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Unveiling the effect of self-regulated learning strategies on learning engagement among Chinese EFL learners in the online learning environment

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Abstract

The significant roles of self-regulated learning (SRL) strategies in enhancing learning engagement have been extensively explored in previous research in general learning contexts while insufficient evidence has been obtained for online learning environments, which often present more challenges and lack physical interactions. Thus, this study aimed to explore the relationships of SRL strategies and learning engagement within online English learning environments, while considering the moderating effect of demographic factors (e.g., age and gender). Focusing on Chinese English as a foreign language (EFL) learners across various age and gender groups, the study administered SRL strategies and learning engagement questionnaires to 328 EFL undergraduates. The confirmatory factory analysis provided robust validation for the factorial structures of SRL strategies and learning engagement pertaining to cognition, emotion and behavior. In addition, the study uncovered no significant difference in SRL strategies and learning engagement across different age groups and genders. Most notably, structural equation modelling revealed that a majority of SRL strategies positively influenced all three types of learning engagement. Among these, help-seeking emerged as the most influential factor in enhancing learning engagement, while environment structuring showed no significant impact on any type of engagement in the online English learning context. These findings offer valuable insights for developing learners' SRL strategies to foster greater engagement in online English learning environments.

Keywords: learning engagement; SRL strategies; online English learning environment; age and gender

Introduction

Learning engagement reflects learners' performance in the learning process, particularly the effort and persistence they exhibit to overcome difficulties and enhance their academic achievement (Cleary & Zimmerman, 2012). The characteristics of engagement integrate behavioral and affective components, including fundamental behaviors such as paying attention to teachers, proactive actions such as help-seeking, and active involvement in learning tasks (Finn & Zimmer, 2012). Based on these attributes, learning engagement can be understood as a multidimensional construct that encompasses cognitive, social, affective, and academic domains (Fredricks et al., 2004; Zheng et al., 2023). These dimensions can be observed through indicators such as behavioral engagement, which reflects the extent to which learners participate in tasks and can significantly influence their achievement across various educational settings, including offline (Fredricks et al., 2004), and online environments (Park & Yun, 2017; Yin & Luo, 2024; Zare et al., 2023).

Different learning contexts influence individuals' expectations and perceived value of engaging in various tasks (Reeve, 2012) across different domains. For instance, previous research has demonstrated that integrating online learning activities into English language courses provides learners with flexible schedules and adaptable learning environments (Alemayehu & Chen, 2021), thereby enhancing their willingness to participate. However, this integration also presents challenges, particularly the absence of physical interaction between students and teachers (Song & Kim, 2020; Sun & Rueda, 2012; Zhang & Liu, 2019). Such a lack of face-to-face interaction may lead to passive attitudes and disengagement (Doo & Bonk, 2020). Another challenge in online learning is students' tendency toward inaccurate self-monitoring and evaluation of their progress and performance, such as overestimating their abilities (Song & Kim, 2020). Consequently, cultivating learners' abilities in utilizing self-regulated learning (SRL) strategies is crucial for fostering effective interaction with others and facilitating reflective cognitive processes. These strategies include planning, goal setting, monitoring progress, and evaluating performance (F. Teng & Zhan, 2023; L. Teng, 2022; L. Teng et al., 2019).

As well, engagement can be conceptualized as an internal process involving SRL strategies and the evaluation of the effectiveness of these strategies in specific contexts. Meaningful online learning engagement involves using a variety of cognitive resources (Ding & Orey, 2017), requiring learners to regulate and monitor their learning processes. This includes making strategic decisions, effectively managing time and resources, and comprehending learning materials. Research highlighted the significant role of SRL strategies in enhancing learners' motivation and positive emotions to engage in the learning process, thereby positively influencing their overall academic performance in traditional learning environments (Song & Kim, 2020; F. Teng & Qin, 2024; L. Teng, 2021; L. Teng & Pan, 2024; Ueno et al., 2025), digital settings such as distance education (Fu et al., 2024; Sun & Rueda, 2012), online learning (Alemayehu & Chen, 2021; Doo & Bonk, 2020; F. Teng, 2025; L. Teng & Pan, 2024), or AI setting (Shen & Tao, 2025; Shen & Teng, 2024). In online learning contexts, students are expected to demonstrate positive attitudes, complete assigned tasks diligently, and monitor areas where they encounter challenges in understanding course materials (Doo & Bonk, 2020; F. Teng, 2024). To achieve their learning goals, students need to develop SRL strategies, such as accurately assessing their progress and making necessary adjustments. These strategies empower learners to actively engage with their motivational, behavioral, and cognitive functioning across various learning contexts. Promoting SRL strategies is, therefore, essential for fostering effective and sustainable online learning engagement.

Also, previous research has shown that SRL strategies and learning engagement vary across demographic factors, such as gender and age (Bai & Wang, 2023; Dunn et al., 2014). Gender, for instance, has been shown to correlate with learning achievements (Bai & Wang, 2023; Dunn et al., 2014). One study suggested that girls in Hong Kong primary schools tend to excel and exhibit greater motivation in language arts, while boys are more motivated in mathematics and science and display stronger self-beliefs in natural sciences (Bai & Wang, 2023). Furthermore, age has also been identified as a significant factor in SRL behaviors. Dunn et al. (2014) observed that age negatively predicts help-seeking behaviors among graduate students in online education. Explicitly, as learners age, their willingness to seek help from teachers or peers diminishes, whereas their critical thinking skills improve, suggesting a preference for autonomous learning. These findings implied that both gender and age may shape learners' SRL strategies and influence their engagement in learning activities.

While most prior studies have explored the relationships between SRL strategies and learning engagement in online learning contexts (Alemayehu & Chen, 2021; Doo & Bonk, 2020; Park & Yun, 2017; Zare et al., 2023), demographic factors such as gender and age have rarely been considered, particularly within specific domains like English learning. To address these research gaps, this study examined variations in SRL strategies and English learning engagement across gender and age groups. More importantly, it investigated how SRL strategies influenced Chinese EFL learners' engagement in online learning. The findings are expected to offer educators and practitioners valuable insights into strategies for enhancing engagement in online English learning environments.

Literature Review

Social Cognitive Theory, SRL and Learning Engagement

Social cognitive theory emphasizes the various cognitive processes individuals use to regulate their behavior and performance. Specifically, it focuses on the beliefs individuals form about their abilities, the anticipated outcomes of their actions, the goals they set, and the strategies they develop to achieve desired results (Bandura, 1991). The theory underscores how individuals exercise control over their thoughts, emotions, motivation, and behaviors through SRL and self-reaction. By adopting behavioral standards, individuals monitor and regulate their actions through self-reactive influences, operating within a framework of "reciprocal determinism" (Bandura, 1991, p. 267). This concept suggests that cognitive, behavioral, and environmental factors interact bidirectionally, influencing each other in dynamic ways (Bandura, 1991; Barnard-Brak et al., 2010). Rooted in these multidimensional factors of social cognitive theory, SRL can be defined as the self-generated thoughts, feelings, and behaviors that influence one's learning and motivation (Zimmerman, 2000). SRL includes self-awareness, self-motivation, and behavioral skills, which enable individuals to effectively apply knowledge and reflect a self-directed process where learners transform their cognitive capacities into academic skills. This process typically unfolds in a temporal sequence as students engage in specific learning tasks (Zimmerman & Tsikalas, 2018). To elucidate, students plan and set goals before learning, direct their attention to the use and monitoring of learning strategies during the process, and reflect on the effectiveness of these strategies after learning to evaluate whether they have achieved their desired outcomes (Barnard-Brak et al., 2010; Cleary & Zimmerman, 2012; F. Teng & Zhang, 2024).

