Chapter 3

Classroom assessment and evaluation with artificial intelligence

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Abstract: The learning process needs to be innovative and creative to meet the changing demands of education. Innovations in artificial intelligence (AI) are reshaping the educational landscape by streamlining routine tasks like instruction and assessment. Examining the role of AI in the classroom, particularly as it relates to instruction and student performance, is central to this chapter. A number of educational technology platforms have made extensive use of AI. The term "artificial intelligence" (AI) refers to the practice of creating computer programs with cognitive abilities similar to those of humans. Teachers will soon be able to delegate tasks like taking attendance, correcting student work, administering quizzes and examinations, explaining material, and creating administrative reports to machines. In contrast to the human mind, particularly that of educators, technology is only able to function systematically and automatically in response to human orders. Hence, the instructor would possess unparalleled intelligence. Similar to how AI sprang out during the industrial revolution, it is a product of human creativity. This chapter provides a literature review on using AI in education, discusses applications of artificial intelligence in education, focuses on the role of AI in classroom education, and presents an overview on how the AI based techniques can enhance the assessment and evaluation in the educational process.

Keywords: AI in education, AI applications, educational process, AI techniques, AI use for the educational assessment.

3.1 Introduction

The process of assessment is at the very core of education that is supported by evidence because it gives information that may assist educators in improving their teaching, students in improving their learning, and systems in improving their operation. A great number of developments in Artificial Intelligence (AI) have taken place over the course of the past few years. The effects of artificial intelligence in general are currently being subjected to a great deal of inspection, and there has lately been a discussion concerning the effects of AI specifically in the field of education, particularly with regard to the

evaluation process. In general, there is an overwhelming view that artificial intelligence cannot be utilized in a constructive manner for the education sector, particularly in the context of the contextual analysis of knowledge assessment, execution and evaluation methodology of assessment tasks (Renz and Hilbig, 2010). There are a wide variety of assessment procedures, which vary from casual, low-stakes examinations to extensive, high-stakes examinations.

There are a variety of factors that may be used to categorize them, including when they are provided, who administers them, what is measured, how findings are acquired and presented, and so on (Yang et al., 2021). On the one hand, there are formative evaluations, the input from which may be utilized to make adjustments to various aspects of learning and instruction. It is possible to use the information that they provide to exert control over the learning process and, as a result, increase the likelihood of success. By their very nature, formative evaluations are low-stakes, and they cannot be utilized to support findings regarding curricular standards, accountability, or any other related topics. The traditional method of formative evaluation consists of exam items that ask students to provide either written or numerical responses, in addition to some type of textual interchange. Formative assessments that are conducted on computers often include filling in blanks processes and are assessed automatically. These assessments replace the majority of the text output. On the other hand, there are summative evaluations, the input from which is utilized to evaluate the value of the educational endeavor that is being discussed. The very nature of these assessments makes them high-stakes, and judgements can be reached about students, instructors, curriculum, schools, and other relevant factors. There must be a high level of control over the content of the test, the manner in which it is administered, as well as the methods by which results are gathered and processed (Moschella-Schuller, 2023; Crisp and Ireland, 2022). Over the past several years, educational evaluation has garnered a significantly increased amount of attention as a means of enhancing the effectiveness of a course that students are enrolled in. Students' knowledge, abilities, and attitudes are evaluated through the use of educational assessments, whether they are formative or summative. The purpose of these tests is to enhance the learning outcomes that are anticipated from a particular course. However, the manner in which educational evaluations are conceived of, carried out, and assessed is a significant factor in determining the degree to which they contribute to the achievement of a course's goals. An extensive number of technical solutions have been developed with the purpose of serving as instruments that may assist in the process of designing and implementing various evaluation techniques. In recent times, Artificial Intelligence (AI) has been hailed as a technology solution that had the ability to bring about significant improvements in educational evaluations (Chen et al., 2021; González-Calatayud et al., 2021). First, a comprehensive discussion of the traditional educational evaluation methods, tools, and

approaches that have been utilized extensively and for a considerable amount of time is presented. Before digging further into the various approaches that are now in use, a worldwide review of conventional educational evaluation methods, resources, and technology is needed. On-site examination of a single, standardized written test that establishes the requirements for finishing a course by employing the same evaluation criteria for all students is one of the most prevalent methods of educational evaluation that has been in use for several decades. Written examinations like these are used to evaluate students' understanding of the material that has been covered over a particular course, as well as their ability to think critically and make connections between the many concepts that are given in knowledge-based questions. The ability of pupils to do calculations is also evaluated through the use of questions that are dependent on computations. Exam questions are often mixed, meaning that they range in terms of both the level of difficulty and the amount of subject that is covered. Exam questions are typically sent to a "team" consisting of instructors and teaching assistants (Kubiszyn and Borich, 2024; Shohamy,. 2020). This is a regular practice that contributes to the resolution of this difficulty.

