness of their responses (Brookhart, 2014). This shift in focus helps students to feel valued for their intellectual effort and critical thinking, rather than solely for producing "correct" answers.

To achieve a helpful form of grouping, creating an inclusive and "error-friendly" environment is essential, particularly for G2-profile students, who are often hesitant to participate online reading due to their fear of making mistakes. To cultivate grouping, teachers could introduce icebreaker activities during the early stages of group discussions, such as inviting students to share the challenges they have faced during reading or intentionally presenting questions that might lead to misunderstandings. These exercises would allow students to experience the process of "falling into traps" and would help them recognize that everyone encounters blind spots or interpretive errors.

For the key strategy of evaluation, teachers should focus on individual progress in reading competencies. Beyond assessing objective outcomes, they are urged to guide students to engage in regular self-reflection, encouraging them to evaluate their progress in areas such as strategy use, comprehension depth, and critical thinking (Zimmerman, 2000). Tools such as self-assessment checklists or portfolio evaluations can help students objectively measure their growth over time. Feedback, meanwhile, should be individualized and descriptive, highlighting specific areas of improvement and providing actionable suggestions for further development (Yao & Zhu, 2024). Such a growth-oriented evaluation approach enhances students' self-efficacy and motivates them to strive for continuous improvement.

Finally, regarding time, online reading instruction should allow students greater autonomy in managing their learning schedules. Teachers should provide ample time for students to pace their reading, explore interconnections across texts, and construct their own reading pathways. That flexibility would enable students to delve deeper into textual meanings and explore the interplay between text and visuals. By empowering students to control their learning pace and invest adequate time and effort in reading, teachers can foster sustained engagement and cultivate a genuine interest in reading.

In addressing extrinsic goal orientation, while research often associates such a goal orientation with surface-level reading comprehension and strategy use (Ames, 1992; Dweck, 1986), its positive impact on academic achievement is well-recognized, particularly in the typically competitive East Asian educational contexts (Lau & Lee, 2008a).This positive influence is partly rooted in the influence of Confucian traditions, which emphasize the critical role of effort in achieving excellent academic performance (Stankov, 2010; Sue & Okazaki, 2009). Consequently, Chinese students may benefit especially well from a combination of intrinsic and extrinsic goal orientations. Indeed, research has indicated that performance-oriented students often adapt more effectively in competitive environments than those in mastery-oriented settings do (Barron & Harackiewicz, 2003). For Hong Kong students, therefore, fostering an extrinsic goal orientation alongside an intrinsic goal orientation is both advantageous and necessary. Importantly, promoting extrinsic goals does not inherently conflict with nurturing intrinsic goals. For instance, in task design, teachers can focus on creating tasks that are appropriately challenging, thereby allowing students to experience a sense of accomplishment. In recognition, the emphasis should shift toward effort-based attributions. Teachers should provide timely, specific feedback that highlights students' progress and attributes success to effort and effective strategy use, rather than to innate ability (Dweck, 2006). At the levels of authority and grouping, teachers can provide students with opportunities to present their work, either in groups or individually, thus fostering a sense of social comparison (Peura et al., 2021). However, teachers must also pay attention to establishing an environment that mitigates tendencies toward performance-avoidance goals. Such an environment can be achieved by fostering an error-tolerant culture in which mistakes are seen as opportunities for growth and are supported by objective but encouraging feedback.

Beyond these strategies, both teachers and parents should recognize the importance of perceived instrumentality (Lau & Lee, 2008). Teachers can support students in setting long-term goals and can clarify the connection between current learning and future

aspirations. For example, prior to an online reading assessment, teachers might explain that the test not only helps students identify their strengths and weaknesses in digital reading, but it also simulates real-world scenarios they will encounter in academic, professional, and personal contexts. Through such a process, students can learn essential skills such as locating information efficiently in complex digital environments, integrating multimodal information for comprehension, and evaluating the reliability of online content—skills that are critical for future success. In instructional design, long-term goals should be deconstructed into manageable, incremental subgoals. For instance, teachers can guide students step-by-step in mastering subskills, such as using online tools for information navigation, integrating textual and visual representations, and evaluating information reliability. By providing students with a clear pathway toward larger goals and opportunities for experiencing achievement at each step, teachers can help sustain students' interest and motivation (Dörnyei, 2005). Moreover, teachers and parents should encourage students to connect their personal goals to the learning content independently, thus fostering intrinsic perceptions of instrumentality. In contrast to an external emphasis on the utility of learning, when students themselves recognize the value of knowledge and skills for their personal development, their motivation tends to be more enduring. As this study's G1 students noted, their enjoyment and intrinsic goal of reading helped them gain prior knowledge, making the online reading exam easier. This success then motivated them to read more and deepened their love for reading.

7.2.3 Suggestions for the ambivalent group (G3)

For students in the G3-profile group, this study recommends that teachers provide more explicit background information and targeted training for online reading tasks. Specifically, in accord with the characteristics of online reading, instruction should focus on teaching strategies for locating and extracting key information effectively in an online reading environment. Findings from the interviews indicate that, although

G3-profile students are aware that multimodal elements and the nonlinear reading environment can hinder their comprehension, their overconfidence prevents them from fully recognizing the differences between paper-based and online reading tasks, as well as the necessity of adjusting their strategies accordingly. This finding is supported by previous research, which has demonstrated that students with greater expertise in a task or subject area are more likely to evaluate their abilities objectively (Barber & Odean, 2001; Erat et al., 2022).

