

Employing Artificial Intelligence in Developing Blended Learning Strategies in Educational Institutions

Prof. Rafid Sabah Abdul Ridha Al-Tamimi, Prof. Dr. Saad Ali Zayer

rafid0074@coadec.uobaghdad.edu.iq

ORCID ID: 0000-0003-1659-7430

Saad.ali@ircoedu.uobaghdad.edu.iq

ORCID ID: 0000-0001-5972-6314

University of Baghdad - College of Education, Ibn Rushd for Human Sciences

Abstract

Artificial Intelligence (AI) is utilized in blended learning to personalize educational pathways according to students' patterns and needs, thereby enhancing effectiveness and flexibility within educational institutions. AI-driven Learning Management Systems (LMS) also help automate repetitive tasks like assessment and content development, and provide accurate analytics to monitor student progress. Moreover, AI transforms the role of the teacher from a knowledge dispenser to a facilitator and mentor, encouraging students to think critically and build digital literacy skills. But there are also basic issues in implementing such an approach, with the most important being the poor technical infrastructure, a lack of faculty training, and the ethical questions of algorithmic bias and data integrity. Research shows that integrated institutional structures with well-defined connections between learning outcomes and integrated AI systems, as well as designing educational activities involving a mix of self-paced learning and in-person interaction, are essential to successful integration. Models have been successfully implemented in a wide variety of settings, including some in Iraqi universities, which have helped to boost success rates and increase engagement when institutional support is provided, and sufficient institutional training is given. Furthermore, the application of generative tools, such as the use of chatbots, in a flipped classroom has proven effective in improving interaction and giving immediate feedback, provided they have adequate skills in prompt engineering to not be relying on the output. Building policies, forming partnerships with technology providers and creating sustainable professional development programs are essential in the future to ensure AI technologies are adopted in a way that is ethical and effective in blended learning environments.

Section One:

Research Problem

The use of digital technology is increasingly becoming a unique paradigm in the education sector, particularly after the development of the blended learning model, which is based on the integration of the strengths of traditional education and e-learning. Concurrently, AI technologies have come to the fore as a potential solution to augment the quality of education by reflecting on the behavior of learners, tailoring content to their specific needs, modifying assessment systems, and giving instant feedback to learners (Khamis, 2011). 17).

While some of these cutting-edge technical tools are available, they are not widely used and are not coordinated in many educational institutions in the context of blended learning. However, there are pedagogical and technical gaps in understanding how to best leverage these tools, as well as challenges (Abdul Majeed, 2021) with infrastructure, training and ethical issues related to privacy

and data utilization. How is AI used in blended learning environments? How much AI is being used in the design of blended learning environments? What are the major barriers that need to be addressed for the best utilization of these technologies in educational institutions?

Significance of the Research

The research takes place in an era of significant transformation in the education industry, with the rapid development of technology especially blending learning model. For many educational institutions this has become a business decision, since the availability of knowledge is not hindered and it integrates the human factor of face-to-face education with the technical possibilities of e-learning. The theoretical value of the research is that it contributes to the enhancement of the scientific literature related to blended learning and AI. It offers a scientific view on the connection between the two concepts and helps researchers in the field of educational technology to create further research based on rigorous scientific bases. Practically, this research is of great importance to teachers, instructional designers, and institutional administrations. It provides a holistic perspective and practical guidance on how to strategically, securely and successfully apply AI to blended learning. This helps to enhance the quality of education, increase opportunities for students and to implement the principle of learner-centred education. Moreover, this study facilitates decision-makers in the educational field to prioritize investing in AI technologies and establishing the required infrastructure, as well as training educational cadres for optimal use of the same technologies (Sabri & Radhi, 2021. 1290).

In addition, the social value is a very significant aspect, raising public awareness of the shift towards smart education, and motivating the connection between humans and machines in creating an educational environment that can fulfill future needs, particularly in the face of digital, economic and cultural challenges (Zayer, 2015). 122).

However, the research also raises ethical and legal concerns related to the use of AI in education and advocates responsible and safe usage of these systems while recognizing the benefits for students, acknowledging that it is important to safeguard students' privacy and rights. To conclude, this research becomes valuable because it discusses a current issue of great need in the context of digitalization of society, aiming to offer scientific and practical solutions that can be put into practice, aiming to improve education and ensure equity and quality in the new learning contexts.

