

The online learning adaptability and its influencing factors for low-proficiency English learners in China

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Abstract

The proliferation of online teaching has emerged as a pivotal trajectory in the evolution of English education, necessitating a critical examination of online learning dynamics tailored to specific learner cohorts. This study endeavours to scrutinize the present status of online learning adaptability and its influencing factors among 262 low-proficiency English learners in China, employing a methodological blend of questionnaires and interviews. The findings are as follows: (1) There exists no statistically significant difference in learning engagement among learners of different levels. Notably, low-proficiency learners manifest a diminished psychological adaptability relative to their high-proficiency counterparts, albeit concurrently expressing heightened satisfaction with online learning modalities. (2) With regard to the influencing factors of online learning adaptability, the salience of environmental adaptation strategies surpasses that of perceived environmental affordance. Moreover, a compelling interaction effect between these two factors is observed in shaping online learning adaptability. Strategic augmentation of support within the learning milieu, fortifying cognizance of online learning strategies, and synergistically amalgamating the strengths of online and offline pedagogical approaches emerge as efficacious measures to cultivate enhanced online learning adaptability for intermediate and low-proficiency learners.

Keywords low-proficiency English learners, online learning adaptability, perceived environmental affordances, environmental adaptation strategies

1. Introduction

The abrupt onset of the novel coronavirus pneumonia (COVID-19) has introduced considerable disruptions to societal functioning and has exerted profound ramifications across diverse industries (McNamara & Newman 2020). Within the realm of education, a pivotal challenge confronting college student is the imperative adaptability to the pervasive implementation of online learning, necessitated by epidemic prevention and control measures (Adedoyin & Soykan 2023). Accustomed to conventional offline instructional methodologies, learners are predisposed to experience a palpable sense of discomfort and resistance in contending with the novel paradigm of online teaching (Kuama, 2016). This discomfort is particularly accentuated for low-proficiency English learners, who, already deficient in essential information literacy, learning skills, and motivation, grapple with heightened challenges in navigating the autonomy demanded by online learning (Esra & Sevilen, 2021). Within this context, acquiring an in-depth comprehension of the prevailing landscape of online learning and discerning potential influencing factors for low-proficiency English learners assumes paramount significance for the implementation of targeted educational management and services, thereby

constituting a substantive subject meriting further exploration.

The transformations in learning environments and modalities invariably pose adaptability challenges for learners (Shamsuddin & Kaur, 2019). Individuals habituated to traditional offline instructional approaches invariably encounter a sense of disquietude and opposition when confronted with the emergent paradigm of online education (Kuama, 2016). This predicament is notably pronounced for low-proficiency English learners, who confront the augmented autonomy prerequisites intrinsic to online learning while contending with pre-existing deficits in information literacy, study skills, and motivational aspects (Esra & Sevilen, 2021). "Learning adaptability," as a pivotal attribute in contemporary education, serves as a robust facilitator enabling learners to surmount educational challenges and navigate pedagogical dilemmas successfully (Torun, 2020). In light of these considerations, cultivating a nuanced understanding of the present state of online learning among low-proficiency English learners and delineating potential influencing factors assumes critical import for tailoring educational management and services with precision, thus constituting an imperative subject warranting comprehensive investigation.

2. Literature Review

2.1. Adaptability in Online Learning

Learning adaptability is defined as the ability of learners to actively adjust their learning strategies and behaviors based on the learning environment provided by the school (Nan, 2021). It involves a continuous adjustment process wherein individuals seek equilibrium between their psychological and behavioural aspects within the learning milieu (Collie & Martin, 2017). In the Western higher education context, initiatives aimed at exploring and cultivating students' adaptability have long been integrated into student learning guidance programs. Academic consensus acknowledges that students' ability to swiftly acclimate to a novel learning environment significantly influences their subsequent academic success (Otaki et al., 2022; Stan et al., 2022). Presently, predominant research on learning adaptability predominantly examines it through the lens of influencing factors, conceptualizing it as an interactive process involving the interplay of learners' resources and the environmental context within a given social setting (Holliman et al., 2021; Farsawang & Songkram, 2023).