From this perspective, SRL consists of forethought, performance control and self-reflection. These cyclical processes concern the extent to which individuals become cognitively engaged in learning, with particular emphasis placed on students' selection, use and

reflection on the effectiveness of learning strategies (Cleary & Zimmerman, 2012). Students who engage in SRL actively identify the essential requirements of a learning task, set clear goals, and develop strategic plans to achieve these objectives. Moreover, the extent of students' engagement in self-observation is significantly related to self-control processes. Students in learning performance utilize various self-control phase processes such as task strategies to optimize their focus on their effort and persistence in learning tasks, which reflect learners' efforts to actively manage and use strategies to reach the goals. The last phase of the SRL process involves tracking students' learning performance and the conditions surrounding it. This process facilitates error analysis and the capacity to adjust one's strategies to improve task performance (Cleary & Zimmerman, 2012).

Building upon these cyclical processes of SRL, Wolters and Taylor (2012) expanded the concept of SRL in relation to engagement by identifying several sub-processes across cognitive, motivational, and behavioral domains. Precisely, student engagement is characterized by high levels of cognitive engagement in SRL. When students employ a range of cognitive strategies and possess the metacognitive knowledge and skills necessary to effectively deploy and manage these strategies, efficient engagement is facilitated. Moreover, self-regulated learners tend to experience more positive emotions in academic settings, highlighting the importance of emotional processing as a critical dimension of their academic functioning. SRL also reflects the engagement characteristic of increased involvement in learning tasks, with students demonstrating overt behaviors such as effort, persistence, and adaptive help-seeking, all of which enhance participation in learning activities. Therefore, engagement of SRL encompasses behavioral, cognitive, and emotional processes.

These sub-processes, grounded in social cognitive theory, serve as a bridge between contextual and personal factors, as well as students' actual performance in general learning contexts (Jung & Lee, 2018; Pellas, 2014) and specific domains (Park & Yun, 2017; Zheng et al., 2023). They incorporated contextual factors into the SRL processes. As suggested by Barnard et al. (2009) and Zheng et al. (2018), learners lacking SRL strategies may misinterpret the autonomy offered in online foreign language learning environments and fail to complete expected tasks. Considering this, in online language learning, SRL encompasses the processes through which learners activate and sustain their cognitive, emotional, and behavioral efforts to achieve academic goals (Zheng et al., 2018). These sub-processes enhance engagement in online learning by extending to interactive attributes, including interactions with others, exchanging ideas, and learners' cooperation and participation (Pellas, 2014). Consequently, engagement in learning encompasses behavioral participation in activities, emotional responses to peers and teachers, and cognitive efforts to understand content and develop skills within the online context. From these perspectives, the model of SRL, grounded in social cognitive theory, may effectively enhance online English learning engagement for EFL learners.

Effects of SRL Strategies on Learning Engagement in Online Environments

Learning engagement is defined as "a learning task or a value referring to the cognitive processes, active participation, and emotional involvement of students in specific learning procedures" (Pellas, 2014, p. 159). It is also conceptualized as a multidimensional construct with three core components within the framework of SRL (Cleary & Zimmerman, 2012; Wolter & Taylor, 2012): cognitive, behavioral, and emotional engagement (Fredricks et al., 2004). Cognitive engagement pertains to the intellectual effort that students exert during learning, encompassing learning goals, intrinsic motivation, and the ability to apply strategies for acquiring new knowledge (Pellas, 2014). This form of engagement is grounded in a

social cognitive perspective of SRL, wherein one key aspect of cognitive engagement is the increased use of cognitive strategies, such as rehearsal, elaboration, and organization (Cleary & Zimmerman, 2012). Another aspect is heightened metacognitive awareness, enabling students to monitor and regulate their learning performance effectively, including efforts to comprehend individual perspectives and utilize cognitive strategies (Fredricks et al., 2004). However, SRL extends beyond cognitive processes to include the intentional enactment of overt behaviors, such as applying strategies or self-recording during the learning process (Ueno et al., 2025). Behavioral engagement refers to the extent to which students invest effort and actively participate in academic and social activities, which are crucial for achieving positive outcomes (Fredricks et al., 2004, 2005; Pellas, 2014). Notably, emotional engagement plays a significant role in students' academic functioning, involving positive and negative emotional experiences. This dimension involves students' emotional responses to teachers and peers, as well as their attitudes, interest, and values toward the learning process, whether positive or negative. Thus, SRL is a key feature that defines how students exhibit engagement in learning (Wolters & Taylor, 2012).

Social cognitive theory emphasizes context specificity, implying that the extent to which students become cognitively and strategically immersed in learning activities varies across different situational demands (Cleary & Zimmerman, 2012). In line with this perspective, prior empirical research has documented the significant impact of SRL strategies on student learning engagement in general (Alemayehu & Chen, 2021; Doo et al., 2023; Park & Yun, 2017) or specific learning domains (Yin & Luo, 2024; Zare et al., 2023), particularly within online settings. For instance, in the context of online English as a Foreign Language (EFL) learning, several studies have explored the role of SRL strategies in enhancing engagement across various culture backgrounds (Xu et al., 2024; Yin & Luo, 2024; Zare et al., 2023). An empirical study by Zare et al. (2023) found that Iranian learners who employed a broader range of SRL strategies, such as cognitive, metacognitive, motivational, and social strategies, presented higher levels of engagement in EFL tasks. These students, exhibiting strong SRL skills, were more likely to be engaged in their learning tasks and, as a result, showed greater language and literacy development in online settings.

Similarly, a study by Yin and Luo (2024) in the Chinese EFL context indicated that SRL strategies, such as goal setting, environmental structuring, and time management, could amplify focus and commitment in online English learning environments. Importantly, SRL strategies were found to mediate the relationship between teacher support and online learning engagement, suggesting that learners are more likely to be motivated to engage in learning when they effectively utilize SRL strategies in conjunction with teacher assistance. Conversely, the study by Xu et al. (2024), which surveyed 1,107 Chinese EFL undergraduate learners in a smart classroom, reported slightly inconsistent results. The study suggested that SRL strategies did not directly predict learners' engagement in English learning for two primary reasons. First, engagement is not solely dependent on SRL strategies; the wide range of AI-assisted tools and interactive features in smart classrooms offers additional avenues for engagement beyond individual self-regulation. Second, not all students are able to fully master the variety of SRL strategies. Although these studies emphasized the importance of SRL strategies in online learning engagement, most focus on general engagement, without examining the specific dimensions of engagement, such as emotional or behavioral engagement, when utilizing SRL strategies in online contexts.

To address this gap, Park and Yun (2017) and Zheng et al. (2023) explicitly explored the role of SRL strategies in cognitive, emotional, and behavioral engagement. For example, Park and Yun (2017) highlighted that the implementation of environmental control strategies effectively safeguarded students' intended actions, thereby facilitating heightened levels of behavioral

engagement. Furthermore, goal orientation strategies were found to influence students' emotional engagement by motivating them to achieve learning goals and master challenging tasks. Cognitive engagement, in turn, was linked to students' individual interest in the content, with students exhibiting a greater desire to engage with the material independently if they had a well-developed interest. Conversely, students with less developed interest might require external support to remain engaged. Thus, comprehending the diverse factors that influence learners' experiences of SRL is crucial for advancing research on online learning engagement.