Research Objective

This research aims to explore the employment of AI technologies in developing blended learning environments and analyze their role in improving the quality of the educational process and enhancing student interaction and participation. It seeks to identify the most prominent smart applications that can be integrated into blended learning and provide a practical framework to help educational institutions use AI systematically, safely, and effectively, focusing on overcoming technical and pedagogical challenges.

Secondary Objectives

1. Define the concept of blended learning and its most prominent models and advantages compared to traditional and e-learning.
2. Clarify the concept of AI, its development, and its applications in the educational field.
3. Monitor the most prominent AI applications and techniques used in blended learning environments, such as recommendation systems, intelligent assessment, and adaptive learning.
4. Analyze the impact of employing AI on the educational process in terms of quality, academic achievement, and the principle of individual differences.
5. Identify the most prominent challenges and difficulties facing educational institutions and teachers in employing AI within blended learning environments.
6. Propose a framework or practical model for the systematic and effective integration of AI into blended learning strategies.

Research Scope

- Spatial: Limited to specific educational institutions within a defined geographical area.
- Temporal: Covers the academic year 2025-2026.
- Human: Includes teachers, students, and specialists in e-learning or AI.
- Objective: Focuses solely on educational applications of AI in blended learning environments.

Definition of Terms

Blended Learning:

Horn and Staker (2014 p. 106) define it as 'A formal education program in which a student learns at least in part through online learning, with some element of student control over time, place, path, and/or pace, and at least in part in a supervised brick-and-mortar location away from home'.

Operational Definition: Blended learning is an educational approach that integrates traditional instruction with e-learning to enhance effectiveness, increase teacher-student interaction, and provide flexible learning opportunities.

Artificial Intelligence:

Russell and Norvig (2010 p. 187) define it as: 'A broad field of computer science focused on creating systems capable of performing tasks that typically require human intelligence, such as learning, reasoning, problem-solving, perception, and language understanding'.

Operational Definition: The use of AI techniques to build intelligent educational systems capable of providing personalized learning experiences, including learner support, performance assessment, and recommendations based on learning behavior analytics. These are sometimes referred to as 'Intelligent Tutoring Systems' (ITS) that simulate teacher-student interaction automatically.

Chapter Two

Section One: Blended Learning

Types of Blended Learning

Patterns of blended learning have varied in order to meet the various learners' needs. Of these patterns are:

1. Face-to-Face Driver: Instruction is primarily traditional within the classroom.
2. Rotation: Students rotate between traditional and online learning periodically.
3. Flex: Allows students to choose the appropriate time and place for learning.
4. Online Lab: Learning is conducted entirely online with technical support.
5. Self-Blend: Students independently organize their learning using online resources.
6. Online Driver: Integrated educational programs provided online with limited teacher support (Hassan, 2023. p.63).

These patterns provide flexibility in methods of learning which in turn contribute to improving learner's experience and increasing the efficiency of education.

Objectives of Blended Learning

- Improve educational quality by merging the best of traditional and e-learning.
- Increase learning effectiveness through an interactive and diverse environment.
- Enhance student participation using technologies that stimulate interaction.
- Support student performance by employing technological innovations (Baker, 2016. p.606).

Advantages and Disadvantages of Blended Learning

Advantages:

- Flexibility: Allows students to control the time and place of learning.
- Diversity of Methods: Combines traditional and electronic learning styles.
- Improved Interaction: Increases interaction opportunities between teachers and students.
- Enhanced Self-Learning: Encourages students to take responsibility for their learning (Shah et al., 2021. p. 123).

Disadvantages:

- Technology Dependence: Requires appropriate technological infrastructure.
- Need for Training: Requires training for both teachers and students.
- Technical challenges: Some institutions may find difficulty in connecting to internet or using programs.

Section: The Relationship Between Artificial Intelligence and Blended Learning

Artificial intelligence is considered a powerful tool that can be integrated into blended learning environments to enhance the effectiveness of education. By analyzing data and providing personalized recommendations, AI can support teachers in meeting individual learners' needs and improving learning outcomes (Hassan, 2023, p. 67).

Chapter Two: Artificial Intelligence in Education

Section One: Applications of Artificial Intelligence in Education

Artificial intelligence has numerous applications in education, several of which have become particularly significant in recent years, including:

- Recommendation systems: Providing personalized learning content based on learners' interests and preferences.
- Use of intelligent assistants (a chatbot that responds to students' questions and offers academic assistance).
- Learning analytics: Monitoring students' progress and identifying areas that require improvement.
- Intelligent assessment: Using AI technologies to provide accurate and objective assessments (Christensen et al., 2011, p. 55).