Amidst the rapid evolution of modern educational technology, scholarly attention has increasingly shifted towards adaptability within the context of online learning. The online environment, characterized by its directive, mobile, convenient, and interoperable nature, presents notable challenges to learners' adaptability (Cheng, 2015). While existing research has actively explored various dimensions, including research perspectives and causal analysis, offering valuable insights into the adaptability of college students in English learning, there exists a conspicuous gap in attention towards a specific demographic—low-proficiency learners. Graves (2010) highlighted that this group often contends with a lack of professional interest and negative self-concepts that impede their academic success. Moreover, Hosp (2004) asserted that these learners encounter heightened discrimination, prejudice, and a deficiency of support, particularly from their peers. In the context of Chinese low-proficiency English learners, Zhou (2021) demonstrated that English learners experiencing adaptation challenges may grapple with fatigue, negativity, and feelings of isolation. Similarly, Cheng (2024) found that confusion and anxiety are common in English learners, and many of them may even easily give up their learning. However, in Zhou's (2024) research, English learners' adaptability can be implemented so as to drive learning motivation, strengthen initiative to complete learning tasks, prolong attention to the course, and enhance positive emotion towards the course. Currently, research findings pertaining to foreign language learning adaptability in the online environment remain fragmented and lack systematicity, with scant investigations involving low-proficiency learners. One primary objective of this study is to discern the distinctions in adaptability in online learning between low-level learners and their high-proficiency counterparts.

2.2. Perceived Environmental Affordances and Adaptability in Online Learning

Affordance, as conceptualized by Gibson (1979), delineates the inherent action possibilities within the environment, offering a novel theoretical lens for the investigation of adaptability in online learning. Within the sphere of networked technological culture, scholars such as Kirschner (2002) & Peterson (2010) have probed into supportive affordances systems present in the online environment. Existing research underscores a close nexus between learners' perceived affordances within the online milieu and their adaptability (Park & Lim, 2019). As scholars delve into the diverse dimensions of affordances, the academic inquiry has extended to explore the interplay between various affordances, such as networked affordance, functional affordance, or interpersonal affordance, and adaptability in online learning contexts (Volet & Wosnitza, 2004; Park & Lim, 2019). Tai (2022) had shed light on the effectiveness of functional affordance in the acquisition of second languages. Learners have the convenience of accessing technology at any time and from any location, enabling them to learn at their own pace and engage in independent practice. Moreover, Yuan (2023) also demonstrated that the networked affordances in online environment could create a secure and non-judgmental space for learners to practice English without the fear of embarrassment or making mistakes. Nonetheless, the operational mechanisms underpinning the efficacy of different affordance types in fostering learners' adaptability in the online environment remain enigmatic. Concurrently, skepticism has been voiced regarding the presumed augmentative impact of modern technology on the learning process. Crompton et al.'s study (2020) discerned that the integration of modern technology into teaching does not inherently enhance learners' adaptability. The current contentious focus of research revolves around identifying which affordances can genuinely be perceived by learners and subsequently transmuted into catalysts for adaptability (Cai, 2021).

The aforementioned literature review underscores the intricate operational mechanisms of environmental affordances in the context of online learning adaptability, revealing that not all affordances uniformly contribute to enhancing learners' adaptability. Building upon Peterson's (2010) framework for environmental affordances analysis, this study aims to investigate and analyze online learning adaptability through the lenses of networked affordances and resource affordances.

