International Journal of Education and Social Development
ISSN: 3078-9931 (Print), ISSN: 3078-2287 (Online) | Vol. 8, No. 2, 2026

Discussion on Empowering Ideas of AI-Supported Learning for the Development of Self-Regulated Learning in Higher Education

Ziye Zhang

Faculty of Education, Monash University, Melbourne, VIC 3000, Australia

Abstract: The popularisation of artificial intelligence assisted learning tools in higher education gives new technical circumstances for the promotion of college students' autonomous learning ability. This research studies the enabling mechanism and possible risks of AI-assisted learning for autonomous learning development from the perspective of autonomous learning theory. The study systematically reviews existing survey data and theoretical achievements, and finds that personalised resource provision can expand the breadth of autonomous learning, immediate feedback helps to enhance learners' process-based self-monitoring, and heuristic interaction has a promoting effect on metacognitive ability. Survey results also pointed to dangers. 40.50% of the college students surveyed claimed that they were used to relying on AI when faced with difficulties, and they did not wish to study independently, and 48.06% said that over-reliance on AI contributed to the decline of independent thinking and writing abilities. Based on the above, this paper proposes to construct a human-machine collaborative path for autonomous learning, shifting the role of AI from "answerer" to "thinking guide", and simultaneously cultivating metacognitive ability and critical thinking while providing technical assistance, so as to achieve the unity of technology empowerment and autonomous development.

Keywords: Higher Education; Artificial Intelligence-Assisted Learning; Autonomous Learning; Human-Computer Collaboration; Metacognitive Ability.

1. Introduction

Artificial intelligence is quickly invading higher education on all fronts. Smart learning analysis systems can provide tailored information to users, and autonomous instructional resources are becoming increasingly important to help teachers assess the state of pupils and develop personalised paths. In 2025, the Ministry of Education and nine other ministries jointly issued the "Opinions on Accelerating the Digitalisation of Education", which explicitly proposed to use artificial intelligence to promote educational reform and build "general + distinctive" university artificial intelligence general courses and smart courses. This demonstrates that the incorporation of AI into higher education has reached the phase of institutionalisation.

The capacity of independent learning has always been the core of the goal system of higher education in the whole process of talent cultivation. Independent learning ability refers to the active planning, self-regulation and deep reflection of learners. However, the type of university instruction of "lecture-acceptance" still accounts for a large share and incentive of students for autonomous investigation is not enough. The purpose of introducing AI-assisted learning tools is to overcome the limits of homogeneity of class teaching system and to provide more individual-adaptive learning supports.

But bringing in technology does not mean an improvement of competence. According to a poll (1,032 questionnaires) performed by China Youth Daily·Zhongqing Xueti Media in July 2026, 98.55% of respondents had used AI tools in their learning, among whom 65.41% utilise it for homework assistance and 62.02% for course learning. As for the use, 25.48% use AI as a reference for ideas; 36.43% use AI to organise materials, then create independently; 26.74% use AI to develop a draft, then revise and refine. More worryingly, 40.50% stated that they "developed a habit of laziness and unwillingness to independently study" and 48.06% claimed that "over-reliance on AI" had caused the erosion of independent thinking and writing abilities [1]. The results suggest that AI-assisted learning without teaching design not only fails to promote autonomous learning, but may greatly reduce cognitive initiative. This article explores practical hurdles and feasible ways to enable autonomous learning utilising AI-assisted learning. Therefore, it is necessary to return to the concept of autonomous learning itself and to analyse how the inclusion of AI-assisted learning has modified the meaning and practical form of this concept within the framework of higher education.

