

# An Overview of Artificial Intelligence in Education

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## INTRODUCTION

Artificial Intelligence (AI) has been introduced into education to enhance teaching and learning. The development of AI assisted teaching and learning practices and outcomes has gained increased interest among researchers and educators. For example, AI supported “smart” tutoring systems have been used to assist learning in higher education and K-12 settings. The support of technology infusion in education has made it possible for students and educators to experience AI embedded learning activities as part of advanced technology. The benefits of using AI in teaching and learning are many: AI works around-the-clock, never tires, and is always ready to assist a student. In this article, the application of AI embedded technology in education in the last five years is explored and discussed based on the literature.

## BACKGROUND

The discussion on artificial intelligence goes back to the topic on what intelligence is and whether computer programs can mimic human intelligence. Despite the fact that there is no widely accepted answer to that question, our understanding of intelligence has shifted over time from the finite to the infinite, and the tangible to the intangible (Anusuya & Kattie, 2010). The discussion of intelligence in education lends itself to Gardner’s theory of multiple intelligences. Gardner (1983, 2003, 2009) believed that there were nine types of intelligence among human beings. These nine types of intelligence could be summarized as linguistic, musical, logical/mathematical, spatial, bodily/kinesthetic, intrapersonal, interpersonal, naturalist and existential.

Furthermore, Gardiner’s theory revealed that each individual possessed more than any one of these intelligences, but that it was rare to have all types operating in one individual at one moment in time. While his theory of multiple intelligences (MI) may have gained some emphasis in fields such as psychology and science, the theory of MI is well respected in the field of education because it makes education more focused on the individual. The theory of multiple intelligences sets the framework for educators to understand and explain differences among students. Teacher educators rely on his theory to better understand the teaching and learning process. These intelligences are widely referenced in education to address learner needs, for using AI technology to provide differentiated instructions, and to best teach about the intelligences in the classroom for more effective instruction of individuals.

Technology has long been encouraged and supported in education. The emphasis on technology in teaching has been demanded by its council for the accreditation of education standards such as CAEP (CAEP, 2013) at the national level and GaPSC technology standards (GAPSC, 2013) at the state level. However, the focus on the use of AI-supported technology is still preliminary. Some attempts in using AI embedded technology to assist student-teacher interaction, learning activities, and instructional designs have been studied. But more empirical research is needed to explore and better understand the use of AI technology for educational settings and with the teaching and learning process.

## MAIN FOCUS OF THE ARTICLE

The article focused on AI embedded technology and its application to education. By analyzing the trends,

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development of AI, and issues in the literature over the last five years, the authors hope the results will shed light on our understanding of AI, and the use of AI technology in education. As revealed in the literature, the use of AI in the form of machine tutors has emerged as a prominent feature. Building on the advances in cognitive science research, AI supported tutoring systems have now become widely available for students, school systems, and home schooling (Chipman, 2010). The article will explore AI tutoring technology.

## AI Technology and Learning Environment / Processes

AI supported tutoring systems first emerged from the study of patterns in research studies. In the article by Pedrazzoli (2010), the author discussed the AI agent as it functioned in a web-based e-learning environment. According to the article, an AI based adaptive system was used to enhance existing language management systems (LMS) that reflected more flexibility than the real-time presence of an instructor. The article found the AI agent helped with the dynamics of course design, support, collaborative sessions, and activities as supported by modern constructivist learning theory which implies activity, constraint-based learning based on individual experiences (Zhou & Lawless, 2014).

In addition, AI supported computer and technological systems have impacted the dynamics of the learning environment. Wong (2012) explored the possibility and potential of AI for learning support and found that AI assisted individualized learning (e.g., MI) in and assessment for the learning process. Similar impacts of AI on the learning process and dynamics was revealed in the article by Adamo and colleagues (2010). There, AI was embedded in the learning process in the form of “talking heads” with the result that the AI technology had had a positive impact on learning and, more importantly, the use of AI-supported technology made the learning process more enjoyable and fun for students (viz., using AI in educational games).

Similar results were echoed in the study by Chen (2009). In the study, Chen found that the AI supported learning system helped formulate more effective and successful learning paths for individual learning needs (MIs). With the advancement of AI technology, a linguistic infrastructure could be enabled to represent

conceptual relationships between course materials and learners. In Chen’s article, the AI-proposed learning paths enabled individual students to master concepts more effectively by reducing their cognitive load throughout the learning process.

## AI Use in Learning Activities

Activities are an important part of teaching and learning. Based on the constructivist theory of learning (“learning by doing”), students learn better when activities are built into the learning process. John Dewey called this “learning by doing” while Vygotsky called it social cultural learning. Regardless of the differences in the terminology, AI has found its way into learning activities in the classroom.

For learning activities, studies found that AI could help with grouping processes to better match learners in a way that improved collaboration. Ounnas and colleagues (2009) had explored the AI role in grouping students for collaborative activities. The results of the study indicated that the AI embedded technology to assist grouping increased participant satisfaction more than traditional teacher or student initiated grouping methods.

AI also found a role in subject-related activities. Hsu and colleagues (2012) used AI to monitor the reading activities of students. In their study, with an approach known as the “artificial bee colony” (ABC) approach because it optimized intelligent foraging, they collected and analyzed data gathered (“foraged”) by sensors, such as webcams, heartbeat sensors, and blood oxygen sensors, to help instructors determine the rates of student reading concentrations in a classroom environment. The results showed that the ABC system effectively obtained near-optimal improvements in student concentration. With its user-friendly graphical interface, the system made it easy for instructors to clearly understand where the reading focus of each of their students was located.

## AI and Learning Styles

The debate on learning styles endures (Galagan, 2014). Whether there is such a construct or concept as a “learning style” remains debated, educators generally agree that learning styles are relevant and affect learning rates

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