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2.3. Perceived Environmental Affordances, Environmental Adaptation Strategies, and Adaptability in Online Learning

The complex systems theory, a theoretical framework focusing on the interplay of individual internal factors, environmental influences, and behaviour, offers robust explanatory power for issues characterized by multifaceted causes and diverse behaviours (Cohen et al., 2007). Departing from the environmental determinism of behaviourism and the personal determinism of humanism, this theory establishes an interactive bridge connecting internal cognition and the external environment surrounding behaviour. Central to this theory is the notion that the existence of the environment and its impact on behaviour is not absolute but contingent upon individual internal factors (Larsen-Freeman, 1997). Factors such as individual expectations, beliefs, goals, intentions, and emotions, while influenced by the environment, can also dictate the effectiveness of the environment's impact on behaviours. Through the lens of complex systems theory, the adaptability of low-proficiency learners in online learning emerges as a product of the dynamic interaction between their individual cognitive factors and the external environment. However, existing research predominantly examines influencing factors of adaptability from an environmental perspective, often neglecting the impact of individual differences and failing to capture the influence of cognitive factors truly relevant to adaptability in authentic learning situations.

Given the distinctive nature of online learning, this study focuses on perceived environmental affordances and environmental adaptation strategies as entry points. Affordances represent intrinsic properties of the environment through which it influences individual behaviours (Van Lier, 2000). Conversely, adaptation signifies the subjective initiative of individuals who actively engage in their learning activities through the regulation of behaviours and cognition (Zimmerman, 1989). The amalgamation of these two factors facilitates a comprehensive understanding of the complexity of adaptability in online learning for low-proficiency learners. Additionally, the study aims to explore the impact of perceived environmental affordances and environmental adaptation strategies on the adaptability of low-proficiency learners in the online learning context.

In summary, the research questions guiding this paper are as follows:

1. What differentiates the adaptability in online learning between low-proficiency learners and high-proficiency learners?
2. What is the relationship between the perceived environmental affordances, environmental adaptation strategies and the adaptability of low-proficiency learners in online learning?

As online teaching has become the prevailing mode in higher education, addressing these pertinent issues contributes not only to theoretical advancements in the understanding of adaptability in online learning among specific learner groups but also deepens insights into students' online learning behaviours and psychology in the post-pandemic era. Furthermore, it provides educational

optimization pathways for the adaptive reconstruction of learning behaviours.

3. Research Design

3.1. Participants

The participants in this research comprised sophomore undergraduate students enrolled at a comprehensive university in Zhejiang province, China. Data were gathered through the distribution of paper-based questionnaires in December 2022, managed by assigned personnel. More specifically, the recruitment period for this study commenced on December 12, 2022, and concluded on January 15, 2023. A total of 350 questionnaires were disseminated, with 307 subsequently collected. After eliminating invalid questionnaires with missing responses, 262 were deemed effective, yielding an overall response rate of 74.85%. Within the cohort of effective responses, 151 participants identified as male (53.78%), and 111 participants identified as female (46.22%). All participants had undertaken the College English Test Band 4 (CET-4) on two occasions but had not achieved a score of 425. To enhance our understanding of the adaptive traits of online learning among intermediate and low-proficiency learners, a control group consisting of 100 students who successfully passed the College English Test Band 6 (CET-6) in the same academic year was selected for comparative analysis.

3.2. Learning Platform

The online English learning platform employed in this study was the "College Experience English Learning System (Listening and Speaking Training)," developed by the Higher Education Press. The system is structured around communication functions and encompasses two distinct modules dedicated to listening and speaking training, respectively. Each module comprises a variety of learning tasks, including fill-in-the-blanks, multiple-choice questions, imitation exercises, and role-playing activities. Units are formed by several learning tasks, with progression to the subsequent unit contingent upon attaining a satisfactory score in the preceding unit. The course primarily adopts a mobile learning approach, necessitating learners to engage in self-directed learning tasks through a dedicated mobile application.

The overseeing teachers offer feedback on students' learning performance, progress, and encountered challenges at least once a month. This platform design is geared towards fostering interactive engagement, reinforcing self-directed learning, and facilitating regular communication between learners and the instructor.