In addition, improving students' online reading performance requires fostering their awareness of self-regulating the learning process (Pintrich, 2004)—a process that is closely linked to objective self-assessment. To support this effort toward self-regulation in learning, some scholars propose incorporating classroom activities that guide students in designing their own test questions—an approach that would allow students to develop a clearer understanding of the skills required for online reading tasks. By making judgments about their academic outcomes—or, more specifically, evaluating their own performance—students are able to temporarily adopt their teachers' perspective (Erat et al., 2022). This new awareness can encourage students to think about the subject matter more objectively, expand their cognitive capacity, and foster deeper self-reflection (Jones, 2019). For example, G3-profile students often undervalue the role of multimodal elements. Teachers can address the tendency to undervalue multimodal resources by guiding students to design test questions that focus on the relationship between text and images. Such an activity encourages students to explore the various functions that images can play in conveying meaning, thereby helping them critically reflect on their inappropriate undervaluation of multimodal elements.

Moreover, providing appropriate feedback is an effective strategy for reducing overconfidence (Erat et al., 2022), because detailed and precise feedback enables students to better assess their own skills and abilities (Eberlein et al., 2011). To address the overconfidence observed in G3-profile students, teachers could prioritize providing

specific and detailed feedback on tasks related to information location and main idea selection after each online reading activity. Meanwhile, considering the students' preference for team-based activities over individual ones, peer-to-peer feedback could be integrated as a complementary approach (Pokorny & Pickford, 2010). Inviting G1-type students to participate in these activities could be particularly effective, because their stronger performance and insights may carry greater influence on G3 students. Knowing that G3-profile students place significant value on the opinions of others, feedback from higher-performing peers is likely to be taken more seriously and thus to encourage deeper reflection and more meaningful adjustments.

Finally, our interview findings revealed that the anxiety experienced by the G3 students stemmed from two key sources. One was that their overconfidence prevented them from allocating appropriate cognitive resources to efficiently manage tasks in a test environment. The other was that their reliance on assistance from parents or teachers contributed to a learned dependency, which then further reinforced their belief that they rarely encountered challenges—and that in turn perpetuated their overconfidence. In reality, help-seeking is particularly critical for students who are navigating new learning tasks because it allows them to integrate the assistance they receive into their existing knowledge framework, to resolve cognitive dissonance, and ultimately to achieve their learning goals (Piaget, 1968; Vygotsky, 1978). Therefore, as with G2-type students, fostering appropriate help-seeking behaviors for G3-profile students will strongly necessitate collaboration between schools and families, including parent training programs.

To be more specific, it is essential for teachers and parents to provide instrumental help that prioritizes teaching the learner how to solve academic problems rather than simply providing answers, as opposed to executive help, which involves directly supplying solutions and thus absolves the learner of responsibility for problem-solving (Gall, 1985). Given the G3 students' reliance on their parents and their overconfidence, it can

be inferred that much of the parental support they received likely fell under the category of executive help—a type of assistance that often leads to surface-level success achieved at the expense of the learning process (Magnusson & Perry, 1992). Moreover, the development of instrumental help-seeking is closely tied to the internalization of intrinsic goal orientations (Fong et al., 2021). When students engage in instrumental help-seeking, they actively seek assistance to improve their understanding and competence in the learning material (Karabenick, 2004). In fact, the process of seeking help to master the learning content can foster a sense of personal responsibility for learning and a focus on self-improvement (Newman, 2008). As students experience the benefits of instrumental help-seeking in enhancing their skills and knowledge, they may internalize the value of learning for mastery and adopt personal mastery-approach goals (Meece et al., 2006).

7.3 Significance, Limitations, and Future Directions

This doctoral dissertation represents a pioneering effort to examine the roles of psychological mechanisms—specifically motivational and emotional variables—in shaping online reading strategies and performance within a testing environment. It is also the first systematic exploration of the emerging Cognitive Affective Engagement Model of Multiple Source Use (CAEM) (List et al., 2019; List & Alexander, 2018, 2019). By adopting a person-centered perspective, the study provides empirical support for the theoretical assumptions that underlie the three phases of CAEM, and it extends the CAEM framework by uncovering complexities in students' default psychological stances that go beyond theoretical predictions. For instance, the findings suggest the existence of contradictory psychological profiles, which challenges the simplicity of the categorizations in the CAEM. Furthermore, the study identified distinct patterns in how students with varying psychological profiles appear to regulate their strategies and perform under test conditions, and it used qualitative data to explore the underlying mechanisms driving those differences.

Moreover, this research addresses a significant gap in the existing literature on online reading, which has predominantly focused on Western contexts and learners of English as a second language. By shifting the lens to a Chinese-speaking environment, the study has revealed how the emphasis on academic achievement in East Asian cultures shapes students' psychological profiles. Specifically, it has demonstrated how an extrinsic goal orientation interacts with an intrinsic goal orientation to foster positive profiles, thereby promoting more effective online reading behaviors. These findings offer valuable insights for understanding online reading in non-Western contexts and contribute to the broader theoretical and practical implications of the CAEM in diverse educational settings.

From a pedagogical perspective, this study focused on fourth-grade students in Hong Kong, providing findings that can directly inform such students' online reading instruction. The results offer practical psychological interventions and guidance for strategies to support students' preparation for the 2026 ePIRLS online reading assessment. The study underscores the importance of teachers understanding students' psychological traits and tailoring interventions to the students' different default psychological stances. For students with a moderate profile, teachers are suggested to focus on both intrinsic and extrinsic goal orientations to help them develop a more positive psychological profile. For students with ambivalent profiles, special attention should be given to addressing issues such as overconfidence and helping the students develop a proper understanding of the complexities of online reading.

In terms of online reading strategies, the study's findings highlight the challenges posed by multimodal elements and the nonlinear nature of online reading spaces, which can cause students to lose their way. Teachers should also focus on helping students transfer effective strategies from print-based reading to online reading environments. Such assistance should include guiding students to properly understand and adapt to the difficulties they may encounter in online reading, offering them specific problem-

solving strategies, and encouraging them to engage in more trial-and-error learning. By addressing these areas, teachers can better equip students to navigate the unique demands of online reading effectively.