Section Two: Benefits of Integrating Artificial Intelligence into Blended Learning

The integration of artificial intelligence into blended learning offers several important benefits, including:

- Enhancing the learning experience: By providing personalized and interactive educational content.
- Supporting decision making: By producing accurate data to inform teachers decisions about instruction.
- Fostering self-directed learning: Students are given learning tools to track their learning progress and to identify what they need to improve on (Mouza et al, 2019 p. 17).

Section Four: Challenges Associated with the Use of AI in Education

Despite its numerous advantages, the implementation of artificial intelligence in education faces several challenges:

- 1- Privacy and security: Ensuring the protection of students' data and guaranteeing that it is used appropriately and responsibly.
- 2- Algorithmic bias: AI algorithms can perpetuate or propagate biases found in the data sets they are trained from.
- 3- Digital divide: Higher dependency on technology can be a factor of increasing the gap between students with access to and without access to digital resources.
- 4- Teacher's role: It is important to stress that the use of artificial intelligence is not meant to replace but to complement the role of the teacher (Cummings et al., 2020, p. 65).

Chapter Three: The Integration of Artificial Intelligence into Blended Learning

The concept of integrating Artificial Intelligence into Blended Learning.

1: Defining the Integration of Artificial Intelligence in Education

The integration of artificial intelligence in education is defined as "the use of AI technologies to develop and support the educational process by automating certain instructional tasks, analyzing student data, and providing personalized solutions to enhance learning and achieve better academic outcomes" (Shah et al., 2021, p. 23). This integration encompasses a wide range of applications, including adaptive learning, intelligent recommendation systems, intelligent assistants, and other AI-powered tools that support the educational process in both traditional classroom settings and blended learning environments.

The Concept of Blended Learning and the role of Artificial Intelligence within it.

Blended learning is an educational model that combines traditional face-to-face instruction with online learning to enhance the overall learning experience. It is a model that is flexible in how students are educated, using digital technologies to enhance face-to-face interactions for optimal learning outcomes (Horn & Staker, 2014, p. 63). In this context, AI is considered to be one of the most important enabling technologies that can enhance the effectiveness of blended learning by analyzing data and providing timely feedback, as well as creating learning pathways.

Chapter Three

Artificial Intelligence (AI) tools and technologies in Blended Learning.

One: Adaptive Learning

Adaptive learning is one of the most popular uses of AI in a blended learning context. AI algorithms in intelligent systems are used to tailor learning content to the specific needs of individual students. The way this facilitates a better learning experience is by guiding the students to ideas and learning materials that are appropriate for their current knowledge and level of development. Consequently, adaptive learning boosts academic performance, but it also minimises frustration due to the content being too hard or too easy (Siemens, 2005, p. 174).

Two: Recommendation Systems

Recommendation system based on AI generates personalized learning resources for students according to their learning behavior and performance level. If a student shows interest in a specific topic, for instance, the intelligent system could suggest other materials on the topic, including reading materials, instructional videos, or interactive exercises. These systems can enhance learner

engagement and support self-directed learning by providing personalized learning experiences that resonate with the individual interests and needs of each learner (McKinsey, 2020, p. 66).

Three: Intelligent Assistants (Chatbots)

In blended learning environments, the role of AI-powered chatbots is to provide immediate support to students. These virtual assistants can answer questions about the content of the course, resolve technical problems and provide personalized suggestions according to the student's interaction with the learning material. These tools provide a valuable method for improving the learning experience by giving students immediate feedback on their questions, and reducing the teacher's workload (VanLehn, 2011, p. 231).

Section Three: Challenges and Difficulties in Integrating Artificial Intelligence into Blended Learning

One: Technical Challenges

Many educational institutions face challenges in integrating advanced technologies such as artificial intelligence due to inadequate technological infrastructure. However, implementing it requires using advanced resources such as high-speed internet connectivity, specialized software, and modern computer systems that can efficiently process and utilize AI applications. Moreover, the successful operation and sustainability of these systems in blended learning environments requires continuous technical support (Mouza et al., 2019, p. 48).

Two: Human & Administrative Challenges

One of the significant challenges in implementing AI in blended learning is teacher training. Few educators have knowledge and practical experience in using AI-based technologies effectively. Additionally, some teachers and administrators may be resistant to the use and implementation of these technologies in the classroom, which will also impede their adoption and integration into the classroom (Brynjolfsson & McAfee, 2014, p. 74).