3.3. Research Tools

The research data were gathered through a questionnaire survey, comprising three modules: "Online learning adaptability," "Environmental Adaptation Strategies," and the "Environmental Affordances Perception Questionnaire." This study has received ethical approval from the Zhejiang Shuren University School of Medicine and Life Sciences Ethics Committee, and

participants have provided informed consent for their voluntary participation. The former two modules were adapted from a questionnaire by Liu Jiang (2019), while the latter was adapted from a questionnaire by Cai Chen (2021). Following content evaluation by two professors, student discussions, and small-scale testing, the final version of the “Online learning adaptability Questionnaire” comprised three sections: learning participation (3 items), psychological adaptation (3 items), and learning satisfaction (3 items). The “Environmental Nurturing Perception Questionnaire” was structured into two parts: network nurturing (3 items) and resource nurturing (3 items). Additionally, the “Environmental Adaptation Strategies Questionnaire” encompassed one dimension, regulatory strategy (4 items). A five-point Likert scale was employed for the measurement tools, with the exception of

“Psychological Adaptation,” which used reverse scoring. All other modules utilized positive scoring.

The internal consistency of the questionnaires, assessed through Cronbach’s alpha coefficients, demonstrated satisfactory reliability. Specifically, the coefficients for the “Online learning adaptability Questionnaire,” “Environmental Affordances Perception Questionnaire,” and “Environmental Adaptation Strategies Questionnaire” were 0.714, 0.752, and 0.802, respectively, based on the data collected from the administered questionnaires. These values indicate a robust internal consistency for all three questionnaires, affirming their appropriateness for subsequent analysis (Xue, 2021). The dimensions and assessment points of the questionnaires are presented in Table 1.

Table 1. Dimensional Structure and Evaluation Points of the Questionnaire

	Primary Dimension	Evaluation Points
Online Learning Adaptability Questionnaire	Learning Engagement	Frequency, duration, and autonomy of online learning
	Psychological Adaptability	Academic pressure, learning anxiety, and workload perception
	Learning Satisfaction	Satisfaction with learning platform, management, and outcomes
Environmental Affordances Perception Questionnaire	Network Affordances	Accessibility, traceability, and structural clarity of the learning system
	Resource Affordances	Guidance, contextual relevance, and inspiration of learning materials
Environmental Adaptation Strategy Questionnaire	Regulation Strategies	Self-regulation and other-regulation

3.4. Data Analysis

Data analysis was carried out utilizing SPSS 19.0, employing the following methodologies:

- 1) Descriptive analysis and independent samples t-tests were employed to assess the adaptive performance of all participants within the online learning environment.
- 2) Correlation analysis and regression analysis were utilized to investigate potential relationships between perceived environmental affordances, environmental adaptation strategies, and online learning adaptability.
- 3) Factorial analysis was conducted to explore the interaction effects of perceived environmental affordances and environmental adaptation strategies on online learning adaptability.

These analytical approaches were selected to provide a comprehensive understanding of the adaptive dynamics of participants in the online learning context, examine interrelationships between key variables, and unveil potential synergies between environmental factors and adaptive strategies. The application of these methods aligns with established practices in statistical analysis and enhances the robustness of the study’s findings.

4. Results

4.1. Comparative Analysis of Online Learning Adaptability between Learners with Different Levels

Descriptive statistics were employed to analyse the online learning adaptability of the two participant groups, generating four scores in total. These encompassed an overall score for learning adaptability and three sub-scores, contributing to a total score of 15 points, with each sub-score carrying a weight of 5 points. Independent samples t-tests were subsequently conducted to discern specific differences between the two groups. The data for each group, as presented in Table 2, exhibited a normal distribution, signifying that the sampling in this study was reasonable and could effectively represent the prevailing status of online learning adaptability among low-proficiency English learners.

Overall, the adaptive performance of both groups of online learners was deemed acceptable, with mean scores of 10.84 and 11.10, respectively. Notably, the low-proficiency group displayed slightly higher internal variability compared to the high-proficiency group, with standard deviations of 0.93 and 0.89, respectively. Among the low-proficiency learners, the most notable adaptability was observed in terms of learning satisfaction and learning engagement, with mean scores surpassing 3.50.