Despite its theoretical and pedagogical significance, this study was not without limitations. First, as with all cross-sectional studies, it overlooked potential psychological changes that students may experience over time. In reality, students' motivation and emotions are often dynamic and subject to significant shifts over time (Dornyei & Ryan, 2015). In addition, as students grow older, their learning motivation tends to decline (Peura et al., 2021; X. Zhu, Chan et al., 2023), and increasing academic pressure may further exacerbate this decline by shifting their focus toward extrinsic goal orientation, thereby reducing their internal goal orientation and heightening their anxiety. These changes can, in turn, impact students' online reading behaviors and performance. To address this limitation, future research could build on the person-centered approach by incorporating longitudinal data collection to capture the temporal dynamics of self-efficacy and emotions. Advanced quantitative techniques, such as latent transition analysis and latent growth curve modeling, could also be employed alongside qualitative interview data to offer a more nuanced and dynamic perspective.

Second, this study relied on questionnaires and backend data to investigate online reading behaviors. However, self-reported data may not always align with students' actual reading behaviors. Although backend data can capture certain reading behaviors, such as reading time and the frequency of clicks on multimodal elements, it falls short of fully capturing students' cognitive processing during reading. Eye-tracking data, on the other hand, offers more direct and granular evidence, shedding light on cognitive processes such as attention allocation, information extraction, and integration (Rayner, 2009). For instance, by analyzing fixation durations and regression counts in specific text regions, researchers can infer students' priorities and areas of comprehension difficulty (Hyönä, 2010). Similarly, patterns of forward and backward saccades can

reveal higher-order cognitive activities such as prediction, inference, and summarization during reading (Bax, 2013). Incorporating eye-tracking measures into online reading strategy research not only provides objective evidence of students' reading behaviors, it also offers critical insights into the cognitive mechanisms that underlie online reading. Future studies could integrate eye-tracking data with traditional methods such as questionnaires, interviews, and backend analytics to explore the cognitive processes behind different reading strategies and their relationship with psychological profiles. Such an approach would yield more precise and effective guidance for optimizing online reading instruction. Moreover, the relatively limited number of participants in this study constrained the use of structural equation modeling (SEM), and thus a path analysis was conducted instead. Future research with larger sample sizes is encouraged to employ SEM, in order to achieve more robust model testing and validation. What's more, in addition to the three emotional variables examined in this study, a broader range of emotions deserves consideration—particularly with regard to balancing the number of positive and negative emotional variables.

Finally, this study primarily focused on students, without systematically considering the influence of teachers and parents on their goal orientations and psychological profiles. Although our interviews revealed that teachers' and parents' attitudes and feedback regarding students' online reading behaviors can impact their self-efficacy and emotions, the study did not delve deeply into the mechanisms of these external factors. Because previous research has demonstrated that teachers' and parents' expectations, support, and feedback styles significantly shape students' learning motivation and behaviors (Senechal & LeFevre, 2002; Van Tetering & Jolles, 2017; S. Zhu, Yao, Chan, & Zhu, 2024a), future research should adopt a more holistic and ecological approach (Morrow, 1989; Vygotsky, 1978). By integrating individual differences with environmental influences, researchers can better understand how feedback from teachers and parents across various social contexts shapes students'

motivation and behavior. Such an approach could provide valuable insights for fostering a supportive online reading ecosystem.

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Appendix A Formal Assessment Task

閱讀任務：保護大自然

年級：KS2

網頁一：	網頁二：	網頁三：	網頁四：
人類對大自然的破壞	森林中的危機	海洋受到的威脅	全球合力保護生態

老師導語 1：

大自然對人類的生存十分重要，我們該如何保護它呢？

下一步

老師導語 2：

我們先來看看人類的哪些活動破壞了大自然。

下一步

網頁一：人類對大自然的破壞（字數：593）

人類許多的不當活動嚴重破壞了大自然，例如：過度捕魚和砍樹、污染環境、過度開發工業與商業等（見圖 1）。那原本的大自然是怎樣的？人類的行為又是怎樣破壞它的呢？

圖 1 造成生物滅亡的人類活動

導致全球暖化

我們的大自然原本擁有清新的空氣，肥沃的土地，各種生物共存。地球通過吸收太陽的能量來維持一個理想的温度——15°C，這有利於萬物健康生長。

這是怎麼做到的呢？原來，環繞着地球有一個氣層叫做「大氣層」，這層空氣把從太陽吸收來的能量鎖在地球的表層，這就叫做「温室效應」。通過温室效應，地球的温度就能保持得剛剛好，讓動物可以生存。

全球暖化是「温室效應」過度而造成的現象，持續的全球暖化會引起冰川融化，海平面上升，還會出現極端惡劣的天氣。例如 2022 年夏天，歐洲出現極端高温，英國的温度就曾高達 43 度呢！

圖 2 温室效應與全球暖化

破壞生態平衡

在地球的自然環境裏，原本有着平穩的生態系統，適合人類、動植物與微生物生存和繁衍後代。生態系統是指在自然界的空間裏，生物與環境互相依存，形成良好的循環。在生態系統中，各種生物之間的捕食關係形成了「食物鏈」。當食物鏈中的生物能良好生長，比牠高一級的生物就有了食物而生存下來，不至於滅亡。由生物之間所形成的食物鏈如果能保持下去，便可維持生態系統的平衡。

食物鏈舉例：

人類的不當活動會破壞生態系統的平衡，例如，人類過度砍樹已經使地球在過去幾十年中失去超過一億公頃的熱帶雨林（相當於九萬個香港的面積），很多動物因此失去了家園和食物，最終破壞了生態系統的平衡。

（廣告圖 出現在網頁最下方）

1. 本網頁哪個標題有提到地球的理想温度？(1 分)

A. 導致全球暖化

B. 導致温室效應

C. 破壞生物平衡

D. 破壞生態平衡

2. 根據圖 2，英國的極端溫度帶來甚麼不良影響？(1 分)

3. 網頁中「全球暖化」的超鏈接，有助於我們瞭解甚麼內容？(1 分)