Besides, SRL strategies and learning engagement in online settings may vary based on demographic factors such as age and gender (Cho & Kim, 2013; Dunn et al., 2014; Korlat et al., 2021; Yin & Luo, 2024). For instance, Dunn et al. (2014) found that help-seeking, a crucial SRL strategy, had a differential impact depending on learners' age. Younger students were significantly less likely to seek help compared to older students when no external support was available. Moreover, help-seeking behavior tends to decline with age, despite the increasing enrollment of older students in university and online programs. However, not all studies have yielded consistent findings regarding age-related differences. In the context of online learning engagement, Korlat et al. (2021) observed that female students exhibited higher motivation for online digital learning compared to their male counterparts. Male learners, in particular, presented lower levels of engagement and a lack of a study-oriented culture. When forced to organize their learning autonomously without external regulation, male students appeared to experience greater pressure, and a higher risk of underperformance compared to traditional face-to-face learning environments.

Regarding the impact of SRL strategies on learning engagement in the Chinese online learning context, a study by Yin and Luo (2024) on Chinese EFL learners found no significant differences in SRL strategies and learning engagement based on gender and age. This lack of difference may be partly explained by the uneven distribution of male and female participants in these studies, underscoring the need for balanced participation across age and gender in future research. Most of the studies discussed above primarily focused on SRL strategies in relation to learning engagement across various learning domains, such as English language acquisition, while considering individual demographic factors. Nevertheless, the divergent findings highlight the critical importance of ensuring the validity and accuracy of measurement tools (Sun & Wang, 2020) in assessing self-regulation and learning engagement, particularly in online English learning contexts.

Measuring SRL Strategies and Learning Engagement in Online Environments

The assessment of learners' SRL strategies and learning engagement within online English learning environments requires further investigation. Existing research predominantly relies on self-reported instruments to measure SRL strategies and engagement (L. Teng & Pan, 2024) in online learning contexts. For example, Barnard et al. (2009) expanded upon Pintrich et al.'s (1993) *Motivated Strategies for Learning Questionnaire* (MSLQ) by identifying six distinct subscales: environment structuring, goal setting, time management, help-seeking, task strategies, and self-evaluation. They also undertook a comprehensive validation process to confirm the internal consistency and applicability of the questionnaire within online learning context. Despite this adaptation, Barnard et al.'s (2009) questionnaire did not address SRL strategies in particular learning domains. In response, Zheng et al. (2018) further modified this questionnaire to incorporate SRL strategies specifically for online English learning, including goal construction, task strategies, time management, help seeking, and self-evaluation. They validated the instrument using confirmatory factor analysis to ensure its reliability and acceptance. Nevertheless, issues remain, such as the lack of clarification

regarding the characteristics of participants with EFL (English as a Foreign Language) or ESL (English as a Second Language) learners.

In addition to SRL strategies, the *Student Engagement Questionnaire* (SEQ) developed by Fredricks et al. (2005) assesses student engagement in learning, encompassing three key components: behavioral, emotional, and cognitive engagement. However, these elements are typically explored within a broad learning context rather than within specific domains, and the original participants were primarily children. In response to this limitation, Sun and Rueda (2012) adapted Fredricks et al.'s (2005) questionnaire to better align with online learning environments. They revised two items related to behavioral engagement, six items related to emotional engagement, and six items related to cognitive engagement, broadening the scope of this questionnaire to larger groups, such as graduate students, to enhance its generalizability beyond its initial focus on children. The reliability of this adapted questionnaire was assessed using Cronbach's alpha to evaluate internal consistency. However, further research is required to confirm the validity of this modified questionnaire in online or AI-assisted learning contexts.

Regarding these two self-report measures, several studies have validated their validity and reliability through confirmatory factor analysis (CFA) in general learning contexts (Barnard et al., 2009; Sun & Rueda, 2012; Zheng et al., 2018), while others have focused specifically on English language learning within online environments (Alemayehu & Chen, 2021; Zheng et al., 2023). These measures reflect the multidimensional nature of SRL strategies and learning engagement across traditional and online contexts. For example, Alemayehu and Chen (2021) employed convergent and discriminant validity to examine cognitive, emotional, and behavioral engagement, revealing the complex, multifaceted nature of learning engagement in online settings. Yet, the issues persist within these two questionnaires. First, the learning engagement questionnaire adapted by Sun and Rueda (2012) primarily assessed learners' general engagement in online learning contexts, without accounting for potential domain-specific factors. As suggested by Fredricks et al. (2004), "incorporating domain-specific measures can help to determine to what extent engagement represents a general tendency and to what extent it is content-specific response" (p. 69). Second, regarding the SRL strategies and learning engagement questionnaires, the characteristics of the participants need to be clearly specified. Therefore, it is imperative to address these issues within this study, and to validate the SRL strategies and learning engagement questionnaires to improve the validity and reliability of these measures within specific domains and contexts.

Current Study

As previously noted, while research has explored SRL strategies and learning engagement in various contexts, few studies have addressed these two constructs in online English learning, particularly considering demographic factors such as age and gender. This study first validated the SRL strategies and English learning engagement questionnaires within the Chinese EFL online learning context. Subsequently, the study investigated the relationship between EFL learners' SRL strategies and learning engagement, incorporating demographic factors of age and gender. Considering these objectives, the following research questions were formulated:

> **Q1.** What are the factorial structures of SRL strategies and learning engagement in online English learning environments?
> **Q2.** To what extent do age and gender affect Chinese EFL learners' SRL strategies and learning engagement in online English learning environments?
> **Q3.** To what extent do SRL strategies affect Chinese EFL learners' learning engagement in online English learning environments?

Method

Participants

A total of 328 EFL students from two Chinese universities participated voluntarily in the study. The participants were in their first to fourth years, with 14% freshmen, 29% sophomores, 25% juniors, and 32% seniors. Most participants were aged between 18 and 22 years (n = 273, 83%), while a smaller group (n = 55, 17%) was older than 22. The sample consisted of slightly more males (n = 178, 54%) than females (n = 150, 46%). The students came from diverse majors, including music, computer science, and English education. All participants were native Chinese speakers and had more than eight years of English learning experience. Most of them had taken a national English test before entering college, with their proficiency generally at an intermediate level. Some, particularly juniors and seniors, had taken the CET-4 or CET-6 exams, indicating upper-intermediate proficiency. Notably, during their first and second years, they enrolled in a compulsory English course designed to improve overall language skills. Due to the impact of the pandemic, participants attended English courses online from 2021 to 2022 using platforms such as Tencent Meeting, which facilitated lessons, assignments, material sharing, and discussions of learning activities.

Measures

Online SRL strategies

The Online Self-Regulated English Learning Questionnaire was adapted from Zheng et al. (2018), designed to evaluate EFL learners' use of self-regulation strategies in online English learning. The questionnaire comprises six factors with 20 items: goal setting, environment structuring, task strategies, time management, help seeking, and self-evaluation.