2. Reinterpretation of the Essence of Autonomous Learning through AI-Assisted Learning

Autonomous learning is a new notion in the domain of education. Different schools have different emphases on the definition of autonomous learning, from the self-regulation theory of Zimmerman to the social cognitive framework of Bandura, most of which consider the self-regulation of learners as the core, which is reflected in three aspects: metacognition, motivation and behaviour. In the traditional higher education scenario, learning is effective when students have self-awareness and the ability to filter information. The support provided by schools is mostly external support including method guidance and literary services. In this approach the quality of learning is mostly dependent on the endowment of the pupils and the room for intervention is limited [2]. Without structured methods, autonomous learning is prone to fall into unproductive repetition and to be difficult

to progress toward in-depth understanding of scattered materials.

The practical form of autonomous learning has been expanded to the dimensions of resource provision and process tracking by the introduction of AI-assisted learning tools. In traditional way of acquiring materials students need to actively search, compare and screen content an energy consuming process which requires high judgement skill. AI tools can be used to match appropriate materials according to the knowledge structure gained by learners and the existing work goals, freeing human resources from the difficult effort of filtering and redirecting them to digest and apply the content. Thus, the barrier of entering into independent learning is broken and learners could obtain more high quality information in a unit period.

In self-monitoring, under conventional conditions, knowledge of one's cognitive state relies mostly on post hoc assessment or on periodic teacher input which is sometimes delayed and subjective. Artificial intelligence systems can collect the learning behaviour traces in real time and generate the visual analysis reports. They illustrate the flow of time of learners and the deficiency of knowledge of learners. Thus, strategy adjustment is not something that has to wait until after the exam to be initiated, but is incorporated into every engagement in daily learning. Moreover, the advent of AI is revolutionising the role of autonomous learning, which is no longer an independent study but a cognitive activity of human-computer collaboration, in which the machines do the lower-level work and the learners can focus their attention on more important and creative thinking processes. This change does not reduce the subjectivity, but makes greater claims on the overall planning and the critical reflection. But this is not automatic change. Three structural constraints still exist to the true operation of autonomous learning [3].

3. The Multi-Dimensional Paths of AI-Assisted Learning in Empowering Autonomous Learning

Three layered non-linear paths provided by AI-supported learning tools solve these three challenges and collectively enable the autonomous learning mechanism to operate.

In the traditional paradigm, learners spend a lot of time on information retrieval and material comparison when acquiring resources, yet they tend to become inefficient due to the absence of judgement. Artificial intelligence systems can actively recommend the matching learning materials according to the knowledge structure of an individual and the requirements of specific jobs, thus releasing human resources from the arduous screening method [4]. Typical cases include the "Zhiyu" platform of Ocean University of China and the "Yousp" system of Beijing University of Posts and Telecommunications, which respectively construct a three-dimensional map of "knowledge-ability-quality" and achieve the visualisation and dynamic tracking of knowledge points. The role of such platforms is not to replace judgement, but to limit the information field and increase the concentration of the subsequent cognitive processing.

The same concerns apply to self-assessment in learning. The learners' evaluations regarding their cognitive status are typically overtly delayed and subjectively skewed without external feedback. AI tools track each practice and inquiry, quantify learning paths and present the real condition of time allocation. When feedback shifts from periodic exams to everyday accompaniment, strategy tweaks cease to be the exception and become routine procedures. This alteration alters the timing and accuracy of self-regulation dramatically.

If resource acquisition and self-assessment solve the questions of "what to learn" and "how to learn", the deep contribution of AI to autonomous learning is to induce metacognitive awareness, i.e. conscious reflection on "how to learn". Heuristic questioning has been suggested as a good technique to teach metacognition, however it is impractical for regular classrooms to provide constant thinking support for individual students. AI large models generate step-by-step question chains to bring this guidance out of the one-on-one setting and make it a repeatable and scalable manner of interaction [5]. When answering questions, learners are often required to backtrack their thought paths, and it is this "forced reflection" that provides the fertile ground for the development of metacognitive ability. The three approaches highlight various aspects, but all of them arrive to the same place: to transfer autonomous learning from its usual function of exploration on its own to a new role of collaboration between humans and technology.