A. 大氣層的總厚度

B. 甚麼是温室效應

C. 全球暖化的原因

D. 全球暖化的危害

4. 請結合網頁中這句話：「全球暖化是『温室效應』過度而造成的現象」和圖 3，解釋温室效應如何加劇全球暖化現象。(2 分)

老師導語 3：

我們再來瞭解一下森林面臨哪些危機。

下一步

網頁二：森林中的危機（字數：508）

森林是維持生態平衡的重要因素，為人類以及各種生物提供天然的保護傘和大量的食物、營養。人類是生態系統的一部分，也是森林資源的使用者、開發者，但是人類的不當活動會破壞生態系統的平衡，導致森林也響起了警鐘！

生存環境被破壞

為了開發農田、開採木材，人類大量砍樹，大大減少了樹木數量、森林面積（見圖 1）。自 1990 年以來，非洲西部沿海一帶 90%的森林消失，亞洲南部的森林面積減少了 88%。從 2021 年熱帶原始森林覆蓋面積減少最多的前 10 位國家（見圖 2）的情況可看出這一點。森林的消失使很多動物失去家園，以致數量日漸減少，例如世界上只剩下不到 600 隻蘇門答臘虎，而野生遠東豹的數量更少於 100 隻。

圖 1 大量森林被砍伐

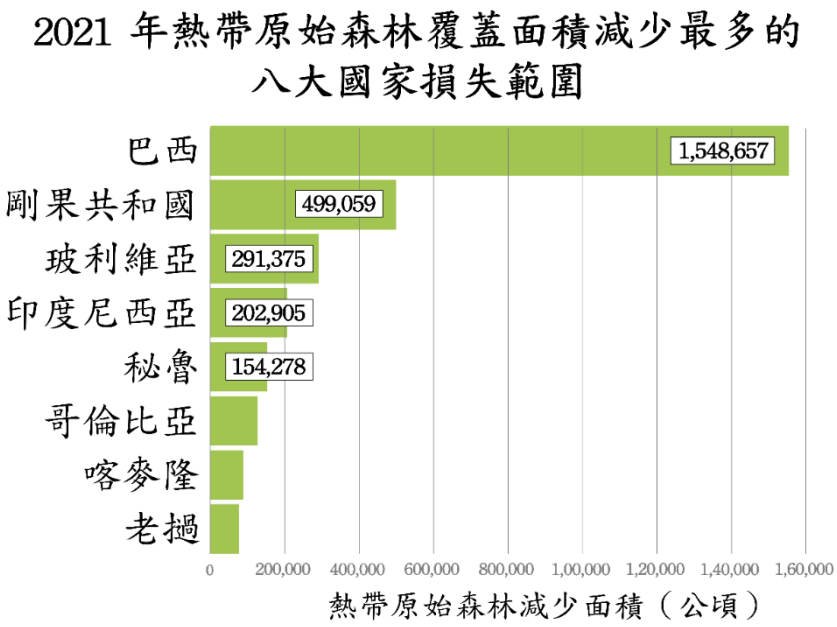


圖 2 2021 年熱帶原始森林覆蓋面積減少最多的國家

另外，全球暖化、氣温上升容易發生山火，很多動植物因此被活活燒死。例如，2019 年澳洲爆發的森林山火燒死了三成樹熊和袋鼠，另有多達 5 億隻動物葬身火海。過度的砍樹和頻繁的山火，使大量的動物因為失去同伴和家園，無法找到食物，也逐漸走向滅亡。

森林的消失，令大自然的食物鏈被中斷（見圖 5）。例如樹木被砍或者山火，會使兔子失去食物。如果兔子因為沒有充足的食物而死亡或消失，那麼狐

狸就失去牠的食物來源。因此，一個物種的消失，會導致這個食物鏈上其他物種的消失，也就破壞了原有的生態平衡。

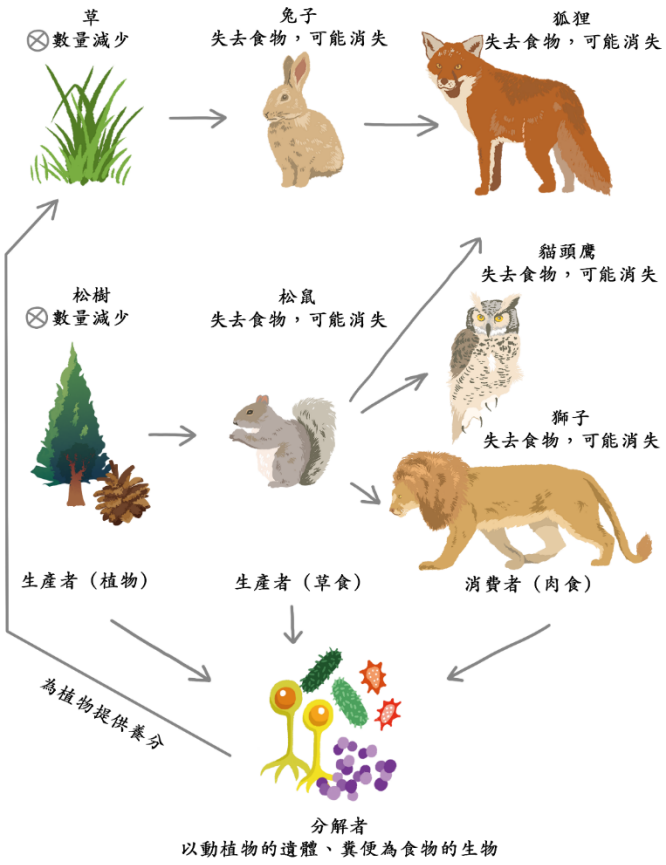


圖 5 被破壞的食物鏈

5. 本網頁哪裏可以瞭解到蘇門答臘虎和野生遠東豹數量減少的原因？(1 分)

生存環境被破壞的標題內容

生態平衡被打破的標題內容

圖 3 山火導致動物失去家園

圖 5 被破壞的食物鏈

6. 2021 年哪個國家不是森林覆蓋面積減少最多的前三個國家？(1 分)