Goal Setting (items 1–4) refers to the planning and organization of online English learning outcomes (e.g., "I set standards for my assignments during online English courses"). Time Management (items 5–8) focuses on the allocation of dedicated time for online English learning (e.g., "I choose a good location for learning English online to avoid too much distraction"). Task Strategies (items 9–11) involve employing appropriate strategies to complete online English learning tasks (e.g., "I prepare my questions before learning online materials"). Environment Structuring (items 12–14) pertains to arranging suitable spaces for online English learning (e.g., "I try to schedule the same time every day or week to study English online, and I stick to this schedule"). Help Seeking (items 15–17) refers to seeking assistance from peers or teachers for online English learning (e.g., "I find someone knowledgeable in online English learning to consult when I need help"). Lastly, Self-Evaluation (items 18–20) concerns assessing one's own progress in online English learning (e.g., "I communicate with my classmates to assess how well I am doing in my online English learning"). Each item was scored on a 5-point Likert scale, ranging from 1 ('strongly disagree') to 5 ('strongly agree'). The reliability of the scales in this questionnaire was 0.910, indicating satisfactory internal consistency.

Online English Learning Engagement

The online English learning engagement scales used in this study were adapted from Sun and Rueda's (2012) questionnaire with some modifications to assess Chinese EFL learners' engagement levels in the context of online English learning, such as replacing "online class" with "online English class." Some items such as BE-5, EE-6, CE-2, and CE-3 were excluded due to their lack of context specificity.

The revised questionnaire consists of 16 items covering the three types of engagement: behavioral, emotional, and cognitive. Behavioral engagement (items 1–4) measures learners'

involvement in English learning activities aimed at achieving positive outcomes (e.g., "I have trouble using the online English class"). Emotional engagement (items 5–9) assesses students' affective responses to teachers, peers, and learning activities (e.g., "I like taking the online English class"). Cognitive engagement (items 10–16) evaluates the effort learners invest in comprehending complex learning materials and utilizing various skills (e.g., "When I read the course materials, I ask myself questions to ensure I understand the content"). Items were rated on a 5-point Likert scale, ranging from 1 ('strongly disagree') to 5 ('strongly agree'). The reliability of these scales was 0.902, indicating high internal consistency.

Procedures

At the initial stage of this study, all participants were informed that their participation was voluntary, and they had the right to withdraw at any time without consequence. Ethical considerations were clearly communicated by the instructor, emphasizing the confidentiality of participants' personal information. Participants were then invited to complete two online questionnaires: one assessing online SRL strategies and the other measuring online English learning engagement. Although participants were instructed to complete the questionnaires within 20 minutes, most finished them in approximately 7 to 10 minutes.

Data Analysis

First, descriptive analysis was conducted to examine the means, standard deviations, and normality of online SRL strategies and online English learning engagement. Pearson correlation analysis was then used to assess the relationships between each construct. The measurement models of the two questionnaires were evaluated to verify the internal correlations among their components. Next, confirmatory factor analysis (CFA) was performed using Amos 24.0 to assess the internal construct of the questionnaires and to determine whether the data fit the hypothesized measurement models. Convergent validity was confirmed by ensuring that all factor loadings exceeded 0.50 and that the Average Variance Extracted (AVE) was greater than 0.50. Construct reliability (CR) was considered satisfactory if the value was above 0.70. Model fit was assessed using the following indices: Chi-square (χ^2) < 5.0, Goodness-of-Fit Index (GFI) > 0.90, Comparative Fit Index (CFI) > 0.90, Tucker-Lewis Index (TLI) > 0.90, Root Mean Square Error of Approximation (RMSEA) < 0.08, and Standardized Root Mean Square Residual (SRMR) < 0.08 (Hair Jr et al., 2017; Kline, 2023). Following the validation of each model, this study utilized multivariate analysis of variance (MANOVA) to examine variations in the use of SRL strategies and English learning engagement across different age groups and genders. Finally, a structural model was used to examine the effect of SRL strategies on learning engagement in online learning.

Results

Evaluating the Measurement Models of SRL Strategies and Learning Engagement in the Online English Learning Environment

The descriptive analysis results, presented in Table 1, display the means and standard deviations for each item on the SRL strategies and learning engagement scales within the online context. The skewness and kurtosis values indicate that the data had a normal distribution. Moreover, the convergent validity for each scale ranged from .562 to .655, exceeding the benchmark value of 0.5, while the construct validity for each scale ranged from .794 to .910, surpassing the acceptable threshold of 0.70, thus magnifying the strong validity and reliability of the six-factor correlated model for SRL strategies and the three-factor correlated model for online English learning engagement. Next, the correlation analysis of each scale, presented

Table 1 Descriptive analysis, construct reliability and convergent validity of SRL strategies and learning engagement.

Variables	Items	Mean	Std deviations	Skewness	Kurtosis	AVE	CR
GS	S1	3.51	1.173	–0.468	–0.44	.655	.883
	S2	3.27	1.258	–0.261	–0.848		
	S3	3.39	1.209	–0.312	–0.722		
	S4	3.41	1.208	–0.435	–0.583		
ES	S5	3.5	1.165	–0.465	–0.496	.581	.847
	S6	3.55	1.154	–0.47	–0.517		
	S7	3.54	1.108	–0.494	–0.376		
	S8	3.48	1.178	–0.516	–0.511		
TS	S9	3.56	1.215	–0.48	–0.627	.622	.831
	S10	3.49	1.237	–0.469	–0.626		
	S11	3.54	1.248	–0.506	–0.672		
TM	S12	3.31	1.229	–0.283	–0.764	.620	.830
	S13	3.37	1.204	–0.343	–0.687		
	S14	3.41	1.208	–0.351	–0.734		
HS	S15	3.34	1.217	–0.326	–0.787	.581	.806
	S16	3.5	1.209	–0.501	–0.575		
	S17	3.4	1.29	–0.409	–0.871		
SE	S18	3.42	1.211	–0.333	–0.73	.562	.794
	S19	3.49	1.224	–0.449	–0.595		
	S20	3.44	1.192	–0.334	–0.676		
BE	E1	3.48	1.16	–0.435	–0.531	.574	.844
	E2	3.48	1.16	–0.408	–0.538		
	E3	3.43	1.16	–0.388	–0.621		
	E4	3.37	1.22	–0.39	–0.681		
EE	E5	3.41	1.17	–0.351	–0.687	.609	.886
	E6	3.35	1.237	–0.321	–0.843		
	E7	3.38	1.164	–0.368	–0.651		
	E8	3.38	1.213	–0.34	–0.809		
	E9	3.39	1.192	–0.394	–0.696		
CE	E10	3.58	1.196	–0.501	–0.61	.592	.910
	E11	3.48	1.227	–0.47	–0.688		
	E12	3.41	1.258	–0.394	–0.823		
	E13	3.52	1.231	–0.502	–0.692		
	E14	3.46	1.221	–0.41	–0.729		
	E15	3.58	1.186	–0.511	–0.557		
	E16	3.41	1.263	–0.379	–0.871		

Note: GS = goal setting; ES = environment structuring; TS = task strategies; TM = time management; HS = help seeking; SE = self-evaluation; BE = behavioral engagement; EE = emotional engagement; CE = cognitive engagement.

in Figure 1, revealed significant correlations among the subcategories, ranging from .330 ($p < .001$) to .511 ($p < .001$). Given these significant correlations, the measurement model was ready for further analysis.