4. The Intrinsic Cognitive Mechanism of AI-Assisted Learning Empowering Autonomous Learning

The three ways above solve the question of what qualities of artificial intelligence can allow autonomous learning. However, if we want to better understand why such an empowering impact might arise, we need to look at the internal cognitive process of learners to find the solution. At the heart of autonomous learning is the active planning, execution and regulation of their cognitive activity by learners. The heart of the operation is to allocate attention and manage cognitive resources. AI offers an empowerment effect at the level of the cognitive process. This is predicated on the optimisation of the allocation of scarce cognitive resources.

That's just a basic limitation of working memory. Cognition is restricted. Where learners expend too many resources on information positioning, data screening and mistake debugging, there is limited scope for deep understanding and critical reflection. The AI does some low level cognitive work, so learners can use limited resources to engage in more psychologically relevant learning tasks. This provides the cognitive basis for the empowerment being enacted.

From the perspective of self-regulated learning theory, the lowering of load is not only about the optimisation of cognitive resources by AI. The biggest change is the feedback loop. In traditional circumstances, the time between cognitive activities and feedback is large, obscuring the causal relationship and inhibiting rapid tactical correction. AI's immediate feedback closes that gap. Each encounter produces perceivable signals and constantly corrects the judgements of the learner, thereby strengthening the skill of self-regulation. In the examination of "npj Science of Learning", the team of Lan Min pointed out that artificial intelligence can significantly improve the autonomy of students in goal setting, process control, and effect evaluation through personalised path planning, real-time feedback, and dynamic monitoring. This high frequency, low latency cycle culminates in autonomous learning from "periodic regulation" to "continuous regulation" [6].

The involvement of AI raises the bar for the cognitive initiative of learners. Once the AI has done the information

retrieval and first processing, learners should be able to scrutinise, interrogate and re-process the output of the AI. Cognitive attention shifts from "how to obtain answers" to "how to evaluate answers" [7]. This increases the requirements for subjectivity. The core of initiative is not to execute all phases separately at a higher cognitive level, but to coordinate, judge and decide. Prior studies have shown that generative artificial intelligence can be helpful for autonomous learning, but its usefulness is limited by students' prior knowledge, cognitive aptitude and metacognitive level. The structural transformation of cognitive processing is the internal possibility of the qualitative change of the ability of independent learning. However, the logical deduction in cognitive level is not exactly equal to the real effect in teaching practice. There are various difficulties in the empowering process of AI-assisted learning to independent learning in some specific scenarios of higher education.

5. The Realistic Challenges of Empowering Autonomous Learning through AI-Assisted Learning

AI-assisted learning theoretically fosters autonomous learning; however, the process in higher education practice is not seamless, and there are prerequisites. The technological promise and the real product are somewhat different.

First, relying on AI lowers the drive to learn on your own. Surveys indicate that 40.50% of questioned college students admit that they have grown sluggish and reluctant to study on their own, and 48.06% admit that their independent thinking and writing ability has diminished due to over-reliance on AI. The paradox of this behaviour is that the faster AI provides answers, the less students are ready to explore on their own. When artificial intelligence (AI) may be used for information retrieval, problem-solving and text generation, the learners tend to skip the processes of autonomous thinking and knowledge internalisation, creating the illusion of "already mastered", and the motivation for deep learning decreases [8]. This "cognitive substitution" effect implies that the more effective the technology, the less keen learners are to invoke their own cognitive powers—counterproductive to the empowerment goal.

Second, there is a move toward shallow AI. AI for homework is being used by 65.41% of respondents, and AI for course learning is being used by 62.02% of respondents, according to surveys. 36.43% let AI organise materials and then develop independently. 26.74% let AI generate the first draft, and then revise and upgrade. More often than not, learners regard AI as a supportive tool rather than an interlocutor for debate and deeper exploration. At the same time, 57.07% of users say that the AI answers are inaccurate or the knowledge points are slipping behind. This condition may further impede the inclination to use deeply- if the authenticity of the knowledge is in doubt, learners may forego using it instead of increasing their discriminate ability, and the deep learning benefits are therefore lessened.