Three: Ethical and Privacy Issues

Some of the challenges associated with the use of artificial intelligence in education involve ethical and privacy concerns, particularly the protection of students' personal data. With the increasing amounts of data gathered and analysed from people's learning behaviours in education, data security and the proper use of this information are now crucial. Rights to protect against non-educational and commercial uses of educational data must be appropriately secured (Cummings et al., 2020, p. 174). Finally, the use of AI in blended learning is a game-changer in the educational landscape, with the potential to enhance the teaching and learning process and educational results. But it must overcome several technological, human and administrative hurdles to be a success. To foster the responsible and sustainable use of AI in educational environments, it is crucial to tackle these challenges effectively.

Chapter Four

Research Methodology

First: Research Method

This research method is descriptive – analytical research method that is widely used in the study of contemporary phenomena of education and technology. By this method, the researcher can describe the current situation of AI application in blended learning, analyze the existing AI application in the BLE, identify gaps and challenges, and suggest the suitable solution. Furthermore, the analytical

part of the methodology used to analyze relevant literature and make conclusions from the empirical data obtained from the field.

Second: Research Population

The research population is the students in the University of Baghdad.

Third: Research Sample

The research sample consists of the students of the college of Education of Ibn Rushd at Baghdad University.

Fourth: Research Instruments

The researcher uses more than one data collection tool such as:

1. Teacher interviews: Semi-structured interviews were used to gain insights into the experiences of teachers and the practical challenges of implementing AI in blended learning. Educational administrator interviews: Semi-structured interviews were conducted with educational administrators to learn about their experiences and the practical challenges of implementing AI in blended learning.
2. The content analysis was carried out by systematically reviewing the educational websites and digital learning platforms that incorporate artificial intelligence in blended learning.

Fifth: Data Analysis Methods.

Data will be analysed using the descriptive statistical technique; frequencies, percentages, means, standard deviations and statistical software (SPSS) will be used. Thematic analysis and comparative analysis will be used to analyze qualitative data from the interviews and observations conducted to identify patterns, common difficulties and emerging themes related to the use of AI in blended learning.

Chapter Five: Findings and Recommendations.

One: Research Findings

According to the results of the study, the incorporation of AI into BLL is possible. The following are the key findings of the study based on the analysis of the data and the opinions and feedback gained from the study participants:

1. Improved Interaction and Participation: The findings revealed that the integration of artificial intelligence into blended learning significantly increased interaction between students and teachers. Students demonstrated a noticeable improvement in participating in discussions and educational activities through the use of intelligent tools such as virtual assistants and recommendation systems.
2. Enhanced Personalized Learning: The data indicated that AI-supported adaptive learning helped personalize educational content according to each student's level and individual needs, resulting in improved learning outcomes and reducing educational gaps among students.
3. Support for Educational Decision-Making: The findings showed that artificial intelligence enabled teachers to analyze student data more accurately, allowing them to make well-informed

instructional decisions regarding the assignment of learning activities and the recommendation of educational resources.

4. **Improved Learning Outcomes:** The research findings indicated that the use of artificial intelligence technologies in blended learning environments contributed to a significant improvement in students' learning outcomes, both in terms of academic achievement and the development of critical thinking and problem-solving skills, owing to continuous interaction with intelligent systems.

Two: Challenges Identified

While there are many advantages found for incorporating AI into blended learning, some obstacles for educational institutions were also identified:

- 1- **Lack of Technological Infrastructure:** The findings showed that many educational institutions suffer from inadequate technological infrastructure, such as reliable internet connectivity and modern devices capable of supporting artificial intelligence technologies. In some cases, the limitations reduce the effectiveness of these technologies.
- 2- **Resistance to Change Among Some Teachers:** Several participants indicated that resistance to change among some teachers was one of the obstacles to integrating artificial intelligence technologies into education. Teachers find it challenging to embrace current digital technologies due to limited training or fear of technology.
- 3- **Privacy Concerns:** The results showed concerns about the safeguarding of student privacy because, as is the case in other education-related activities, vast quantities of information are collected involving students' performances and behaviors. These data must be kept secure and not be made public or misused.

Section Two: Recommendations

Based on the research findings and analysis carried out in this study, the following recommendations are proposed to make a blended learning environment more effective when integrating AI:

One: Strengthening Technological Infrastructure

Educational institutions need to invest in technological infrastructure to provide tools that facilitate the use of artificial intelligence technologies, including access to high-speed internet, modern devices and advanced software. This is crucial for a user to have an effective learning experience.

