

The Promotive Effect of Student AI Literacy on English Autonomous Learning Ability

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Abstract: With the deep integration of artificial intelligence technology in education, scholars in language education have begun to pay more attention to how students' AI literacy is related to their ability to learn independently in English. This paper examines the promotion effect of AI literacy on English autonomous learning ability and its reasons, explains the various components of these two literacies, and also presents their common foundation in the theory of self-regulation. The three driving paths proposed in this paper are intelligent information processing, human-computer collaboration strategies and adaptive feedback mechanisms, and the three types of moderating factors have also been studied, which are algorithmic cognitive beliefs, learning task types and interaction density. The theory of AI literacy promotion for the self-study ability of English is presented in this paper.

Keywords: Student AI Literacy, English Autonomous Learning Ability, Intelligent Information Processing, Human-Computer Collaboration Strategies, Adaptive Feedback Mechanisms, Moderating Factors

Introduction

With the development of the digital learning environment, many AI tools have gradually become part of students' daily lives, and as a result, AI literacy has been added to the list of factors affecting language learning. The Environment of intelligent technology has also changed how English autonomous learning ability is developed. Most of the previous studies have focused on describing the functions of AI tools, and little attention has been paid to how AI literacy can help students learn English independently. If one does not know the way, the reasons and limits, or the goal of using education, then it will be difficult to make a good plan. In theory, this paper has established an ordered system by moving from the idea of abilities to the driving paths and finally to the moderators; thus, the necessary circumstances and modal circumstances for the promotional effect have been identified.

1. Theoretical Connotations of Student AI Literacy and English Autonomous Learning Ability and Their Relational Basis

1.1 Definition of the Multidimensional Competence Structure of Student AI Literacy

Student AI literacy refers to a set of technical operating skills and also to the whole system of cognitive, metacognitive and socio-emotional abilities. The first two are the formation of algorithmic consciousness and the development of data-interpretation ability; the third is the application of human-computer interaction strategies. Algorithmic consciousness is one's awareness of the basic logic of intelligent systems for information recommendation and learning path planning, and it is no longer passive acceptance but active learning. First, one should be able to read and interpret the results shown in the data visualisation tool for learning analytics, and then make learning decisions based on this information. Strategies for Human-Computer Interaction are organised skills that learners use to set interaction goals, control the frequency of interaction and evaluate the results of interaction; together, they form the behaviour-manifestation layer of AI literacy.

According to the level of ability, two kinds of student AI literacy have been identified: basic literacy and generative literacy. Basic literacy is the ability to recognise the basic functions of AI tools and use them effectively so that students can operate the intelligent learning environment easily. Generative literacy is an advanced ability to use artificial intelligence for problem organisation, division of labour and improvement of strategies; thus, the goal is to have students work with AI as a thinking partner

rather than being led by it. The two kinds of literacy are in a hierarchical relationship; the former serves as the basis for the latter, and at the same time, the latter can also be modified according to changes. The structure of the multiple competencies shown above will be taken as the foundation for the next study on their correlation with English autonomous learning ability^[1].

1.2 Cognitive and Metacognitive Attributes of English Autonomous Learning Ability

Cognitive ability in self-study of English generally refers to one's system of knowledge about the language that can be built by learners and the planning level for learning tasks. Cognitive ability in the learning of English as a foreign language includes self-discovery of new words and grammar rules, inferential monitoring during reading and listening, and error correction in speaking. The learner should be able to actively set the type and difficulty of language input, choose suitable learning materials according to their own language proficiency, and use memory and induction strategies to improve the assimilation of learned language. High achievement in the cognitive domain can be shown by a student's ability to independently recognise cognitive conflicts in language learning and apply the resources of knowledge at hand to solve them.

The metacognitive factor is one's awareness of and control over one's own learning during the process of learning English. These are the stages of setting learning goals, constantly monitoring the actual results of the study plan, and being able to assess one's own learning progress. Metacognition can help students know how well they have learned a particular language task and be more effective in their studies; they can also identify problems and change their study methods. Metacognitive monitoring in the process of self-study for English is more evident in the active regulation of attention, time and emotions. The cognitive factor and the metacognitive factor are close to each other; the former provides the foundation for learning behaviour, and the latter is used to guide the direction and improve the quality of this behaviour, together forming the whole psychological system of English autonomous learning ability.