A. 印度尼西亞

B. 玻利維亞

C. 剛果共和國

D. 巴西

7. 本網頁主要傳達甚麼訊息？ (1 分)

A. 分析森林消失的原因和影響

B. 比較動物和植物的生存環境

C. 說明山火威脅着動物的生存

D. 教導大家認識食物鏈的特點

8. 請結合本網頁內容與圖 3、圖 4、圖 5，簡述山火對生態平衡的破壞。(3 分)

9. 以下是四個超鏈接的標題。如果想知道食物鏈對維持生態平衡的重要性，應該點選哪個超鏈接？(1 分)

A. 超鏈接一：現代食物供應鏈對國民生計的重要性

B. 超鏈接二：齊齊種草養花：談談食物鏈的生產者

C. 超鏈接三：少了誰都不可行：食物鏈與生態平衡

D. 超鏈接四：全民保護生態平衡：大家一起愛環保

10.作者對人類破壞森林資源的行為持甚麼看法？為甚麼？(3 分)

11. 網頁一與網頁二均提到過度砍伐森林會造成甚麼影響？(2 分

A. 人類不夠食物和資源

B. 動物失去食物和家園

C. 自然災害會經常發生

D. 破壞生態系統的平衡

E. 國家之間會發生衝突

老師導語 4：

我們再來瞭解一下海洋受到甚麼威脅。

下一步

網頁三：海洋受到的威脅（字數：508）

人類的不當行為對海洋造成威脅特別是污染海洋和過度捕魚的行為，極大地危害海洋生物。

嚴重的污染

雨水為海洋補充了綿綿不斷的水源。然而，近年來的城市工業化發展迅速，化工廠、汽車排放大量廢氣，容易形成酸雨。一旦酸雨降落下來，就不僅會危害土壤和動植物，也會對海洋造成威脅。其過程是這樣的：

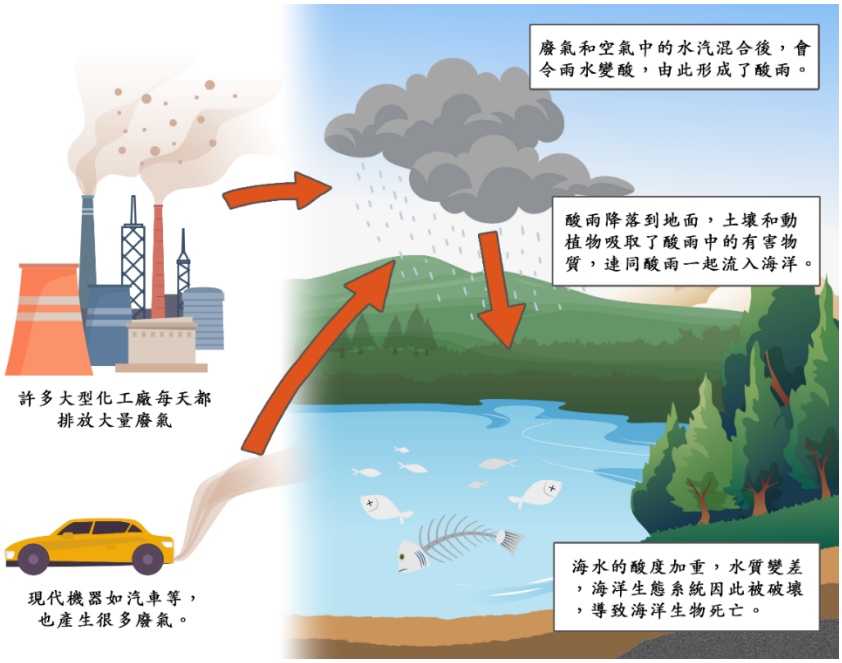


圖 1 酸雨對海洋的威脅過程

除了酸雨外，工業廢水和生活中的垃圾排放到海洋中，也會污染海水，破壞海洋的生態系統。許多工廠的化學品、廢水，農場上的廢物、污水，以及人類每天製造的生活垃圾，如塑膠袋、飲管、剩餘飯菜、糞便等，都會經陸地而流入海洋，令很多海洋生物無法在受污染的海水中生存，數量日漸減少。

圖 2 陸地活動造成海洋污染

根據世界環保組織評估，目前約有四分之一的海洋生物生存受到威脅。例如，全球只剩下約 20 萬頭綠海龜，屬於瀕危物種。又如白鮑魚的數量曾經有數百萬隻，但目前已減至只有 1600 到 2000 隻之間，屬於極度瀕危物種。

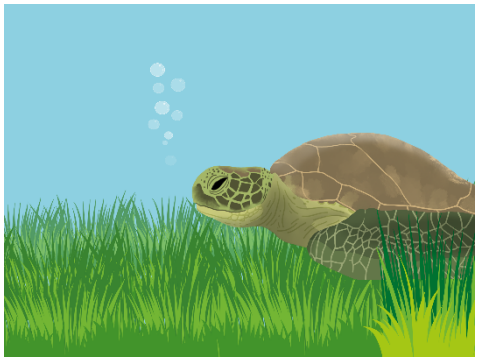


圖 3 綠海龜

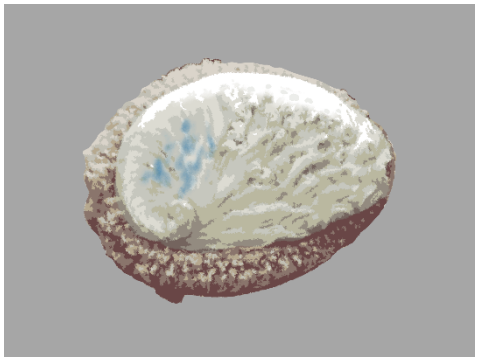


圖 4 白鮑魚

過度的捕撈

全球本來有着多樣化的海洋生物種類，但人類為了生計及私利，過度捕撈海洋生物，令大量海洋生物的生存面臨威脅。例如在香港，黃唇魚的魚鰾是價值很高的花膠，漁民們都渴望捕捉，結果導致黃唇魚在香港也越來越少。而在印度洋的愛德華王子島，圓鱈魚因有利可圖而被大量捕捉，在短短兩年間就幾乎滅絕了。

