1. Introduction Information technologies, particularly artificial intelligence (AI), are revolutionizing modern education. AI algorithms and educational robots are now integral to learning management and training systems, providing support for a wide array of teaching and learning activities (Costa et al., 2017, García et al., 2007). Numerous applications of AI in education (AIED) have emerged. For example, Khan Academy offers Khanmigo, an AI tutor harnessing GPT-4 capabilities, delivering personalized learning support and intelligent feedback across various subjects, including mathematics, programming, and language learning. Similarly, Duolingo, a language learning platform, uses sophisticated AI systems to improve learner experiences (Bicknell et al., 2023). iFlyTek offers intelligent assessment systems tailored for various grading scenarios, including the national college entrance examination in China (iFlyTek, 2024). AI-powered learning management systems (LMS), such as Absorb LMS and Docebo, deliver multiple AI capabilities to support teaching and learning activities, such as intelligent content creation, administrative task automation, and personalized learning (Leh, 2022). In the realm of educational robots, SoftBank Robotics Nao and Pepper robots are developed to serve as language-teaching social robots (Belpaeme & Tanaka, 2022). The applications of AIED are rapidly evolving, reshaping the overall teaching and learning landscape (Popenici & Kerr, 2017). The advent of generative AI technologies has introduced further opportunities, attracting investment into and development of the AIED industry. The global AIED market, valued at USD 1.82 billion in 2021, is projected to grow at a compound annual rate of 36 % from 2022 to 2030 (GrandViewResearch, 2021). Learners, teachers, and educational institutions are quickly embracing AIED. Recent statistics indicate that 43 % of college students in the US use AI tools like ChatGPT and half of instructors employ AI to develop their lessons (Businessolution.org, 2023). Moreover, AIED demonstrates its efficacy and effectiveness. Adaptive learning enabled by AIED has been shown to improve student test results by 62 %, while AI usage, in general, enhances student performance by 30 % and reduces anxiety by 20 % (Businessolution.org, 2023). Concurrently, research on AIED has surged in recent years, yielding a substantial body of work exploring various aspects of these applications, including design, effectiveness, and outcomes (Chiu et al., 2023). This burgeoning research landscape has attracted review studies, which offer insights into the general AIED research field (Chassignol et al., 2018, Goksel and Bozkurt, 2019, Guan et al., 2020, Hwang et al., 2020, Srinivasan, 2022) as well as specific topics such as learning analytics (Charitopoulos et al., 2020), machine learning and precision education (Luan & Chin-Chung, 2021), or educational AI within particular subject areas such as mathematics (Hwang & Tu, 2021) or STEM (Xu & Ouyang, 2022). Nonetheless, few studies have systematically delineated the conceptual structure of the AIED research field and its theoretical underpinnings, which are pivotal for understanding its current state and evolving prospects.