1.3 Theoretical Logical Starting Point of the Interaction between the Two Types of Literacy

According to the two theories of information processing efficiency and cognitive load redistribution, the link between AI literacy and the ability to learn English independently can be explained. AI tools can pre-filter and annotate the difficulty of many input materials for English learning to reduce the filtering cost for learners at the stage of obtaining information. Therefore, the cognitive resources that were previously used for retrieval and filtering can be employed to improve the processing of language and strategy, and thus the benefit obtained per unit of time in self-study will increase. At the same time, AI can also give students timely feedback and personalised recommendations for self-study; thus, they will be more confident trying different ways to learn on their own and more motivated to study independently.

AI literacy will help all the students grow well in life and motivate them to study English independently; we will not study for them. When learners have a good understanding of AI, they can make better use of the analysis results produced by AI (such as the probability of mastering vocabulary and the distribution of grammatical errors) to revise their own study plans in advance, and they will be able to work with AI rather than being controlled by it. At the same time, very independent and self-disciplined learners of English can also use AI tools on their own to find problems in their learning and solve these difficulties, creating a positive cycle for both types of literacy. The first reason for this interaction is that both are based on the same mechanism: self-regulation of the learning process. AI literacy broadens the sources of information and operational tools for regulation, and English autonomous learning ability provides the intentional structure and executive force for regulation^[2].

2. Pathways and Mechanisms of AI Literacy in Promoting the Improvement of English Autonomous Learning Ability

2.1 The Gain Effect of Intelligent Information Processing in the Autonomous Filtering of Learning Resources

The first basic function of AI literacy for students is to help them organise the large amount of information on the Internet and improve their study efficiency. The traditional English autonomous learning environment has many problems: learners are overwhelmed by information, the quality of

resources is uneven, they need to sift through a large number of materials, and are likely to make the wrong choices. Students who are good at processing information can set all sorts of filters based on the logic of natural language processing and recommendation algorithms, such as the level of language difficulty, relevance to the topic and timeliness of the corpus, etc., and have the AI tool automatically filter and rank relevant raw corpora. Therefore, the students do not need to make many individual comparisons; instead, they can determine the relative sizes of all the resources and choose a reasonable order for studying them.

The way intelligent information processing can reduce the external cost of resource acquisition and also change the learner's internal valuation system for the value of learning resources is called the gain effect. Many applications of AI for information filtering have helped learners learn about the linguistic features of algorithmic classification, such as the frequency of words, syntactic complexity and discourse coherence, and they have gained a better sense of how their own language proficiency meets the demands of a task. Learning this will help the students learn how to use the resources and be less dependent on AI tools in the development of independent thinking. Therefore, the gain effect of intelligent information processing in the autonomous filtering of learning resources is twofold; that is to say, it can improve efficiency immediately and also optimise filtering strategies in the long run.

2.2 The Catalytic Role of Human-Computer Collaboration Strategies in the Adaptation of English Learning Goals

Collaboration between people and computers can be seen in the voluntary use of AI tools by learners to set and change their English learning goals dynamically, and a catalytic effect of this collaboration is that the level of these goals can be specified and made more flexible. The learning goals that students have set for themselves in the previous period of independent study in English are too general (e.g., improve reading comprehension, increase vocabulary), and they lack operability and staged assessment criteria. Students who are good at cooperating with computers can have AI assess their language proficiency and then break down the main goal into several small steps with clear levels and specific time limits. According to the vocabulary-mastery heatmap generated by AI, some areas in the students' vocabulary knowledge are weak and will be addressed separately. At this time, AI will help break down the goal into several small steps, and it will not do so alone^[3].

The reason for changing the adaptation of learning goals is also the result of cooperation between people and computers. During the process of learning English, the actual progress of the students often does not meet their initial expectations, so based on the feedback they have received, they need to revise their goals. Students with good AI literacy can use AI tools to carry out all kinds of assessments of their learning progress at different times (e.g., writing samples, oral recordings), and then obtain data-driven feedback on aspects such as grammar, vocabulary size, fluency, etc. Based on the above data, the students will know how far they have come in achieving their first goal and can set more realistic short-term goals or add some steps in between. The purpose of setting an end goal in human-computer collaboration is not to make people feel frustrated or bored; rather, a closed-loop system for goal-setting, progress tracking and corrective feedback will be created to help improve the direction of self-study in English significantly.

