



When AI Learns With Students: The Impact of Cognitive Co-Pilots on Self-Regulated Learning in Digital Education

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Abstract: Recent studies emphasize a notable transition in e-learning platforms from features driven by automation to tailored learning experiences facilitated by artificial intelligence [1]. Although this shift has enhanced content flexibility and student involvement, its educational consequences are still insufficiently examined. Specifically, little focus has been placed on the impact of AI-driven personalization on students' self-regulated learning activities, such as goal-setting, monitoring, and the use of cognitive strategies. As AI systems like ChatGPT evolve into interactive learning partners instead of merely passive tools, an important question arises: does this customization promote learner independence or encourage reliance?

Generative AI has been envisioned as a "cognitive co-pilot" in language acquisition, effectively aiding in idea formulation, writing progression, and linguistic precision [2]. Likewise, in math education, AI-powered tools assist in problem-solving via guided engagement and incremental assistance [3]. Additionally, AI has been described as a "metacognitive mirror," enabling learners to monitor and repair comprehension breakdowns during reading activities [4]. Though these advancements showcase AI's ability to transform various fields, they also highlight worries about excessive dependence, decreased cognitive involvement, and fewer chances for constructive challenges.

This research presents a conceptual and empirical examination of artificial intelligence as a cognitive co-pilot in online learning environments, with a particular focus on its influence on self-regulated learning. Employing a quantitative research design based on survey data, the study examines how varying levels of AI support shape learner autonomy, metacognitive awareness, and knowledge retention. Data collected from students engaged in distance education are analyzed using SPSS for descriptive statistics and reliability testing, and SmartPLS for structural equation modeling to assess relationships between key constructs.

The study contributes to the field by bridging personalization, co-pilot theory, and self-regulated learning, offering a novel framework for understanding human-AI collaboration in education. It further provides practical implications for designing AI-integrated learning environments that balance support with the preservation of independent thinking.

Keywords: Artificial intelligence in education, self-regulated learning, generative AI, learner autonomy, cognitive co-pilot

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I. OBJECTIVE

The main objective of this paper involves analysing the function of AI as a cognitive co-pilot in e-learning and its potential implications for self-regulated learning.

This includes exploring the way AI-based personalized learning in e-learning applications affects various aspects of self-regulated learning behaviour, such as goal setting and use of cognitive strategies. Another objective of this

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study involves examining the nature of AI's effect on self-regulated learning through a closer look at the use of generative AI, such as ChatGPT, in e-learning. This will involve analysing the extent to which such tools can serve as cognitive co-pilots in diverse learning situations, like language learning, mathematics, and reading. This research also seeks to analyse the relationship between the use of AI learning technology and factors such as learning effectiveness and autonomy. This study will therefore provide information that could be used to understand and improve the integration of AI into education.

II. LITERATURE REVIEW

The current trends in the sphere of educational technology imply that there will be a considerable change in the nature of e-learning environments from automation-driven solutions to more advanced AI-driven adaptive and personal learning experiences [1]. However, regardless of numerous benefits associated with the emergence of such an educational approach as the application of artificial intelligence in online courses, the potential effects of such technologies on pedagogy have not been thoroughly investigated yet. In particular, there is a scarcity of studies that assess the impact of AI on the process of self-regulated learning among students. Self-regulated learning involves such key elements as goal-setting and monitoring of one's own performance and learning strategies.

Literature also points out that artificial intelligence systems are now moving beyond their traditional role of being mere tools for instructive purposes towards becoming partners in learning through interactive processes [5]. The emergence of AI software like ChatGPT is one clear example of how such a change is being realized by facilitating learners in conversations, explaining ideas, and completing tasks [2, 3]. This development brings about questions of whether the process of AI-based personalization is helping learners become more autonomous in their activities or fostering dependence on technology.