Finally, the online literacy gap produces unequal empowerment. According to the surveys, 29.84% of the respondents do not have any scientific usage techniques and only use AI to deal with schoolwork; 27.91% do not understand the boundaries of AI usage. Technology empowerment has uneven effects as different learners have different capacities to apply AI. The one with a greater literacy is more likely to benefit from it, whereas the one with a lower literacy may fall into passive dependence [9]. This disparity of ability can be increased among college students with the intervention of technology. The proportion of respondents who believe that schools should formulate the usage norms of AI learning tools is as high as 83.24%, which not only reflects the general demands of students for rule guidance, but also reflects the basic direction for breaking the deadlock, that is, relying solely on the introduction of technology cannot automatically achieve the goal of empowerment and it is necessary to build an institutionalised practical framework under the premise of clearly defining boundaries.

6. Establishing the "Human-Machine Collaboration" Path for AI-Enabled Autonomous Learning

Higher education should establish a "human-machine collaboration" approach to strengthen autonomous learning with the realisation of the value of artificial intelligence (AI) technology. It is founded on the idea that the AI provides a support role, and that the final goal of a technological intervention is to empower, not to diminish, the cognitive subjectivity of learners. In particular, it is worth to focus on the following three directions.

First, conceptualise the basic logic of AI-assisted learning in terms of metacognitive capacities. Metacognition, or the knowledge and regulation of one's thought processes, can be used to examine whether learners would utilise AI to enhance their understanding or to get out of thinking completely. Metacognitively competent students are capable of making clear judgements regarding the function of AI in learning and are aware that AI should be considered as a cognitive tool rather than a replacement [10]. Teaching design should embed metacognition training into human machine interaction — the student should be asked "Where am I stuck?" "What have I tried myself?"—this a constant pre-meditation.

Second, alter the interaction function of AI from directly answering queries to guiding the thinking process. Most present AI systems are based on an immediate question-response logic where people ask questions and the machine gives responses. It is a simple technique, yet it quickly leads to mental inertia. The problem-chain progressive guiding is a better engagement method. It does not give learners the conclusions directly, but rather employs a series of questions to progressively guide learners to the center of the problem, forcing them to complete the derivation themselves. Various asking strategies have been examined in this area and performance has been shown to be improved in semi-free situations as compared to highly controlled or totally open questioning techniques. This shows that learners should neither be totally dependent nor wholly separated from AI, but rather have a sense of tension between guidance and autonomy.

Third, provide a normative framework for the use of AI at the institutional and assessment levels. Most college students do not have a strong sense of the boundaries of AI capabilities and ethical usage, thus universities need to provide systematic counsel [11]. Some universities have experimented in this area. Chongqing Normal University enhances critical thinking training in addition to technical teaching by upgrading the computer foundation course to an AI general education compulsory course. Nanjing University has established a three-level curriculum structure integrating

knowledge transmission, ability cultivation and value judgement into a whole. The evaluation approach also has to be updated, reducing standardised question types that can be easily processed by AI, and enhancing the exploration of thought streams and problem analysis processes.

7. Conclusion

AI assisted learning is changing the current patterns of learning in higher education. This research investigates the distinctive modalities of AI-powered autonomous learning from three dimensions: resource acquisition, self-evaluation and metacognition activation: Personalised push widens the range of information available; fast feedback enhances the frequency of self-regulation; and heuristic interaction provides a technical carrier for the development of metacognition. From the perspective of cognition, AI brings about a structural reconfiguration of the limited cognitive resources and a compression of the learning feedback loop in the dimension of time, jointly boosting the cognitive efficiency of autonomous learning.

But these systems only work in particular settings. According to the survey data, most college students have developed an AI dependency and mostly use AI to complete basic tasks such as homework help and course learning without extensive examination. Thus, the positive shift from technology to ability is not straightforward—if learners skip the independent thinking step, the AI may actually undermine their cognitive subjectivity.