Subsequently, psychological adaptability exhibited the next highest level of adaptation, with a mean score of 3.32. Conversely, high-proficiency learners showcased optimal adaptability in terms of psychological adaptability and learning engagement, with mean scores surpassing 3.50,

followed by learning satisfaction with a mean score of 3.49. This suggests imbalances in the developmental trajectory of adaptive performance between the two groups of online learners, with significant disparities evident within each group.

Table 2. Comparison of Network Learning Adaptability Among Learners at Different Levels

	low-proficiency learners		high-proficiency learners		MD	T Score
	M	SD	M	SD		
Overall Adaptability	10.84	0.93	11.10	0.89	-0.26	-3.414*
Learning Engagement	3.70	0.60	3.76	0.51	-0.06	-1.337
Psychological Adaptability	3.32	0.62	3.85	0.40	-0.53	-11.840*
Learning Satisfaction	3.81	0.44	3.49	0.59	0.32	8.097*

* $p < 0.05$

The independent samples t-test analysis revealed a significant difference in overall adaptive performance between the two learner groups ($t = -3.414$, $p < 0.05$), with high-proficiency learners outperforming their low-proficiency counterparts. More specifically, significant differences were observed between the two groups concerning psychological adaptation ($t = -11.840$, $p < 0.05$) and learning satisfaction ($t = 8.097$, $p < 0.05$), whereas no significant difference was found in terms of learning engagement ($t = -1.337$, $p > 0.05$). In terms of mean differences, low-proficiency learners rated their learning satisfaction higher than high-proficiency learners, while high-proficiency learners exhibited superior performance in terms of psychological adaptation compared to their low-proficiency counterparts. These findings underscore the distinctive adaptive features exhibited by different proficiency levels of English learners during online learning.

4.2. Factors Influencing the Online Learning Adaptability of Low-Proficiency Learners

Among low-proficiency learners, the mean score for perceived environmental affordances was 3.29, with a standard deviation of 0.491, while the mean score for environmental adaptation strategies was 3.38, with a standard deviation of 0.554. To investigate the relationship between these factors and online learning

adaptability, a multiple linear regression analysis was conducted. Perceived environmental affordances and environmental adaptation strategies were treated as dependent variables, and overall online learning adaptability served as the independent variable.

Pearson correlation analysis revealed a mild positive correlation between perceived environmental affordances and online learning adaptability ($r = 0.228$, $p < 0.05$). Additionally, a mild positive correlation was also observed between environmental adaptation strategies and online learning adaptability ($r = 0.351$, $p < 0.05$). The regression results indicated that perceived environmental affordances and environmental adaptation strategies significantly predicted online learning adaptability among low-proficiency learners ($F = 13.159$, $p < 0.05$), with an R-squared value of 0.301. This implies that these variables accounted for 30.1% of the variance in online learning adaptability. In terms of the mechanism, the standardized regression coefficient for environmental adaptation strategies was the highest ($Beta = 0.204$), followed by perceived environmental affordances ($Beta = 0.172$). These findings suggest a close association between perceived environmental affordances, environmental adaptation strategies, and online learning adaptability among low level learners, with environmental adaptation strategies exhibiting a stronger association. Refer to Table 3 for the detailed numerical values.

Table 3. Regression Analysis of Perceived Environmental Affordances and Environmental Adaptation Strategies on Online Learning Adaptability

Model	unstandardized coefficients		standardized coefficients		
	Beta	standard error	trial version	t	p
constant	8.414	0.479		17.585	.000
perceived environmental affordances	0.351	0.124	0.172	2.822*	.005
environmental adaptation strategies	0.375	0.112	0.204	3.341*	.001

However, the preceding discussion solely delves into the individual relationships among perceived environmental affordances, environmental adaptation strategies, and online learning adaptability, omitting consideration of their interactive effects. Researchers stratified all low-proficiency learners into two groups based on a critical value of 3 for perceived environmental

affordances and environmental adaptation strategies in the questionnaire: “high perceived environmental affordances - low perceived environmental affordances” and “high environmental adaptation strategies- low environmental adaptation strategies.” Subsequently, the researchers conducted an analysis of variance with perceived environmental affordances and environmental

adaptation strategies as independent variables and online learning adaptability as the dependent variable.