Figure 2 presents the results of the CFA for the six-factor correlated model of SRL strategies, which includes goal setting, environment structuring, task strategies, time management, help-seeking, and self-evaluation. The standardized regression weights for the measurement model were all significant ($p < .001$), with satisfactory standardized factor loadings on each latent construct. The CFA model fit indices, as presented in Table 2, are as follows: $\chi^2 = 290.871$; $\chi^2/df = 1.877$; $p < .001$; GFI = .920; TLI = .948; CFI = .958; RMSEA = .052; SRMR = .034, indicating an acceptable fit. Figure 3 illustrates the three-factor correlated model of online English learning engagement, which includes behavioral, emotional, and cognitive engagement. The parameter estimates for all items were statistically significant ($p < .001$). The model fit indices for this CFA, as shown in Table 2, are as follows: $\chi^2 = 203.202$; $\chi^2/df = 2.012$; $p < .001$; GFI = .928; TLI = .957; CFI = .964; RMSEA = .056; SRMR= .034, also indicating an acceptable fit. Overall, the results indicate that the six-factor correlated model of SRL strategies, and the three-factor correlated model of learning engagement effectively represented the underlying structures of these constructs at an acceptable level.

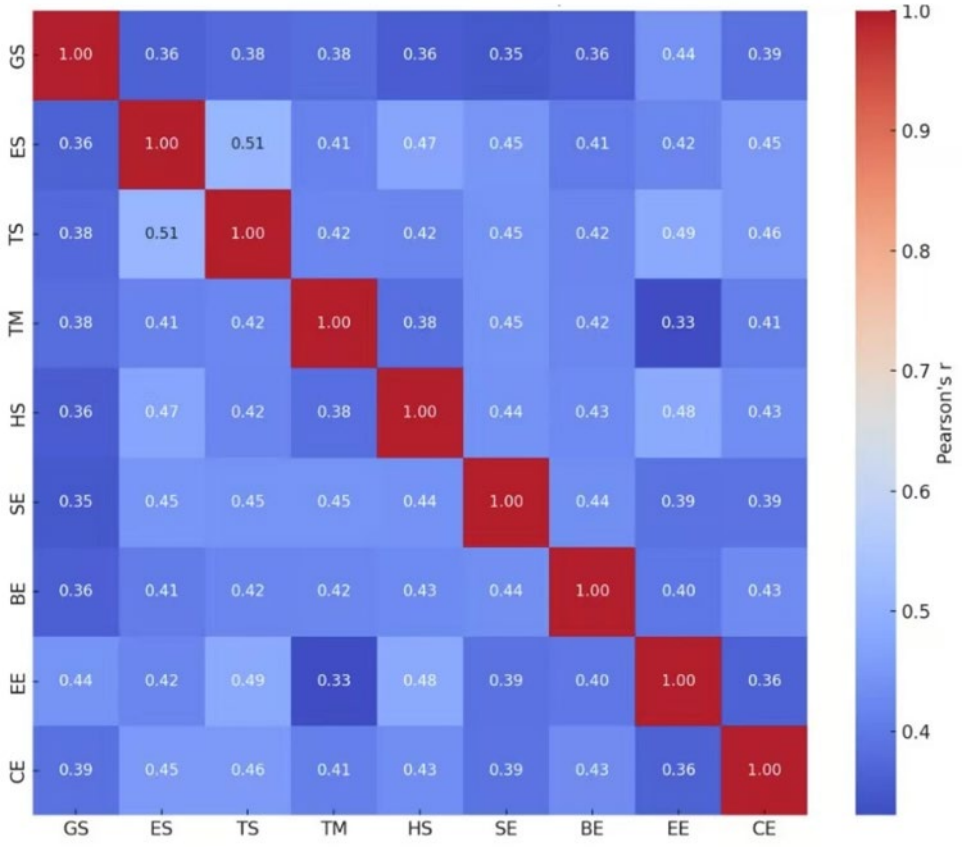

Figure 1 *Correlations between SRL strategies and learning engagement.*
Note: GS = goal setting; ES = environment structuring; TS = task strategies; TM = time management; HS = help seeking; SE = self-evaluation; BE = behavioral engagement; EE = emotional engagement; CE = cognitive engagement.

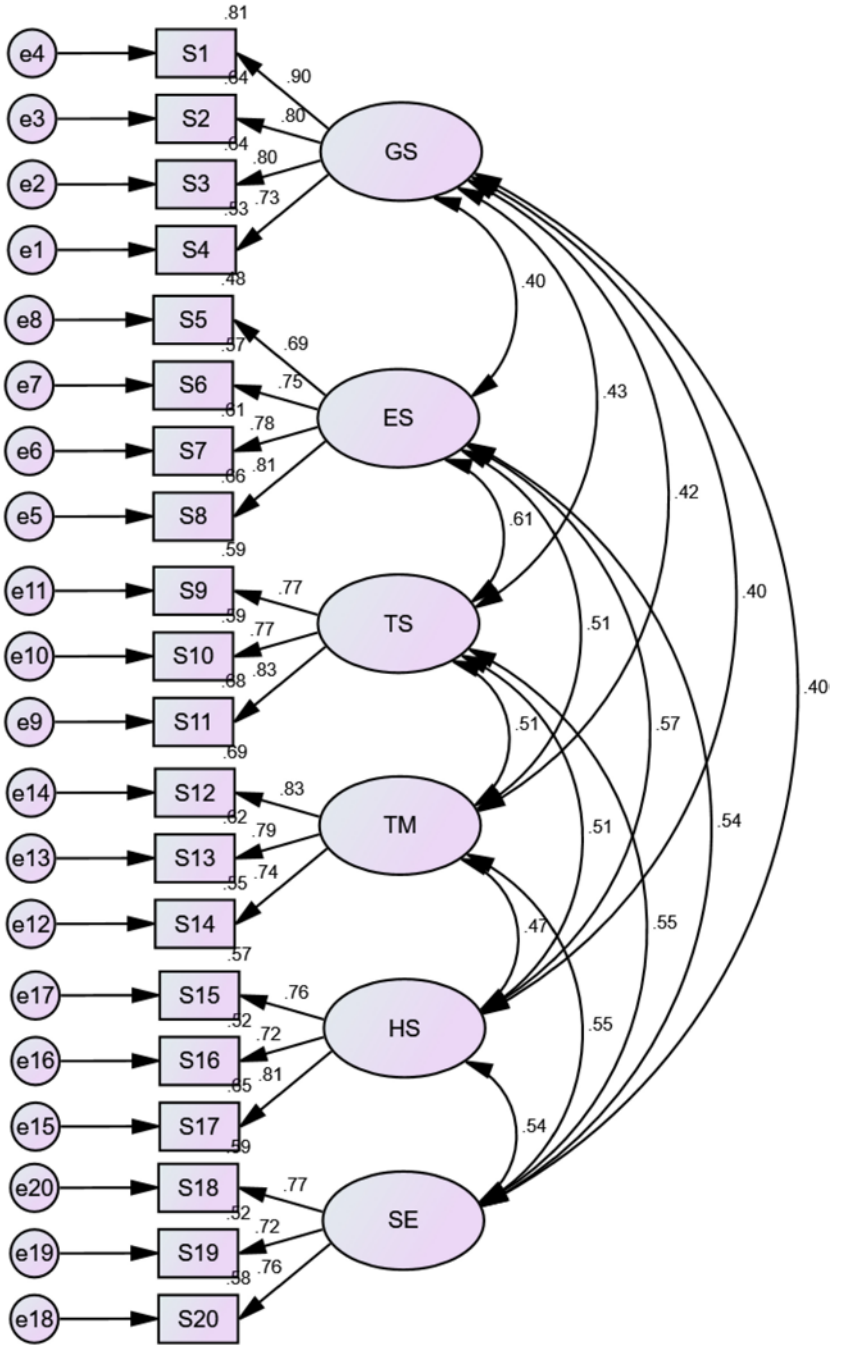

Figure 2 *Standardized results for the six-factor correlated model of online SRL strategies.*
Note: GS = goal setting; ES = environment structuring; TS = task strategies; TM = time management; HS = help-seeking; SE = self-evaluation.

