# Impact of Artificial Intelligence (AI) On Secondary Education

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**Abstract**
Artificial Intelligence (AI) is rapidly changing education. AI helps teachers create learning paths that fit individual student needs and also automates administrative tasks. It provides data that support teaching and assessment. This study explored how AI influences schools, teaching practices, assessment processes, student engagement, and existing challenges. A descriptive survey design was used, involving 122 respondents: 30 teachers, 80 students, and 12 administrators from secondary schools in Gujranwala. Data were collected using a 20-item Likert-scale questionnaire and analysed through descriptive statistics in SPSS.The findings showed that AI supports learning, enhances student engagement, reduces teacher workload, and increases access to learning materials. Students also reported improved motivation. However, challenges were identified, including insufficient teacher training, high costs of AI tools, and limited internet access. The study indicates that AI has strong potential for improving education, but effective use requires investment in digital tools, teacher professional development, and clear ethical guidelines to ensure fairness and sustainability. It further suggests integrating AI-related teaching methods into teacher education programs and increasing institutional and governmental support for implementation.

Keywords*:* artificial intelligence; secondary education; personalized learning; teaching practices; educational technology

**Introduction**

Artificial Intelligence (AI) has become a transformative force across multiple fields, including education. In education, AI enables personalized learning, administrative efficiency, and equitable access. Many countries around the world have adopted AI extensively. The United States, China, and the United Kingdom are leading users of AI, demonstrating its potential. However, several challenges remain, such as teacher training and data privacy concerns. In Pakistan, AI adoption is still at an early stage. Some secondary schools have begun to experiment with AI-based learning platforms, although the digital divide continues to limit widespread implementation.

AI is increasingly being used in education. It supports teachers in providing individualized learning, helps schools streamline administrative tasks, and expands access to learning opportunities. Globally, the rapid adoption of AI shows its potential while also highlighting challenges such as data privacy risks and the need for teacher preparation. Internationally, countries such as the United States, China, and the United Kingdom lead the use of AI in education. In the United States, AI helps teachers adjust lessons to meet individual student needs through data-driven insights. In China, government-led initiatives support the use of AI tools to improve academic performance and develop skills for the economy. In European countries, including the United Kingdom, investments focus on AI research alongside strong data protection measures. These global developments show how AI is reshaping classrooms but also reveal issues such as data privacy concerns, unequal access to technology, and the need for teacher training. This worldwide perspective highlights the importance of understanding how AI can be integrated into schools effectively.

AI adoption in education is steadily increasing across different regions. Secondary schools in urban areas of Pakistan are beginning to incorporate AI tools such as learning applications and automated grading systems to support student engagement and ease teacher workload. Rural areas, however, continue to face barriers such as inadequate infrastructure and limited financial resources. At the secondary level, teachers manage large classes, diverse learning needs, and administrative tasks that reduce instructional time. AI tools offer potential solutions by automating tasks, providing real-time feedback on student performance, and helping teachers identify students who require support. Nevertheless, local implementation faces obstacles, including insufficient teacher training, limited access to technology, and restricted budgets. These issues make AI adoption both necessary and difficult.

Understanding how AI affects education in the local context is important for identifying suitable solutions and designing effective integration strategies. This study investigates the impact of AI on secondary education. It examines how AI may enhance student engagement, improve learning outcomes, and reduce teacher workload. Although research on AI in education is growing, a gap remains regarding its influence at the secondary level, which plays a critical role in skill development, critical thinking, and future career preparation. Exploring AI at this stage is essential for determining how it can support educators in meeting diverse learning needs. The study also explores challenges faced by educators and students when using AI. Its purpose is to provide insights for policymakers and educational leaders seeking to integrate AI into secondary education.

The study focuses on applications, challenges, and benefits, and aims to offer practical recommendations for educators, policymakers, and AI developers. Understanding AI's role in secondary education is essential for leveraging its potential to create more equitable, personalized, and effective learning environments for students

The study examines the knowledge and use of Artificial Intelligence (AI) in education, particularly in low-resource settings such as Pakistan. Secondary educators face challenges including lack of training, limited resources, and the need to balance traditional methods with new technologies. This research will examine how AI can support student engagement and learning outcomes while addressing these barriers.

The study focuses on the lack of knowledge regarding how AI affects student engagement, academic results, and teacher workload. AI has the potential to provide personalized learning experiences, but secondary educators face challenges in its adoption due to insufficient training, inadequate materials, and the need to integrate conventional teaching with technology. Ethical concerns, including data privacy and accessibility, also affect AI implementation in classrooms.

This research aims to identify the challenges teachers encounter when using AI and to explore factors that support or hinder its use in schools. The findings will provide insights for policymakers and education leaders to develop strategies that ensure students benefit from AI while addressing inequalities in education.

## Research objectives
1. To assess the impact of AI on student engagement and academic performance.
2. To find the challenges and limits teachers have when teachers use AI in education.
3. To Find the factors that affect the integration of AI in education.

## Research questions
1. How does AI influence student engagement, learning outcomes, and academic performance in secondary education?
2. What are the main challenges teachers' faces when teachers use AI tools in the secondary school classroom?
3. What institutional and external factors support or hinder the successful integration of AI in secondary education?