The outcomes revealed a main effect of perceived environmental affordances on learning adaptability ($F=16.718, p<0.05$), as well as a significant main effect of environmental adaptation strategies on learning adaptability ($F=9.633, p<0.05$). Furthermore, a notable interaction effect between the two variables was identified ($F=27.994, p<0.001$). Given the significant interaction effect, researchers conducted further analysis on this interaction. Post-hoc tests indicated that within the low perceived environmental affordances group, there was a significant difference in learning adaptability based on environmental adaptation strategies ($F=43.065, p<0.001$).

Participants with high environmental adaptation strategies exhibited superior performance in learning adaptability compared to those with low environmental adaptation strategies. Conversely, within the high perceived environmental affordances group, no significant difference in learning adaptability was observed among different environmental adaptation strategy groups ($F=3.840, p>0.05$). These statistical findings suggest that the relationship between perceived environmental affordances and online learning adaptability among low-proficiency learners is influenced by their environmental adaptation strategies. Refer to Table 4 for the results of post-hoc tests.

Table 4. Interactive Effects of Perception of Environmental Support and Environmental Adaptation Strategies

Mode	Learning Style	N	M	SD	sig
perception of low affordance	low environmental adaptability	74	10.13	0.88	$F=43.065^*$
	high environmental adaptability	49	11.14	0.75	$p<0.05$
perception of high affordance	low environmental adaptability	73	11.24	0.88	$F=3.840$
	high environmental adaptability	72	10.93	1.02	$p>0.05$

5. Discussion

5.1. Characteristics Analysis of Online Learning Adaptability for Learners at Different Proficiency Levels

The observed parallel levels of engagement in network learning between low and high proficiency learners suggest a noteworthy phenomenon, possibly rooted in the unique attributes of the online environment. This platform excels in facilitating ubiquitous and self-directed learning, tailored to individual needs. Effective instructional management, notably the establishment of weekly learning timeframes and task delineation, coupled with the implementation of QQ study groups providing progress prompts, emerges as a crucial factor motivating learners to actively participate.

Farsawang & Songkram's (2023) argument emphasizing learning as a dynamic process involving individual-environmental selection and interaction resonates with our findings. Learners adeptly navigate the online space, extracting pertinent information to construct contextual understanding conducive to effective communication. This study underscores the pivotal role of technological advantages intrinsic to the online environment and the supervisory guidance offered by instructors in ensuring active engagement in network-based English learning.

However, a nuanced perspective emerges when considering low-proficiency learners. Similar to Cheng (2024), our individuals contend with heightened anxiety and perceive greater academic pressure and workload in the online learning milieu as well. Their psychological maladjustment manifests in three primary dimensions. Firstly, a lack of a sense of belonging in learning becomes pronounced due to limited interactions with the learning system and spatial-temporal separation from instructors. Secondly, confusion in learning positioning arises as

teachers struggle to gauge student progress, relying predominantly on assignment quantity and completion. The burden of extensive learning materials further complicates the establishment of stable learning objectives. Thirdly, insufficient metacognition in learning becomes evident as exam-oriented education influences low-proficiency learners, leading to a preference for traditional, teacher-centered teaching models and a relative weakness in autonomous learning abilities.

The pivotal role of learning satisfaction in shaping self-willingness and motivation for future learning is underscored, with low-proficiency learners expressing higher satisfaction with network learning. Their contentment revolves around the perceived relaxed nature of the online learning environment, facilitating fragmented task completion outside of scheduled classes. Moreover, they appreciate the multimodal nature of learning content, incorporating sound, text, images, and animations, which effectively captures their attention and prevents information disorientation. The above findings are consistent with Yuan's (2023) research. However, their reliance on teacher-student interactions to address learning challenges and their preference for receptive rather than productive learning tasks highlight a limitation in autonomy.