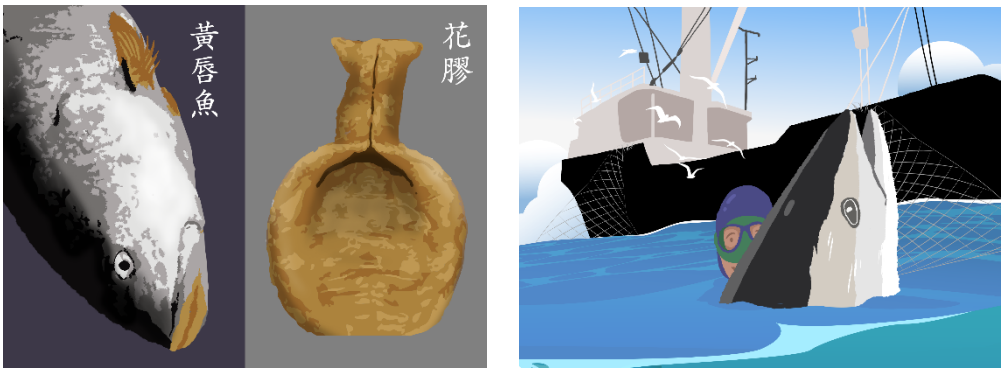


圖 5 珍貴的黃唇魚

12. 結合本網頁內容，圖 1 想表達甚麼信息？(1 分)

A. 氮氫化物的來源及特點

B. 二氧化硫的成因及危害

C. 雨水形成時的化學反應

D. 酸雨形成的過程及影響

13. 根據圖 2，判斷下列說法是否正確。 (1 分)

有 80%的海洋垃圾來自海洋生物。（正確 / 錯誤）

14. 這個網頁主要傳達甚麼訊息？ (1 分)

A. 人類經常大量捕魚的收穫

B. 酸雨的形成和該如何預防

C. 污染和過度捕魚破壞海洋

D. 黃唇魚受漁民歡迎的原因

15. 森林和海洋面臨危機的原因有甚麼相同之處？請根據網頁二與本網頁的內容加以說明。(1 分)

16. 最近網站流傳一則消息：「若在海邊游泳時塗防曬乳，其中的某些物質可能會危害海洋。」你認為這則消息可信嗎？為甚麼？(1 分)

A. 可信，因為全世界的海灘和游泳池已全面禁止塗防曬乳。

B. 可信，因為防曬乳中的化學成分會影響海洋生物的生存。

C. 不可信，因為防曬乳中的有機物質為海洋生物提供營養。

D. 不可信，因為防曬乳中的化學成分不會被海洋生物吸收。

17. 如果告訴漁民有關「圓鱈魚已經瀕臨滅亡」的消息，你認為他們會因此而停止捕捉嗎？為甚麼？(2 分)

18. 結合網頁一至三的內容，下列哪些是人類保護大自然的正確行動？ (2 分)

A. 外出多乘坐公共交通工具

B. 將一些零食扔到海裏餵魚

C. 堅持不吃魚翅等海鮮製品

D. 把生活廢水等排放到河流

E. 到郊野公園捕捉珍貴蝴蝶

老師導語 5：

我們來看看不同國家和地區保護生態環境的做法。

下一步

https://kknews.cc/zh-hk/eae2023/g8mxnq9.html

今年的世界環保大使選舉將於 9 月 16 日在瑞士日內瓦舉行，今年的參與人數遠超去年……

香港人人愛地球繪畫比賽

https://lovetheearth.com/8/hib7c5eec.html

香港是一個注重綠化環保的國際大都會，每年都會舉行人人愛地球的繪畫比賽，教導年輕人……

不同國家和地區如何保護生態

https://kknews.cc/zh-hk/protectecology/9eeq3ne.html

所有生物都是維持生態平衡的重要一環，許多國家和地區都為此而努力，……

要生存還是要生態

https://kknews.cc/zh-hk/hotissue/v8pq3q.html

當人類的居住環境越來越簡陋，食物越來越不足夠時，究竟我們是要繼續生存下去還是空談理想要生態保育呢……

網頁四：全球合力保護生態（字數：392）

所有生物都是維持生態平衡的重要一環，許多國家和地區都為此而努力，成功解決了許多生態危機。

加拿大的大熊雨林

大熊雨林（見圖 1）在加拿大西部，1990 年，只有 5%的林地受到保護，許多野生動物因此失去家園。加拿大卑詩省政府在 2009 年頒布了雨林保護計劃，立法禁止居民在雨林保護區內進行開採，於是，超過 85%的林地得到保護（見圖 2）。