Table 2 Goodness-of-fit indices of online SRL strategies and learning engagement models.

	χ^2	df	p	χ^2/df	GFI	TLI	CFI	RMSEA	SRMR
SRL	290.871	155	<.001	1.877	.920	.948	.958	.052	.034
LES	203.202	101	<.001	2.012	.928	.957	.964	.056	.034

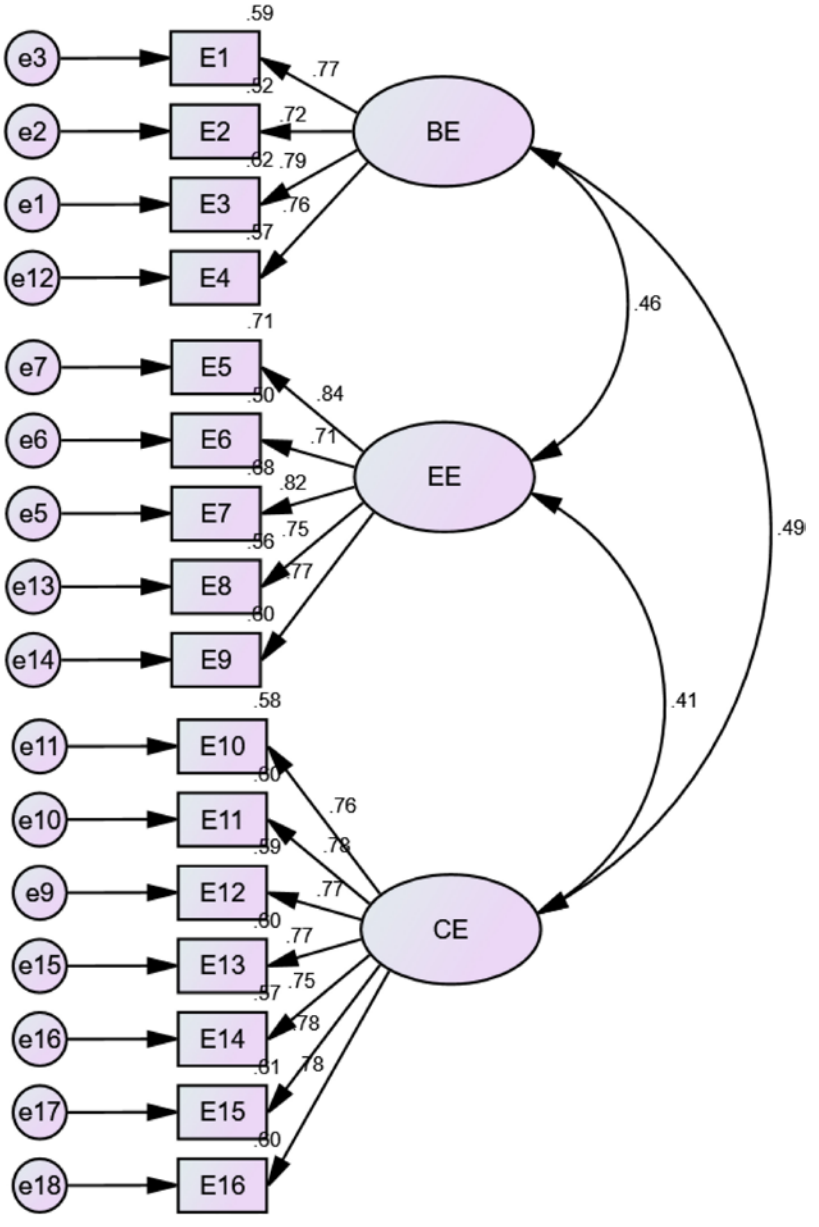

Figure 3 *Standardized results for the three-factor correlated model of online learning engagement.*
Note: BE = behavioral engagement; EE = emotional engagement; CE = cognitive engagement.

The Impact of Age and Gender on Chinese EFL Learners' SRL Strategies and Learning Engagement in the Online English Learning Environment

A Multivariate Analysis of Variance (MANOVA) was conducted to examine the effect of age and gender on Chinese EFL learners' utilization of SRL strategies and learning engagement in an online English learning environment. The Wilks's Lambda for the main effect of age was .971, with $F(3, 324) = 1.046$, $p = .403$, which exceeds the significance threshold of 0.05, and partial $\eta^2 = .029$. As shown in Table 3, age did not generate any significant effect on SRL strategies (i.e., goal setting, environment structuring, task strategies, time management, help-seeking, and self-evaluation) or learning engagement, including behavioral, emotional, and cognitive engagement.

Similarly, no significant effect of gender was observed with $F(3, 324) = .683$, $p = .726$. Thus, no significant differences were found in SRL strategies or English learning engagement between different age or gender groups among Chinese EFL learners.

Table 3 Effect of age and gender on Chinese EFL learners' SRL strategies and learning engagement.

	Factors	Type III Sum of squares	Mean square	*F*	Sig.
Age	GS	1.442	1.442	1.332	.249
	ES	.008	.008	.009	.926
	TS	.26	.26	.227	.634
	TM	.049	.049	.045	.833
	HS	.038	.038	.034	.853
	SE	.159	.159	.153	.696
	BE	3.381	3.381	3.607	.058
	EE	2.008	2.008	2.053	.153
	CE	.004	.004	.004	.952
Gender	GS	.456	.456	.421	.517
	ES	.965	.965	1.058	.305
	TS	.047	.047	.041	.839
	TM	.374	.374	.338	.562
	HS	.851	.851	.772	.38
	SE	.05	.05	.048	.826
	BE	.092	.092	.098	.755
	EE	.087	.087	.089	.765
	CE	.164	.164	.166	.684

Note: GS = goal setting; ES = environment structuring; TS = task strategies; TM = time management; HS = help seeking; SE = self-evaluation; BE = behavioral engagement; EE = emotional engagement; CE = cognitive engagement.