In summary, while low-proficiency learners exhibit greater acceptance of network learning, their limited autonomy in fully harnessing online advantages becomes apparent. This underscores the need for tailored instructional strategies to enhance autonomy and address specific challenges faced by learners across proficiency levels in the online learning landscape.

5.2. Analysis of Factors Influencing the Adaptability of Low-proficiency Learners in Online Learning

Perceived environmental affordances exhibit a positive correlation with the adaptability of low-proficiency learners in online learning, underscoring the crucial role of the learning environment in facilitating

learners' active meaning construction and capability development (Tabuenca et al., 2021). The mean score for low-proficiency learners' perceived environmental affordances in this study was 3.29, indicating their effective perception and utilization of various forms of support in online learning. Specifically, low-proficiency learners demonstrated a positive perception of both network support and resource support. In terms of resource support, participants particularly appreciated the traceability feature of the system, enabling them to use backend data to understand their task completion status and compare their progress with peers. The learning system's organization of task modules in the sequence of "instruction-practice-feedback" resonated well with their learning patterns. Additionally, the learning content incorporated multimodal formats, such as audio/video input and text/speech output, preventing monotony and allowing them to focus on the learning tasks. This discussion suggests that the online learning environment effectively harnesses low-proficiency learners' technological preferences and learning patterns, actively guiding their engagement in online learning.

Environmental adaptation strategies also exhibit a positive relationship with the adaptability of low-proficiency learners in online learning. Drawing from action control theory, individuals adopt specific action control strategies when faced with multiple task orientations to prioritize and achieve specific goals (Zelazo, 2023). In this study, environmental adaptation strategies played a crucial role in this action control process for low-proficiency learners. The mean score for low-proficiency learners' environmental adaptation strategies was 3.38, slightly higher than their mean score for perceived environmental affordances. While high-proficiency learners primarily focused on self-regulation, solving learning problems through online exploration or self-guided approaches, low-proficiency learners emphasized other-regulation, resolving learning challenges through peer or teacher interactions. This highlights the low-proficiency learners' greater inclination toward collaborative learning in the online environment. According to the theory of learning phenomenology, self-regulation of learning is influenced and guided by self-phenomena, and its development depends on the state of the individual's self-system (McCombs, 2001). Unlike high-proficiency learners, most low-proficiency learners have not developed mature self-learning systems through prior experiences, necessitating external social interactions to adapt to online learning. This discussion underscores that, for low-proficiency learners, enhanced experiences from external sources are crucial for maintaining and adapting to online learning.

Furthermore, an interaction effect exists between perceived environmental affordances and environmental adaptation strategies on the adaptability of low-proficiency learners in online learning. Complex systems theory posits that an individual's learning behaviour is not solely an internal process but a consequence influenced by both cognitive and environmental factors (Byrne, 2002). In this study, low-proficiency learners first gained information about learning support through firsthand experience with the online learning environment, then

adjusted their behaviour to address specific learning difficulties, gradually adapting to the online learning environment. However, complex systems theory emphasizes that the development process of individual capabilities is nonlinear, where slight changes in variables can lead to significant changes in the entire system (Larsen-Freeman, 1997). This is reflected in the different effects of perceived environmental affordances and environmental adaptation strategies on online learning adaptability.

In the low perceived support subgroup, high environmental adaptation strategies had a more pronounced promoting effect on learning adaptability. This suggests that environmental adaptation strategies play a role in internal regulation during the impact of perceived environmental affordances on online learning adaptability for low-proficiency learners. However, in the high perceived support subgroup, there were no significant differences in learning adaptability among different environmental adaptation strategy groups. This may be because when learners are provided with sufficient learning support in their environment, they can construct a self-concept regarding their abilities and learning-related factors, leaving limited room for self-regulated improvement in learning. The differences between the two groups align with the autonomy perspective in complex systems theory, indicating that individuals will autonomously regulate themselves to achieve internal equilibrium when they encounter "attractive" or "repulsive" external environmental states.