3.2 Literature Review

Following a comprehensive examination and analysis of pertinent scientific and professional literature, numerous significant studies in the field of AI in education have been identified.

Sadiku et al. (Sadiku et al., 2021) define artificial intelligence as the capability of a computer system to do tasks typically requiring human intelligence, such as reasoning and learning. AI technology in education offers an unprecedented level of flexibility and adaptability. This is transforming educational institutions and classrooms, significantly simplifying the role of educators. Artificial intelligence is poised to transform schooling. There are several applications of artificial intelligence in the field of education.

Joshi et al. (Joshi, et al., 2021) assert that the application of AI is now evident in nearly all facets of our life. Artificial intelligence is a sophisticated technology that transforms every facet of our social interactions. In education, it will create innovative learning solutions that will be evaluated in several contexts. New educational technology can enhance the achievement and management of educational goals. The study examines the application of AI to enhance educational outcomes, offering instances of how AI technology might assist educators in using data to advance equity and educational ranks in developing nations. The objective is to analyse the perceptions of educators and learners on the use and efficacy of artificial intelligence in education. Additional research on the generational

and geographical diversity of teacher and student perceptions can enhance the effective deployment of AI in Education (AIED).

Research (Kengam, 2020) elucidates the applications and utilisation of artificial intelligence within the educational sector. The 21st International Conference on Artificial Intelligence in Education, conducted in 2020, identified AIED as a burgeoning domain within educational technologies. The application of AI by educators is ambiguous regarding its potential to provide pedagogical benefits on a larger scale and its impact on teaching and learning in higher education. The research discusses the influence of artificial intelligence in education, highlighting its benefits and drawbacks. The author delineates a particular method for constructing an educational platform utilising AI, as well as the subsequent impacts of AI on education.

Another research (Lee, 2020) asserts that the application of AI in education has transitioned from the realm of science fiction to a tangible reality during these times of extraordinary dynamic change. This domain includes many strategies, algorithms, and solutions capable of addressing contemporary challenges in the classroom. The study examines the potential extension of a current world-supporting AI into the educational sector and analyses the problems associated with using AI in schools throughout Singapore.

Evaluate the influence of artificial intelligence on education. The study's focus was confined to the use and impact of AI in administration, teaching, and learning, based on a narrative and assessment framework derived from the preliminary research. An excellent research methodology employing a literature review as its design successfully aided the study's objectives. Artificial Intelligence is a domain of inquiry and subsequent inventions that have produced computers, machines, and other entities exhibiting human-like intelligence, defined by cognitive capabilities, learning, adaptability, and decision-making proficiency. The research indicated that AI was predominantly implemented and utilised in education, particularly inside educational institutions, in multiple formats. Artificial intelligence initially manifested as computers and computer technologies, subsequently evolving into intelligent educational systems reliant on the web and networks, and ultimately incorporating embedded computer systems alongside other technologies, like humanoid robots and web chat interfaces. Through these platforms, teachers could execute many administrative tasks, including the more effective and efficient assessment and grading of student assignments, thereby enhancing the quality of their instructional activities. Conversely, as the technologies facilitate machine learning and adaptability, the curriculum and content are tailored to meet the needs of students, thereby enhancing the student experience and the overall quality of education.

Research discussed (Panigrahi, 2020) allowing stakeholders in the education sector to comprehend the degree of artificial intelligence utilisation in education and its anticipated advantages. The research presents instances of AI use in education, particularly in developing nations like India, where universal education is regarded as a key objective of sustainable development. The paper initially provides the reader with an overview of artificial intelligence. AI has progressed from basic rule-based systems to data-driven systems, culminating in context-aware systems with enhanced capabilities. The research subsequently examines the utilisation of AI in education to enhance learning results. As an emerging technology, artificial intelligence in education will transform the "learning experience" by establishing an adjustable learning environment that fosters a "personalised learning experience". The report ultimately provides instances of AI technology application in the education sector to enhance the learning experience and quality of education.