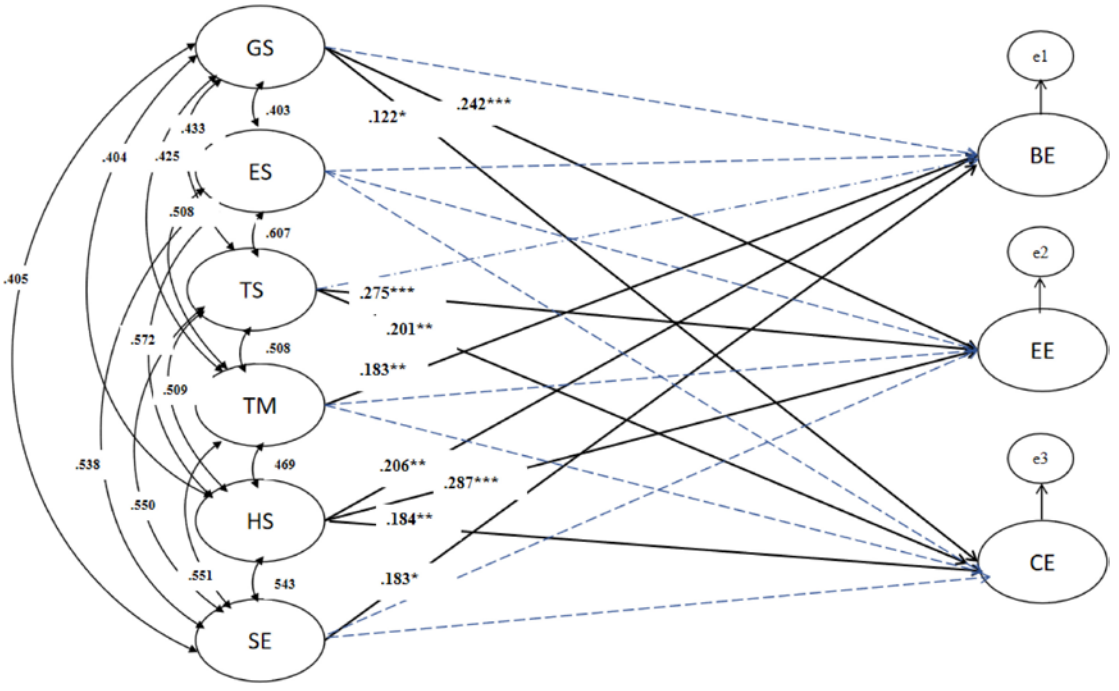

Figure 4 *Effect of SRL on learning engagement in online English learning.*

Effect of Chinese EFL Learners' SRL Strategies on Learning Engagement in the Online English Learning Environment

The analysis of the influence of SRL strategies on learning engagement, using structural equation modeling, revealed a positive relationship between specific strategies and types of engagement, as illustrated in Figure 4. Specifically, time management (β = .183, p < 0.01), help-seeking (β = .206, p < 0.01), and self-evaluation (β = .183, p < 0.05) were positively associated with behavioral engagement. Goal setting (β = .242, p < 0.001; β = .122, p < 0.05), task strategies (β = .122, p < 0.05; β = .201, p < 0.01), and help-seeking (β = .287, p < 0.001; β = .184, p < 0.01) had a positive effect on emotional engagement and cognitive engagement. Notably, help-seeking emerged as the most influential factor in shaping all three types of engagement. However, environment structuring did not generate any significant impact on any of the engagement types.

Discussion

This study sought to explore the interplay between SRL strategies and learning engagement among Chinese EFL learners, with particular attention to the moderating effects of demographic variables such as age and gender in online learning environments.

Validation of SRL Strategies and Learning Engagement in the Online English Learning Environment

The findings of this study validated the factorial structure of two self-report questionnaires designed to assess students' use of SRL strategies and their level of engagement in English learning within an online environment. Through the evaluation of the measurement model for each subcategory, our results signified an acceptable and satisfactory multidimensional

structural model for SRL and learning engagement. To be specific, the CFA results for SRL confirmed that the six correlated factors of SRL strategies including goal setting, environment structuring, task strategies, time management, help-seeking, and self-evaluation loaded onto a higher-order construct. This suggested that SRL strategies are multifaceted, incorporating cognitive, metacognitive, social, and contextual factors. Moreover, these multidimensional factors are not independent but interact in online settings, aligning with the principles of social cognitive theory (Bandura, 1991) which emphasizes the interconnectedness of person, behavior, and environment. In this context, individuals apply knowledge and skills to regulate their cognitive processes and engage effectively in online environments. Also, the SRL questionnaire used in this study extended the model proposed by Zheng et al. (2018) within online English learning, providing insights into how Chinese EFL learners utilize SRL strategies in this specific context.

Similarly, the learning engagement questionnaire, which encompasses behavioral, emotional, and cognitive engagement, was also validated through CFA, emphasizing its multifaceted nature within a specific domain (Fredricks et al., 2004). These multidimensional facets aligned with Cleary and Zimmerman (2012) and Wolter and Taylor (2012)'s theory of SRL, which posits that individuals motivate themselves to engage in learning by managing cognitive strategies to reflect their effort and persistence within a particular context. Thus, these two questionnaires reflect core elements of social cognitive theory, emphasizing the interactions of person, behavior, and environmental factors, by investigating the use of SRL strategies and engagement within a specific learning context (Bandura, 1991; Zimmerman & Tsikalas, 2018).

Impact of Age and Gender on SRL Strategies and Learning Engagement in Online English Learning Environment

Regarding the demographic characteristics addressed in the second research question, the findings indicated no significant differences in SRL strategies and learning engagement across various age and gender groups. Specifically, Chinese EFL learners showed similar levels of goal setting, environment structuring, and task strategies regardless of age or gender. These results echoed previous study by Yin and Luo (2024), which found no impact of age and gender on SRL strategies and learning engagement. Our study extended their findings by providing a more detailed analysis, showing no variations in SRL sub-dimensions regarding metacognitive and social regulation as age and gender shifted. This study also reveals the consistent levels of behavioral, cognitive, and emotional engagement in online English learning across different age and gender groups.

In contrast, the results of our study differed from those reported on the effect of gender in previous research (Cho & Kim, 2013; Dunn et al., 2014; Korlat et al., 2021). For example, Dunn et al. (2014) and Korlat et al. (2021) have observed that female students are more motivated to engage in online learning than their male counterparts. This discrepancy may be attributed to cognitive load in English learning, especially in online environments that involve creativity and technology (F. Teng & Qin, 2024). Another possible explanation could be the lack of differences in digital learning beliefs between gender groups (Korlat et al., 2021). In addition, variations in language proficiency may contribute to the differences observed between gender and age groups. For instance, while Korlat et al. (2021) surveyed secondary students in Australia, our study focused on Chinese EFL undergraduates in online English learning contexts. As a result, no significant differences in SRL strategies or engagement levels were found across age and gender groups among Chinese EFL learners in our study.

Effect of SRL Strategies on Learning Engagement in the Online English Learning Environment

Our findings in response to the third research question revealed that help-seeking in SRL strategies emerged as the most significant factor influencing Chinese EFL learners' engagement

across behavioral, cognitive, and emotional dimensions in the online environment. Regarding other SRL strategies, goal setting and task strategies were found to affect emotional and cognitive engagement, while time management and self-evaluation primarily influenced behavioral engagement. These results provided strong support for the application of social cognitive theory in computer-based learning environments (Zimmerman & Tsikalas, 2018), emphasizing the cyclical phases of forethought, performance, and self-regulation in online learning. Moreover, our study extended Cleary and Zimmerman (2012), and Wolter and Taylor's (2012) framework on engagement in SRL by highlighting how Chinese EFL learners cognitively engage with online English learning, with a particular focus on their participation and motivation.