2.3 The Reinforcement Link of Adaptive Feedback Mechanisms for Self-Monitoring of the Learning Process

The other kind of AI system is an adaptive feedback mechanism; that is, based on how well a student performs, this system will change both the content and form of feedback, and thus students can adjust their own study methods according to the feedback and gradually form an internal norm for learning. In the course of self-study for English, students' self-monitoring is often under the influence of subjective bias because there is no objective norm; thus, they may incorrectly judge the quality of their own language production or fail to identify learning bottlenecks in time. Based on the construction of an external standard for self-correction, change the feedback to be more specific, timely and diagnostic according to the current ability of the learners; for example, specify grammatical errors, correct pronunciation problems, point out a lack of logical connection, etc. Students will compare the feedback they have received with their original hopes for learning, find any deficiencies, and then adjust their study plans accordingly.

The first use of this reinforcement link will be to learn from feedback and set up self-monitoring norms. After a long time in an adaptive feedback environment, students will be able to learn about the

dimensions of evaluation and judgment rules for the AI system; for example, they can learn the system's logic for determining discourse coherence or the basis for scoring lexical collocation appropriateness. Internalisation of rules helps students use the same criteria to judge the results of their own learning in independent study, so it is motivated intrinsically rather than extrinsically. Therefore, the adaptive feedback mechanism can increase the immediacy of the accuracy of self-monitoring and improve the long-term stability of monitoring ability; it is one of the neurocognitive pathways through which AI literacy supports the development of autonomous learning in English.

3. Individual and Environmental Moderating Factors of the Exertion of the Promotive Effect

3.1 Threshold Moderation of Learners' Algorithmic Cognitive Beliefs on the Intensity of Effect

Learners' algorithmic cognitive beliefs refer to their own knowledge and trust in how an artificial intelligence system works; whether the results produced by this system are correct and what problems exist in the system will affect this factor, and thus, it will have an impact on the degree to which AI literacy is used to promote students' autonomous learning in English. When learners have a strong sense of algorithmic cognition, they can correctly distinguish among the different kinds of output from AI tools (such as deterministic feedback and probabilistic suggestions) and know when to use and when to question the information provided by AI according to the circumstances of the task. The first two options should not be selected; otherwise, there will be complete dependence on AI or outright rejection of it, and thus the positive effects of AI assistance on all aspects of autonomous learning ability will not be realised. Learners with low algorithmic cognitive beliefs are more likely to believe that AI is a "black box", so they may rely too much on the results provided by AI and fail to learn how it works, or they may ignore the analytical advantages of AI. Both of the above have a relatively weak promotional effect^[4].

The non-linearity of the moderation effect is that the size of the effect of algorithmic cognitive beliefs varies slightly with the threshold and generally decreases as the threshold increases. In a certain range, a higher level of belief will lead to an increase in the proportion of people who can self-study; that is to say, they will be better able to make full use of the information obtained from AI in their own studies. If the level of belief is already above a certain threshold, adding more trust in the algorithm will not improve the results; rather, it may lead to cognitive offloading, and learners will be too dependent on the AI system for decision-making, losing their own thinking and learning initiative. The upper limit of promoting the positive effects of algorithms is not to make students' cognitive beliefs about algorithms increase indefinitely; rather, it should be kept at a reasonable level so that students can maintain a healthy scepticism towards artificial intelligence and a proactive spirit of exploration.

3.2 Differential Constraints of English Learning Task Types on the Effectiveness of AI Assistance

According to the level of cognitive processing and the form of output, types of English learning tasks can be divided into closed-skill training tasks and open-ended communicative expression tasks; these two kinds of tasks have very different requirements for the effectiveness of AI assistance. Closed-ended questions (e.g., grammar gap-filling, vocabulary matching, pronunciation correction) have one correct answer or evaluation criteria, and AI can immediately give you the correct answer and specific practice tips. AI assistance has had a relatively good effect on these tasks, and the promotional effect of student AI literacy on English autonomous learning ability can be shown as an increase in the speed of task completion and a decrease in the number of errors; this effect is stable and measurable. Open-ended tasks include free writing, thematic oral expression and cross-cultural pragmatic inference, all of which require creative language production and context-sensitive judgment; although the output of current AI tools is fluent in form, it lacks deep semantic coherence and cultural appropriateness.