Huang et al. (Huang, et al., 2021) assert that the advent of innovative technologies influences pedagogical approaches and learning methodologies. The fast advancement of AI technology in recent years has made its application in education increasingly evident. The research initially delineates the utilisation of AI in education, including adaptive learning, assessment of instruction, and virtual classrooms. The analysis examines its influence on teaching and learning, which positively enhances teaching standards and the quality of learning. The forthcoming obstacles that AI applications may encounter in education are outlined, along by allusions to AIs that advocate for educational change.

3.3 Applications of Artificial Intelligence in Education

The majority of research on artificial intelligence in education mostly concentrates on the implementation of AI technologies. AI technology is instigating numerous transformations in the educational sector, enhancing the efficacy of educators' efforts and the learning experience of students. The following applications are discussed below (Yang et al. 2021; Moschella-Schuller, 2023).

- *Classroom application* - AI enables educators to instruct on all AI assessment activities, so allowing them to dedicate more time to students. Furthermore, artificial intelligence is advantageous for education. As educators cannot be perpetually accessible to students, the latter require tutors.
- *Customised education* - AI can deliver a degree of differentiation that tailors learning to the individual needs of each student. Artificial intelligence facilitates the creation of individualised learning schedules for each student, thereby tailoring education to

their exact need. This creates novel methods for engaging with students who have learning impairments.

- *Administration* - AI can streamline administrative functions. The system can automate assessment processes including several tests. This implies that educators would possess increased time for pupils.
- *Universal access to global classrooms* - AI can eliminate barriers, facilitating the ability to study any course from any location at any time worldwide. Artificial intelligence systems can enhance the accessibility of global classrooms for all individuals, especially those who communicate in various languages.
- *Medical education* - The rapid advancement of new health AI technology is being integrated into clinical practice.
- *Marketing education* - Artificial Intelligence is changing the marketing field. These encompass sales forecasting, online experience personalisation, speech recognition, content generation, and chatbots.

Additional applications encompass personalised coaching, support, feedback, assessment instruments, virtual assistants, mobile games, intelligent teaching systems, educational robots, smart education, and engineering education. The implementation of AI in education can be perceived through adaptive learning, instructional assessment, virtual classrooms, smart campuses, and intelligent pedagogy (Wang et al., 2021).

- *Adaptive learning* — AI facilitates the advancement of adaptive learning, which utilises data mining, intelligent educational systems, learning analytics, and real-time analysis.
- *Classroom evaluation* - AI technologies, including image recognition, predictive systems, and computer vision, facilitate classroom assessment.
- *Virtual classroom* - The advancement of virtual reality, augmented reality, auditory, and sensory technologies facilitates the transformation of the educational environment.
- *Smart Campus* - Artificial Intelligence is integral to the administration of campuses and services. Facial, auditory, and sensory recognition technologies are employed to construct an intelligent campus.
- *Intelligent teaching robots* - Educational robots have been specifically designed for the academic sector to foster analytical, creative, and practical skills.

3.4 AI implementation for the assessment in the educational field

In recent years, technologies that utilize artificial intelligence (AI) have been created and implemented in a broad variety of educational settings, including assessment as well as teaching and learning. There are a lot of tools and methods that are based on artificial

intelligence that are utilized for assessment processes. These methods include both machine learning techniques and deep learning approaches. There are a number of their application in the evaluation area (Owan et al., 2023; Wang et al., 2021).

As a result of the pandemic caused by the COVID-19 virus, educational institutions have been compelled to implement novel approaches to remote learning, which have become the norm. This has led to the investigation of technology-enhanced solutions that are continuously changing in order to accommodate these changes. In the field of education, educational evaluations are extremely important since they serve as a spine, assessing whether or not learning has taken place and how well it has taken place. The existing assessment procedures, on the other hand, are not only inadequate for higher-order thinking capacities but also ineffective for coping with the massive shift that has occurred in the student pedagogical and learning environment. Also, they are humdrum and have been around for a long time. As a result, the field of educational evaluation is in need of renovation, and artificial intelligence (AI) is one of the technologies that is driving the demand for this reinvention. Research interest in this topic is rapidly increasing, and this trend is expected to continue.