The main limitations of this study are as follows: 1) mainly based on the secondary analysis of the existing survey data, no independent first-hand empirical research has been carried out; 2) the discussion of the causal relationship between AI and autonomous learning still remains at the theoretical deduction level without the longitudinal tracking data for verification. In the future, controlled trials can be created to investigate the influence of different use techniques of AI on autonomous learning and the regulating effect of metacognitive levels on AI-assisted learning can also be explored. Practically, the design of AI assisted learning should include metacognitive training into the interaction process, converting AI from a quick "answer provider" to a gradual "intellectual conversationalist". The universities should establish the corresponding evaluation system, so that the focus of assessment changes from knowledge reproduction to thinking process and issue analysis abilities. Artificial intelligence can reduce the temporal cost of information acquisition, but it can't replace the indirect reasoning and trial-and-error within the thinking process itself. Technology should stay within this boundary to become a support for autonomous learning.

References

[1] Liu, Y., Cheng, S., Wang, H., & Mo, Y. (2026, July 10). Over 90% of the surveyed college students regard AI as their "all-round study companion". China Youth Daily, 006.

[2] Anthonysamy, L., Koo, A. C., & Hew, S. H. (2020). Self-regulated learning strategies and non-academic outcomes in higher education blended learning environments: A one decade review. Education and Information Technologies, 25(5), 3677–3704. https://doi.org/10.1007/s10639-020-10137-8

[3] Banihashem, S. K., Bond, M., Bergdahl, N., Khosravi, H., & Noroozi, O. (2025). A systematic mapping review at the intersection of artificial intelligence and self-regulated learning. International Journal of Educational Technology in Higher Education, 22(1), 50. https://doi.org/10.1186/s41239-025-00447-9

[4] Huang, A. Y., Lu, O. H., & Yang, S. J. (2023). Effects of artificial intelligence–enabled personalized recommendations on learners' learning engagement, motivation, and outcomes in a flipped classroom. Computers & Education, 194, 104684. https://doi.org/10.1016/j.compedu.2023.104684

[5] Steinert, S., Avila, K. E., Ruzika, S., Kuhn, J., & Küchemann, S. (2024). Harnessing large language models to develop research-based learning assistants for formative feedback. Smart Learning Environments, 11(1), 62. https://doi.org/10.1186/s40561-024-00311-7

[6] Lan, M., & Zhou, X. (2025). A qualitative systematic review on AI empowered self-regulated learning in higher education. npj Science of Learning, 10(1), 21. https://doi.org/10.1038/s41539-025-00270-8

[7] Wang, C. Y., & Lin, J. J. (2023). Utilizing artificial intelligence to support analyzing self-regulated learning: A preliminary mixed-methods evaluation from a human-centered perspective. Computers in Human Behavior, 144, 107721. https://doi.org/10.1016/j.chb.2023.107721

[8] Jin, S. H., Im, K., Yoo, M., Roll, I., & Seo, K. (2023). Supporting students' self-regulated learning in online learning using artificial intelligence applications. International Journal of Educational Technology in Higher Education, 20(1), 37. https://doi.org/10.1186/s41239-023-00405-1

[9] Zhang, C., Rice, R. E., & Wang, L. H. (2026). College students' literacy, ChatGPT activities, educational outcomes, and trust from a digital divide perspective. New Media & Society, 28(2), 673–695. https://doi.org/10.1177/1461444825114131

[10] Li, C., Cui, H., & Hagedorn, L. S. (2026). The cognitive impact of ChatGPT in higher education: A systematic review of critical and creative thinking outcomes. Computers and Education: Artificial Intelligence, 7, 100571. https://doi.org/10.1016/j.caeai.2026.100571

[11] Chan, C. K. Y. (2023). A comprehensive AI policy education framework for university teaching and learning. International Journal of Educational Technology in Higher Education, 20(1), 38. https://doi.org/10.1186/s41239-023-00406-0