圖 1 大熊雨林裏的動植物

大熊雨林：

佔地 640 萬公頃，是世界上最大的沿海温帶雨林。

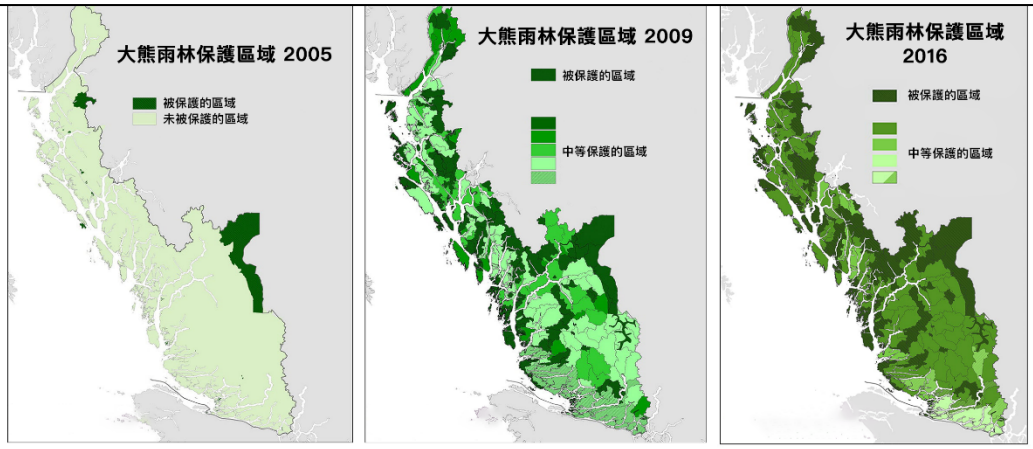


圖 2 大熊雨林保護區域

澳洲的大堡礁

大堡礁在澳洲東北海岸，是世界最大最長的珊瑚礁群（見圖 3、圖 4）。大堡礁大部分區域都得到大堡礁海洋公園的保護，同時，澳洲政府計劃發展新一代工具和技術，以解決因為海水温度上升和海水污染而造成的珊瑚白化問題。

圖 3 原本健康的珊瑚群

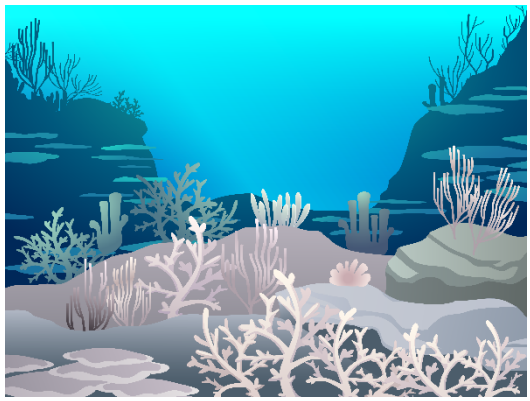
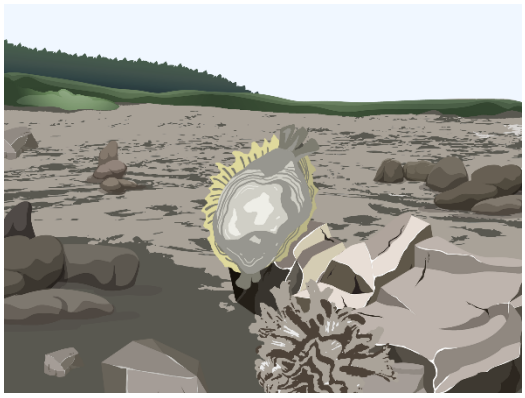


圖 4 海洋生態破壞後白化的珊瑚群

香港的蠔礁

香港的蠔礁（見圖 5）在過去數十年受到過度捕撈和開採的傷害，蠔的數量大大減少，海洋生態環境也逐年惡化。為了讓蠔礁復原，本地的大自然保護協會與香港大學合作，在香港西北部后海灣展開首項蠔礁生態研究及恢復工作，持續監察蠔礁的生長狀況及其對生物多樣性和水質的影響。



19. 看看左邊的搜尋結果。哪個網頁能幫你瞭解世界各地合力保護生態的措施？(1 分)

20. 以下哪個方法最容易讓我們瞭解大熊雨林保護計劃的成果？(1 分)

A. 瀏覽小標題「加拿大的大熊雨林」的內容

B. 查看大熊雨林保護區域的三幅圖（即圖 2）

C. 點擊大熊雨林的超鏈接

D. 查看網頁二的內容

21. 根據「澳洲的大堡礁」的文字和圖片，以下哪項是圖 3 和圖 4 主要傳達的信息？ (1 分)

A. 分辨珊瑚的不同種類和顏色的特點

B. 觀看珊瑚如何和魚共同生活的情景

C. 瞭解大堡礁受颱風破壞的主要原因

D. 認清大堡礁所面臨的珊瑚白化危機

22. 本網頁提到香港蠔礁數量減少，是印證了網頁二海洋所受到的哪一個威脅？(1 分)

A. 垃圾的排放

B. 酸雨的形成

C. 嚴重的污染

D. 過度的捕撈

23.根據網頁內容，試分別說明加拿大、澳洲和香港保護生態的措施。(3 分)

24.根據網頁三和本網頁的內容，判斷下列說法是否正確。 (1 分)

大堡礁珊瑚白化和香港黃唇魚瀕臨滅亡都是與人類過度捕捉而令海洋生物受到危害有關。（正確 / 錯誤）

25.本網頁舉出了三個地方保護生態環境的方法，作者對這些方法有甚麼評價？你同意作者的看法嗎？為甚麼？(3 分)

Appendix B Questionnaire

構建數碼閱讀平台提高小學生線上閱讀能力

小學第二階段 KS2

學生調查問卷

親愛的同學，以下問卷是為了調查您在線上閱讀時候的學習行為與心態。問卷一共分為兩個部分，第一部分為”基本信息”第二部分為”在線閱讀的學習心態與興趣”。請認真閱讀每道題目根據你的真實情況，圈出對應的數字。所有題目沒有對錯之分。 答題時間為 25 分鐘。在答題過程中，您有任何不明白的地方均可向測試人員尋求協助。您填寫的信息將嚴格保密，並對您的學業表現無任何影響，請放心作答。