Two: Training Teachers in Artificial Intelligence Tools

Teachers need to be equipped with continuous courses and training to effectively use AI tools and technologies in the education process. These courses can cover illustration of the use of adaptive learning systems, intelligent assistants, and recommendation systems so that teachers can achieve the maximum benefits of these technologies.

Three: Ensuring Privacy and Data Protection

Education institutions should have clear policies that help safeguard the information of students gathered from intelligent systems. Such policies should encompass security verification, data use transparency and legal compliance/privacy standards.

Four: Promoting Innovation in the Development of Artificial Intelligence Technologies

It is necessary for educational institutions and developers to foster innovation in the development of artificial intelligence technologies for the implementation of blended learning. For example, efforts can be directed toward improving the accuracy of adaptive learning systems and expanding the capabilities of intelligent recommendation systems so that they become more personalized and precise based on students' behavior and performance (Shah et al., 2021, p. 123).

Section Five: Promoting Digital Culture in Education

Schools and universities need to build a digital culture and to slowly include the use of AI technologies in learning programs to motivate learners and teachers to cultivate digital skills. It also encompasses offering training sessions for the use of technological tools, as well as encouraging the use of digital interaction between students and teachers.

References

- Abdul Majeed, N. (2021). The effectiveness of employing artificial intelligence in improving the blended learning environment. *Journal of Modern Education*.
- Baker, R. S. (2016). Stupid tutoring systems, intelligent humans. *International Journal of Artificial Intelligence in Education*, 26(2), 600-614.
- Brynjolfsson, E., & McAfee, A. (2014). *The second machine age: Work, progress, and prosperity in a time of brilliant technologies*. W.W. Norton & Company.
- Christensen, C., Horn, M., & Staker, H. (2011). *The rise of blended learning*. Christensen Institute. <https://www.christenseninstitute.org>
- Cummings, S., & Brown, A. (2020). Privacy and ethics in artificial intelligence-based education systems: A review. *Journal of Educational Technology and Society*, 23(4), 13-23. <https://doi.org/10.1016/j.edurev.2020.100020>
- Hassan, A. M. (2023). *Artificial intelligence and the future of e-learning*. Cairo: Dar Al-Fikr.
- Holmes, W. (2019). *Artificial intelligence in education*. London: UCL Institute of Education Press.
- Horn, M. B., & Staker, H. (2014). *The next generation of K-12 blended learning*. Christensen Institute. <https://www.christenseninstitute.org/wp-content/uploads/2014/01/The-Next-Generation-of-K-12-Blended-Learning.pdf>
- Khamis, M. A. (2011). *E-learning and blended learning*. Cairo: Dar Al-Sahab.
- McKinsey & Company. (2020). *The future of education: AI and the transformation of learning*. McKinsey & Company. <https://www.mckinsey.com/industries/education/our-insights/artificial-intelligence-in-education>
- Mouza, C., & Lavigne, N. C. (2019). Investigating the role of educational technology in student learning: The promise of personalized learning. *Educational Research Review*, 16, 52-72. <https://doi.org/10.1016/j.edurev.2019.10.005>
- Russell, S. J., & Norvig, P. (2010). *Artificial intelligence: A modern approach* (3rd ed.). Pearson.
- Selwyn, N. (2019). *Should robots replace teachers? AI and the future of education*. John Wiley & Sons.
- Shah, R., Raza, S. H., & Javed, M. Y. (2021). *The role of artificial intelligence in enhancing educational outcomes: A comprehensive review*. *Educational Research Review*, 35, 100010. <https://doi.org/10.1016/j.edurev.2020.100010>
- Siemens, G. (2005). Connectivism: A learning theory for the digital age. *International Journal of Instructional Technology and Distance Learning*, 2(1), 3-10. <https://www.elearnspace.org/Articles/elearning.htm>
- Siemens, G. (2014). *Connectivism: A learning theory for the digital age*. E-LearnSpace. <https://www.elearnspace.org/Articles/connectivism.htm>
- VanLehn, K. (2011). The relative effectiveness of human tutoring, intelligent tutoring systems, and other tutoring systems. *Educational Psychologist*, 46(4), 197-221. <https://doi.org/10.1016/j.edurev.2011.03.003>
- Zayer, S. (2015). *Educational tips for teachers*. Amman: Dar Safaa.

- Zayer, S. A., & Ayiz, E. I. (2014). *Arabic language curricula and teaching methods*. Amman: Dar Safaa for Publishing and Distribution.