These findings echoed previous research (e.g., Park & Yun, 2017; Yin & Luo, 2024; Zare et al., 2023; Zheng et al., 2023), which indicated that students with higher levels of self-regulation are more likely to engage in learning activities and demonstrate greater dedication to online English learning. While Zare et al. (2023) and Yin and Luo (2024) examined the broader influence of SRL strategies on overall learning engagement in online English contexts, our study advanced their work by investigating specific subcategories of engagement involving behavioral, emotional, and cognitive engagement. Also, our findings supported Park and Yun's (2017) research, which identified goal setting and help-seeking as influential in emotional and cognitive engagement in online learning. In addition to these SRL strategies, our study contributes by demonstrating the impact of task strategies on emotional and cognitive engagement in online English learning among Chinese learners.

However, our results diverged slightly from Zheng et al. (2023), who found that help-seeking and time management positively predicted behavioral, emotional, and cognitive engagement, while self-evaluation and goal setting had a more significant impact on these three types of engagement for Han or ethnic students. In contrast, our study found that, aside from help-seeking, neither goal setting nor task strategies impacted behavioral engagement, and time management and self-evaluation did not significantly affect emotional and cognitive engagement. These discrepancies may stem from the cultural and social context, as our study focused on EFL learners from a single cultural background (i.e., Han EFL students), whereas Zheng et al. (2023) included learners from diverse backgrounds, including rural and urban settings, as well as Han and ethnic groups. Besides, the EFL learners in our study presented a certain level of understanding regarding the skills they had applied in the online environment. Thus, our study underscored the significant role of goal setting, task strategies, time management, help-seeking, and self-evaluation as predictors of student engagement in online English learning environments.

Our results indicated that environment structuring did not affect the three types of learning engagement in the online English learning environment, a finding that reinforced the conclusions of Zheng et al. (2023), which also reported no impact of environment structuring on EFL learners in Chinese online English learning contexts. In contrast, our findings slightly diverged from those of Park and Yun (2017), who reported that environment structuring influenced behavioral engagement in online learning. The discrepancy may be attributed to large class sizes, which pose challenges for student-centered learning in online environments (Doo & Bonk, 2020). Future studies could explore the impact of class size, such as small classes, on shaping the online English learning experience for Chinese EFL students. Overall, aside from environment structuring, our results suggested that SRL strategies positively influence learning engagement in online English learning contexts.

Conclusion

In summary, this study provides robust validation for the multidimensional self-report measures of SRL strategies and learning engagement in online English learning contexts. As well,

it signified no significant difference in SRL strategies and learning engagement across age and gender. Notably, the findings revealed most SRL strategies positively influence learning engagement, with help-seeking emerging as the most critical factor. In contrast, environment structuring had no significant impact on any dimension of engagement in online English learning.

This study offers several theoretical and practical implications. It reinforces the SRL cycle phases within the social cognitive theory framework (Bandura, 1991; Zimmerman, 2000; Zimmerman & Tsikalas, 2018), highlighting the diverse experiences of EFL learners across ages and genders in online contexts, and extending prior research focused on traditional face-to-face learning. The findings also demonstrate the pivotal role of SRL strategies, particularly help-seeking, in fostering active engagement in online learning. Moving forward, English language educators can leverage these insights to support learners in integrating technology into their skill development in listening, speaking, reading, and writing. Teachers are suggested to design differentiated English learning activities that align with the varied needs of learners across age groups and genders, addressing specific weaknesses in SRL strategy use while fostering interest and active participation in English-related activities. As such, educators may place greater emphasis on promoting learners' abilities to structure their learning environments and cultivating their autonomy in using technology-assisted tools, such as ChatGPT, outside the classroom. Thus, encouraging the effective use of such tools can sustain learners' motivation and engagement in English learning, regardless of whether it occurs inside or outside the classroom.

While this study offers valuable implications, its limitations should also be acknowledged. The study primarily focused on two demographic variables with age and gender. Future research could benefit from exploring other individual differences, such as learning experiences and cultural backgrounds, to identify other potential influences on English learning. Moreover, this study employed a cross-sectional design, capturing data at a single point in time. Future research could adopt a longitudinal approach to examine how learners' SRL and engagement in English learning evolve across different stages, providing deeper insights into the developmental aspects of SRL and engagement over time.

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Declaration of Interest Statement

There is no potential conflict of interest.

Data Statement

The data can be obtained from the corresponding author upon request.

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Appendix A

Table A1 Online SRL Strategies Questionnaire.

Items	1	2	3	4	5
Goal Setting					
1. I set short-term (daily or weekly) goals as well as long-term goals (monthly or for the semester) when learning online English course.					
2. I set standards for my assignments during online English course.					
3. I keep a high standard in my online English course.					
4. I set goals to help me manage study time for my online English learning.					
Environment Structuring (ES)					
5. I choose a good location for learning English online to avoid too much distraction.					
6. I find a comfortable place for learning English online.					
7. I choose a place with few distractions for studying for learning English online.					
8. I choose a time with few distractions when studying for learning English online.					
Task Strategies (TS)					
9. I try to take more thorough notes for my online English learning because notes are even more important for learning online than in a regular classroom.					
10. I read aloud instructional materials posted online to fight against distractions.					
11. I prepare my questions before learning instructional with online materials					
Time Management (TM)					
12. I try to schedule the same time every day or every week to study English online, and I observe the schedule.					
13. I allocate extra studying time for learning English online because I know it is time-demanding.					
14. I try to schedule the same time every day or every week to learn course materials online, and I observe the schedule.					
Help Seeking (HS)					
15. I find someone who is knowledgeable in online English learning so that I can consult with him or her when I need help.					

Continued

Continuation

Items	1	2	3	4	5
16. I share my problems with my classmates online so we know what we are struggling with and how to solve our problems.					
17. If needed, I try to meet my classmates face-to-face and discuss problems when learning English online.					
Self Evaluation (SE)					
18. I communicate with my teachers to find out how I am doing with my online English learning.					
19. I communicate with my classmates to find out how I am doing with my online English learning.					
20. I communicate with my classmates to find out what I am learning that is different from what they are learning in online English learning.					

Appendix B

Table B1 The Online English Learning Engagement Questionnaire.

Items	1	2	3	4	5
Behavioral engagement					
1. I follow the rules of online English class.					
2. I have trouble using the online English class.					
3. When I am in the online English class, I just 'act' as if I am learning.					
4. I am able to consistently pay attention when I am taking the online English class.					
Emotional engagement					
5. I like taking the online English class.					
6. I feel excited by my work at the online English class.					
7. The online English classroom is a fun place to be.					
8. I am interested in the work at the online English class.					
9. I feel happy when taking online English class.					
Cognitive engagement					
10. I check my schoolwork for mistakes with technology assistance.					
11. I try to look for some course-related information on other resources such as television, journal papers, magazines, etc.					
12. When I read the course materials, I ask myself questions to make sure I understand what it is about					
13. I read extra materials with technology assistance to learn more about things we do in the online English class.					
14. If I do not know about a concept when I am learning in the online English class, I do something to figure it out.					
15. If I do not understand what I learn in online English class, I go back to watch the recorded session and learn again.					
16. I talk with people outside of school about what I am learning in the online English class.					

Author Bio

Xiaolei Shen holds a PhD in Teaching English as a Second Language (TESL) at the Faculty of Educational Studies, Universiti Putra Malaysia. Her research primarily explores the learning strategies in English writing, with a particular emphasis on metacognitive writing strategies, critical thinking skills, writing self-efficacy, and writing anxiety. Her recent articles have been published in *System* and other academic journals.

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