3.4.1. The assessment of learning outcomes (LO) based on machine learning

For the purpose of LO evaluation, a number of different machine learning approaches have been utilized. During the learning objective (LO) evaluation process in an engineering class, decision tree and support vector machine classifiers were utilized. In the same vein, support vector machine and Naïve Bayes classifiers were employed for the purpose of evaluating learning outcomes (LO) through the written texts of students enrolled in engineering courses. In addition, Naïve Bayes and k-nearest neighbour classifiers were employed in order to quantify the degree of adoption of four distinct learning objectives (LOs) in the learning portfolios of the students. In many cases, AI for assessment and evaluation are embedded within standard synchronous and asynchronous activities, e.g., evaluating test scores or written work (Rastrollo-Guerrero et al., 2020; Yağcı, 2022).

3.4.2. Natural language processing-based assessment

For evaluating the rubric-based qualitative assessment of written work, natural language processing techniques were used (e.g., and sentiment analysis technique). When it comes to the evaluation of various written assignments, such as review articles, project proposals, and technical reports, it was also determined that varied requirements for the building of rubrics were necessary. It was proposed that constructive alignment may be used to bridge the gap between the learning outcome and the design of the assessment

process (Rock, 2022; Davies et al., 2021). Fig. 3.1 illustrates use of AI in the analysis of data in education, and Fig. 3.2. illustrates AI use in the assessment process in the classroom.
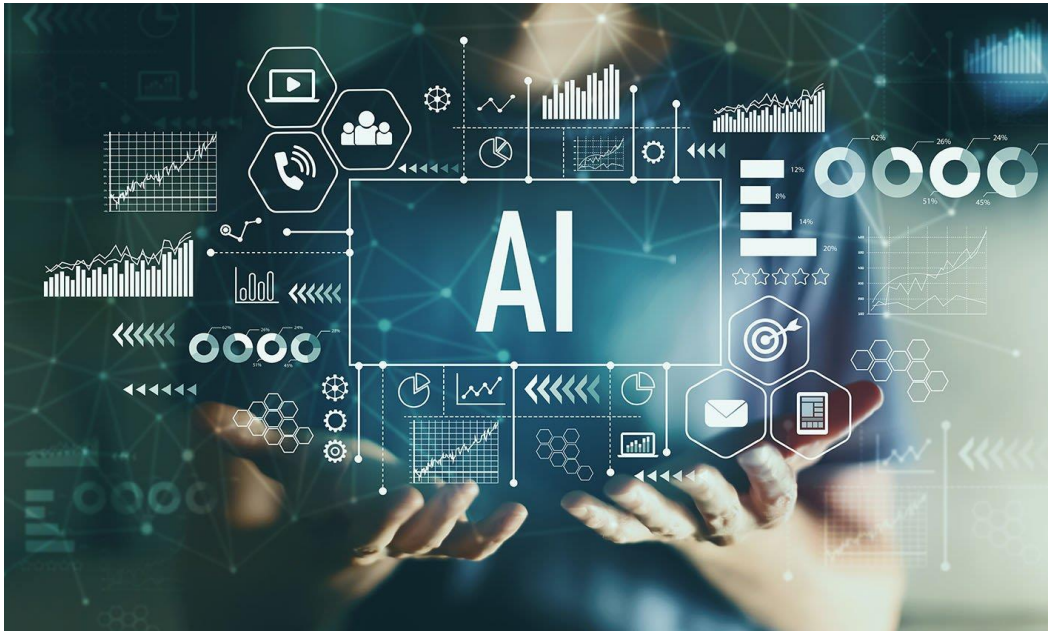

Fig. 3.1. AI use in the analysis of data in education

Fig.3.2. AI use in the assessment process in the classroom

Conclusions

With its ability to provide solutions that are scalable, personalized, and efficient, artificial intelligence is set to revolutionize the evaluation process in the educational sector. However, despite the fact that traditional approaches offer a foundation, they frequently lack the adaptability that is necessary in contemporary educational settings. These deficiencies are addressed by artificial intelligence, which improves both formative and summative evaluations by utilizing cutting-edge technology such as machine learning and natural language processing technologies. These problems, which include preserving academic integrity and equal access, continue to be major considerations, despite the substantial advantages that are associated with it. As artificial intelligence continues to advance, its role in educational assessment will grow. In order to maximize its potential while addressing both ethical and practical issues, it will be necessary to do continuing study and implement recent research in this area with careful consideration.

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