A relative deficiency in one area can be seen from the fact that AI literacy varies by the type of task. Artificial intelligence can be employed to generate a large number of closed-ended questions and rapidly collect data from all kinds of tests; thus, we can determine students' AI literacy by observing how quickly they learn from feedback and recognise error patterns. For open-ended questions, the function of AI should be changed from evaluating students' answers to that of a discussion partner or the first point of reference for materials, and a high level of students' AI literacy is shown by their ability to revise and adjust the style of AI-generated content. Students who do not know about the various types of tasks may be too dependent on the final results produced by AI for open-ended questions and fail to use their own creativity in language. Therefore, the types of English-learning tasks

can be regarded as moderators of the effect of AI assistance, and they determine the particular paths and upper limits for which AI literacy can promote autonomous learning ability.

3.3 The Modal Influence of Interaction Density in the Digital Learning Space on Conversion Efficiency

A digital learning space is a combination of a physical space and a virtual space that people can use to interact with artificial intelligence; how often and to what extent a person learns from AI tools in a certain period will affect the degree of transformation of their AI literacy into independent learning ability in English. Due to a lack of interaction, most students do not use AI tools frequently and only do so for certain reasons, such as looking up a word or correcting a sentence; otherwise, they are not widely used. In this mode, the AI is to be employed as the problem-solving end device, so it will not affect the general structure of autonomous learning ability, and its conversion efficiency will be limited to that of a passive-triggering type of interaction. At a certain density of interaction, students start to use artificial intelligence (AI) in all areas of their studies; for example, they can determine the difficulty of preview materials, try different study methods during practice, and analyse their own mistakes in the review stage to improve the efficiency of their study.

If the interaction density is too high, there will be a change in the mode of conversion; that is to say, the positive gain will be a plateau in efficiency or even decrease. If the frequency of interaction is too high, it will break the continuous process of language learning by frequently demanding responses from the AI; thus, it will disturb the normal cognitive functions of comprehension and expression and hinder the development of independent language skills. High-density interaction can also lead to cognitive overload; both the demands of language-processing tasks and the management of interaction operations are high, and it is difficult for learners to learn how to make good use of AI feedback. Therefore, there is a curvilinear, inverted U-shaped relationship between the density of interaction in the digital learning space and conversion efficiency, and an ideal level of interaction density can be achieved to obtain good promotional results. Therefore, it can be concluded that in order to improve the conversion efficiency of new users, the time of contact with them should be adjusted according to changes in their cognitive load.

Conclusion

Systematically explore how to enhance students' English independent learning ability with AI literacy from the perspective of theory in this paper. It shows the meanings of the two basic ability structures and the theoretical starting point for their interaction. The three reasons for this are intelligent information processing, strategies for human-computer cooperation and adaptive feedback. The three types of moderators are algorithmic cognitive beliefs, types of learning tasks and density of digital interaction. The first result of this study is that all the spread phenomena of AI-assisted learning can be explained by a hierarchical and mechanistic framework; more significantly, the cultivation of autonomous learning ability through AI literacy is not an automatic process but is, in fact, repeatedly moderated by people's cognitive beliefs, task environments and modes of interaction. The three directions for future research are as follows: First, determine whether the weights of the structural dimensions of AI literacy and their corresponding impacts on the promotive effect for different groups of learners at various stages of education or with different levels of language proficiency are different. Second, in the future, one can improve the classification system of English-learning tasks and study how the gradient of AI-assistance effectiveness changes at different levels of cognitive demand for the same type of task. Thirdly, in the future, we will carry out a longitudinal study to determine whether there is a bidirectional recursive development relationship between AI literacy and the ability to learn English autonomously, and we will also observe changes in the roles of all kinds of moderators over time. The above will help us learn more about why people are learning languages in the information age.

References

- [1] Ba, T. X. (2026). *A Study on the Influence of Digital Learning Environment on English Autonomous Learning Ability*. *Journal of Jilin Agricultural Science and Technology University*, 35(01), 115-119.
- [2] Dong, X. Q. (2026). *A Study on Cultivating English Autonomous Learning Ability of Higher Vocational Students from the Perspective of Digital Intelligence Literacy*. *Science and Education*

Literature, (04), 150-153.

[3] Zong, L. (2025). *How to Cultivate Students' English Autonomous Learning Ability from the Perspective of Core Literacy. English on Campus, (40), 127-129.*

[4] Liu, S. (2022). *Cultivation of Students' English Autonomous Learning Ability from the Perspective of Information Literacy Ability. English on Campus, (18), 106-108.*