作答示例

	非常不同意	不同意	不確定	同意	非常同意

1. 我更喜歡有挑戰性的線上閱讀材料，因此我就能從這些材料中學到新東西。	1	2	3	4	5

	非常不同意	不同意	不確定	同意	非常同意
我更喜歡有挑戰性的線上閱讀材料，这样我就能学到新东西。	1	2	3	4	5
我喜歡閱讀有趣的線上材料，即使我理解它們有些困難。	1	2	3	4	5
線上閱讀最令我開心的地方在於，我可以盡可能全面地理解多種類型的閱讀材料。	1	2	3	4	5
當我進行線上閱讀時，我會選擇我感興趣的內容，即使這些內容與學習無關。	1	2	3	4	5
	非常不同意	不同意	不確定	同意	非常同意
在線上閱讀測試中獲得高分，現在對我來說是最愉快的事情。	1	2	3	4	5
我目前學習線上閱讀的首要任務是提高我在線上閱讀的整體表現。	1	2	3	4	5
如果可能的話，我希望在線上閱讀中獲得比其他大多數學生更好的表現。	1	2	3	4	5
對我來說，向家人、朋友、老師以及其他人展示我的（線上閱讀）能力非常重要，所以我希望在線上閱讀中能取得好的表現。	1	2	3	4	5
	非常不同意	不同意	不確定	同意	非常同意

我確信我可以有效地找到有用的材料。	1	2	3	4	5
我確定我可以評估材料的的可信任的程度。	1	2	3	4	5
我確信我能理解文本中的信息。	1	2	3	4	5
我有信心理解文本中的主要論點。	1	2	3	4	5
我確信我能評估文本中的實例。	1	2	3	4	5
我有信心能將線上閱讀材料縮小到我需要的範圍。	1	2	3	4	5
我知道，我能確定文本之間的關係。	1	2	3	4	5
	非常不同意	不同意	不確定	同意	非常同意
我知道如何在電腦上搜索並找到一個文件。	1	2	3	4	5
我可以研究明白/學會如何編輯電子照片或其他圖像。	1	2	3	4	5
我知道如何創建或編輯文檔。	1	2	3	4	5
我知道如何在互聯網上搜索和尋找信息。	1	2	3	4	5
我知道如何創建一個多媒體演示文稿（PPT）。	1	2	3	4	5
我知道如何將文件、圖片或視頻上傳到在線資料中。	1	2	3	4	5
	非常不同意	不同意	不確定	同意	非常同意
我確信我能學會更快地閱讀。	1	2	3	4	5
我確信我能學會閱讀，這樣能使我少犯錯誤。	1	2	3	4	5
我確信我可以學會閱讀，這樣能使我能理解我所讀的內容。	1	2	3	4	5
	非常不同意	不同意	不確定	同意	非常同意
當我需要在課堂上閱讀線上材料時，我感到很高興。	1	2	3	4	5
我喜歡在做家庭作業時閱讀線上材料。	1	2	3	4	5
我喜歡在做測試時閱讀線上材料。	1	2	3	4	5
	非常不同意	不同意	不確定	同意	非常同意
我對在課堂中理解線上文本這件事感到厭煩。	1	2	3	4	5

我非常厭煩線上閱讀理解作業。	1	2	3	4	5
我厭煩需要閱讀線上材料的測試。	1	2	3	4	5
	非常不同意	不同意	不確定	同意	非常同意
我對閱讀線上材料沒有信心。	1	2	3	4	5
當我必須閱讀線上材料時，我非常擔心我無法完成作業，以至於會出汗。	1	2	3	4	5
如果考試要求我必須閱讀線上材料，我害怕我的成績不好。	1	2	3	4	5
	非常不同意	不同意	不確定	同意	非常同意
當我在互聯網上搜索信息時，我不知道該做什麼。	1	2	3	4	5
當我在互聯網上搜索信息時，我總是感到迷失搜索方向。	1	2	3	4	5
當我在互聯網上搜索信息時，我總是感到緊張。	1	2	3	4	5
我不知道如何開始線上搜索。	1	2	3	4	5
	非常不同意	不同意	不確定	同意	非常同意
在線上閱讀時，我會不斷評估在網上搜索到的信息之間的關係。	1	2	3	4	5
在線上閱讀時，我經常會思考如何呈現和整理我在網上搜索到的數據。	1	2	3	4	5
在線上閱讀時，我經常會比較從不同網站收集的信息。	1	2	3	4	5
在線上閱讀時，我會評估網站所提供的信息是否值得參考。	1	2	3	4	5
	1	2	3	4	5
在開始線上搜索之前，我通常會確定目標。	1	2	3	4	5
在進行線上閱讀時，我會不斷提醒自己線上搜索的目標。	1	2	3	4	5
有時候在線上閱讀時，我會停下來思考還缺少哪些信息。	1	2	3	4	5
在線上閱讀時，我會思考如何利用搜索到的信息去搜尋目標。	1	2	3	4	5
	1	2	3	4	5
當我在一個網站中找不到任何信息時，我會嘗試其他網站。	1	2	3	4	5

當我在一個網站找不到足夠的信息時，我會嘗試一些別的網站。	1	2	3	4	5
當我的搜索不成功時，我會嘗試一些其他搜索引擎（如 Google，Safari 等）。	1	2	3	4	5
	非常不同意	不同意	不確定	同意	非常同意
在線上閱讀時，我通常會提前考慮我可以使用哪些關鍵詞。	1	2	3	4	5
我會盡可能地選擇每個網頁中提供的主要觀點。	1	2	3	4	5
我通過瀏覽網頁中的標題或超鏈接來捕捉主要信息。	1	2	3	4	5
	非常不同意	不同意	不確定	同意	非常同意
我會计划和管理線上材料的讀取順序，以达到在线阅读的目标。	1	2	3	4	5
在線上閱讀时，我會控制（閱讀材料）中的信息獲取範圍，包括：搜索、選擇、分析、評估。	1	2	3	4	5
在線上閱讀時，我會注意時間分配。	1	2	3	4	5
在線上閱讀的過程中，我會使用一些方法，如：做筆記、重讀、提問等方式幫助自己理解線上材料。	1	2	3	4	5
	非常不同意	不同意	不確定	同意	非常同意
在線上閱讀中，當我遇到難以解決的問題時，我經常會放棄搜索。	1	2	3	4	5
我會盡最大努力解決線上閱讀過程中出現的任何問題。	1	2	3	4	5
在線上閱讀中，當我因一些問題而感到沮喪時，我會思考一些解決方案。	1	2	3	4	5

問卷完