Simultaneously, the application of AI technology has been explored in various educational sectors as a "cognitive co-pilot" concept. In the sector of English language learning, for instance, the use of generative AI assists learners in idea creation, writing skills improvement, and linguistic accuracy, which consequently positions AI as an active learning partner [2]. In mathematics learning, on the other hand, AI provides systematic guidance during the problem-solving process, giving step-by-step instructions that facilitate learners' thinking process [3]. The "metacognitive mirror" concept has also been employed in reading comprehension learning, where learners can detect their mistakes and resolve reading comprehension

issues through interactive feedback provided by AI [4].

However, according to the existing studies, some potential dangers that can arise as a result of the introduction of AI in educational processes have been identified. Among them, there is a decrease in cognitive involvement in learning, lack of productive struggle, and diminished independent problem-solving caused by the excessive use of artificial intelligence systems[5]. Thereby, one may conclude that there is a significant gap in the literature regarding the effect of AI on the self-regulation of learners and their autonomy.

The present research will help bridge the gap by considering AI personalization, cognitive co-pilot theory, and self-regulated learning in the same research design.

III. METHODOLOGY

A quantitative research approach will be employed to examine the impact of artificial intelligence on students' self-regulated learning processes in distance education contexts. Data will be collected through an online survey distributed to undergraduate and/or postgraduate students enrolled in online learning programs at a higher education institution. The survey will include validated measurement scales assessing key constructs such as perceived AI use, AI-driven personalization, cognitive co-pilot interaction, self-regulated learning behaviors, metacognitive awareness, learner autonomy, and knowledge retention. Generative AI tools such as ChatGPT will be considered as the primary reference system for AI-assisted learning interaction.

Descriptive statistics and reliability analysis (Cronbach's alpha) will be conducted using SPSS to ensure the internal consistency of the measurement instruments. In addition, SmartPLS (Partial Least Squares Structural Equation Modeling – PLS-SEM) will be used to test the proposed relationships between constructs and evaluate the structural model. The analysis will include assessments of convergent validity (AVE), discriminant validity (HTMT criteria), and path coefficient significance. Bootstrapping procedures will be applied to examine the significance of direct and indirect effects, particularly the influence of AI support on learner autonomy, metacognitive regulation, and learning outcomes.

IV. RESULTS

It can be reasonably assumed that although the use of artificial intelligence in online education is expected to increase the learning efficiency and academic success of distance learning students to an impressive level, when taken to excess, it can lower the cognitive involvement of the learners and the development of their ability to reg-

ulate learning. In accordance with Zimmerman's theory of self-regulated learning that assumes that goal setting, self-monitoring, and strategic control form the backbone of efficient learning, it is expected that a moderate and proper use of AI tools like ChatGPT will improve learners' metacognitive skills and learner autonomy [6]. At the same time, if artificial intelligence is used as a kind of cognitive co-pilot too extensively, it might negatively influence cognitive involvement and the ability to think independently.

V. IMPLICATIONS

The results of the research may be used as a guideline to improve the practice of education in general, as well as create effective AI-powered education environments. From an educator's perspective, the research implies the necessity to structure the integration of artificial intelligence into the educational process appropriately. In detail, teachers have to make sure that artificial intelligence serves as means of enhancing self-regulation and learning strategies, not as a substitute to learners' activities related to goal setting, monitoring, and reflection. From the perspectives of instructional designers and decision-makers, the results imply the necessity to create recommendations that would ensure balance between personalized education driven by AI and the maintenance of autonomy and learning engagement. Lastly, the risks related to excessive dependence on artificial intelligence also imply incorporating opportunities for productive struggle and independent problem solving.

VI. CONTRIBUTION & ORIGINALITY

In terms of novelty, this study contributes to the body of research on artificial intelligence in education in at least two ways. First, the study brings together three concepts—personalization through AI, cognitive co-pilots, and self-regulated learning—which have hitherto remained distinct from one another in the literature. Second, whereas most studies on AI in education have considered AI as merely a technology of automation and/or

performance improvement, this study presents an innovative perspective on AI as a dynamic partner of human thought and a powerful agent capable of re-configuring our learning experiences by changing our modes of self-regulation. What is particularly novel about the study is its focus on the relationship between different degrees of involvement of AI technologies in learning processes and learner autonomy, meta cognition, and cognitive dependence.

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