In conclusion, the interaction between perceived environmental affordances and environmental adaptation strategies illuminates the nuanced dynamics shaping the adaptability of low-proficiency learners in online learning. This multifaceted understanding contributes to the ongoing discourse on enhancing the effectiveness of online learning interventions for diverse learner populations.

6. Conclusion and Suggestions

The primary objective of this study was to delve into the characteristics of learning adaptability and its influencing factors among low-proficiency learners in online English learning. The novelty of this research lies in the integration of external environmental and internal cognitive factors into the realm of online English learning for special learner groups. By examining the interactive mechanism between the learning subject (strategy) and the learning environment (nurture) in the learning process, this research sheds light on the correlation and synergistic effects of environment-cognition-behaviour. It offers fresh insights into the study of online learning adaptability for low-proficiency learners in the post-pandemic era, drawing on the perspective of complex systems theory. The key findings of this study are summarized as follows: (1) Learning participation does not significantly differ among learners at different levels. Low-proficiency learners exhibit weaker psychological adaptability than high-proficiency learners but express higher satisfaction with online learning. (2) In terms of influencing factors on online learning adaptability, environmental adaptation

strategies play a more crucial role than perceived environmental affordances. Additionally, there is an interaction effect between the two factors on online learning adaptability. These results provide a new explanatory framework for current research on online learning adaptability and contribute to enriching the content of online English teaching research.

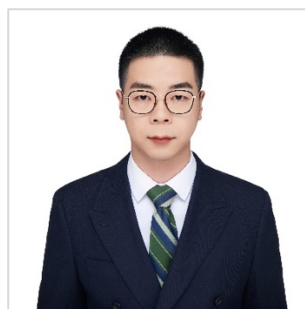
In light of the research findings, it is imperative to develop targeted educational intervention systems that foster better adaptation to online English learning for low-proficiency learners. Firstly, collaboration between educational technology organizations and education functional departments is essential to create an optimal online learning environment. The online environment constitutes the basic condition for effective online learning, and only by enhancing the supply of nurture in the online environment can a conducive learning atmosphere be established for learners. Secondly, teachers engaged in online teaching must actively cultivate low-proficiency learners' self-regulation learning abilities by raising their awareness of effective learning strategies. Given the dynamic nature of the online environment, and the unpredictability of learning challenges faced by low-proficiency learners, enhancing their strategy awareness is crucial for their successful adaptation to online learning. Finally, teachers should integrate the collaborative advantages of online learning and traditional offline classrooms. By stimulating and sustaining low-proficiency learners' enthusiasm for English learning, educators can actively address the challenges posed by the online environment. This comprehensive approach aims to optimize the learning experience for low-proficiency learners in the context of online English education.

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Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Appendix

Learning Adaptability

I engage in online English learning every day.
I spend more than 1 hour each time I learn online.
I can effectively schedule my weekly learning plans.
Online learning tasks are too difficult for me.
I always feel anxious during online learning.
Teachers assign too many online learning tasks every week.
I am satisfied with the learning platform.
I am satisfied with the teacher's teaching management.
I am satisfied with the learning outcomes.

Environmental Affordances

Logging into the online learning system is easy.
The online learning system presents learning trajectories well.
The learning module structure of the online system is clear.
The online learning system arranges learning content from shallow to deep.
Online learning tasks consist of text, images, videos, and other media.
The online learning system provides many open-ended learning tasks.

Environmental Adaptation Strategy

I proactively adjust my learning plans.
I regularly reflect on my online autonomous learning.
I proactively discuss online learning situations with the teacher.
I proactively exchange online learning experiences with other classmates.

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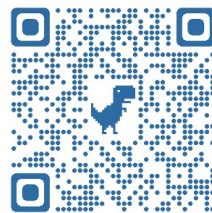
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