## Significance of the study
Artificial Intelligence (AI) plays an increasingly important role in education. This study examines how AI can transform secondary education in Pakistan by enhancing teaching methods, supporting personalized learning, and improving overall academic outcomes. By exploring the perceptions and experiences of teachers, students, and administrators, the findings provide evidence on how AI tools are used and the challenges faced during integration. The results are expected to assist educators, policymakers, and curriculum designers in making informed decisions regarding AI adoption, ensuring equitable access, improving teaching practices, and fostering student engagement. Furthermore, the study fills a research gap by providing data from under-resourced Pakistani schools, offering insights that may guide effective AI implementation in similar developing country context.

## Literature Review

### Artificial Intelligence in Education
Artificial Intelligence (AI) in education is growing rapidly. AI is used in tutoring programs and data-based assessment models. Scholars suggest that AI is not merely a tool but represents a shift that changes the way teaching and learning occur (Luckin et al., 2016; Holmes et al., 2019). AI plays an important role in education by enabling students to engage with complex tasks and prepare for higher education or the job market. This section reviews four main areas relevant to this study:
1. AI in teaching practices
2. AI in assessment and evaluation
3. AI and student learning outcomes
4. Challenges associated with AI adoption

### AI in Teaching Practices

AI technologies support teachers in becoming more effective. Intelligent support systems and adaptive learning platforms analyze student data in real time and recommend customized learning materials based on individual performance (Zawacki-Richter et al., 2019). These systems allow teachers to adjust instruction to meet learners' needs, which can be challenging in classrooms with large student populations. Holmes et al. (2019) note that AI enables differentiated instruction by tailoring content to each learner. AI complements the teacher's role rather than replacing it, automating tasks such as attendance tracking, grading, and classroom logistics, allowing teachers to focus on instruction (Luckin et al., 2016). Selwyn (2019) cautions that excessive reliance on AI may reduce teachers' autonomy. In Pakistan, barriers such as limited training and restricted access to AI platforms hinder the integration of AI in secondary classrooms.

### AI in Assessment and Evaluation

Assessment is a key area for AI adoption. Traditional assessment methods are often time-consuming, biased, and limited in scope. AI technologies address these issues through automated grading, real-time analytics, and adaptive testing. Heffernan and Heffernan (2014) show that intelligent assessment tools can analyze student responses, adapt question difficulty, and generate performance analytics for teachers, improving feedback speed and helping identify learning gaps. Natural language processing (NLP) algorithms are increasingly used to grade written assignments by evaluating grammar, coherence, and critical thinking. However, Williamson and Piattoeva (2020) warn that AI-based assessment raises concerns regarding fairness, transparency, and data protection. In Pakistan, assessment largely relies on traditional examinations, and the adoption of AI remains limited due to unequal access to digital resources across schools.

### AI and Student Learning Outcomes

When applied effectively, AI can improve student learning outcomes. AI platforms adapt content to students' pace, prior knowledge, and preferred learning styles (Zawacki-Richter et al., 2019). Personalized learning supports struggling students while providing challenges for high achievers. AI-powered intelligent tutoring systems enhance performance in STEM subjects by offering explanations and feedback (Holmes et al., 2019). Gamified AI applications increase student motivation and engagement, while tools such as language-learning chatbots and virtual labs allow practice outside the classroom. Critics emphasize that AI should complement, not replace, human-led teaching. Excessive reliance on AI-driven content delivery may limit critical thinking, creativity, and socio-emotional development (Selwyn, 2019; Williamson & Piattoeva, 2020).

### Challenges, Barriers, and Ethical Issues

Despite its potential, AI adoption in secondary schools faces numerous challenges, especially in developing countries like Pakistan. Issues include inconsistent internet connectivity, limited device availability, and unreliable power supply. Teacher preparedness is another barrier, as many educators lack the necessary digital literacy to use AI tools effectively (Holmes et al., 2019). High costs of AI technologies limit scalability in low-resource settings. Ethical concerns include data privacy, security, and algorithmic bias, which may perpetuate inequality if not properly addressed (Williamson & Piattoeva, 2020). In Pakistan, the absence of clear policies further complicates the fair implementation of AI, potentially widening the digital divide between students with and without access to technology.

**Synthesis and Research Gap**

The literature indicates that AI in education offers both opportunities and challenges. International studies demonstrate that AI can enhance teaching, accelerate assessment, and improve student learning. However, ethical issues, teacher preparedness, costs, and infrastructural limitations remain significant concerns. Evidence regarding AI in Pakistani schools is limited, as most studies focus on universities or well-resourced urban schools. There is insufficient data on how secondary teachers, students, and administrators perceive AI or the barriers they encounter during adoption. This study addresses this gap by providing data from secondary schools in Gujranwala, examining stakeholders' perceptions and the benefits and challenges of integrating AI into Pakistan's secondary education system.

**Methodology**

The study employed a descriptive survey design to examine the impact of Artificial Intelligence (AI) on education in Pakistan. The survey approach was chosen as it provides an efficient method to capture the perceptions and experiences of a group of participants within a short timeframe.

**Population and Sample**

The target population comprised teachers, students, and administrators from private schools in Gujranwala, Pakistan. Data were collected from 122 respondents, including 30 teachers, 80 students, and 12 administrators. Stratified sampling was used to ensure that key subgroups within the population were proportionally represented. This approach allows for accurate comparisons between teachers, students, and administrators, ensuring that the perspectives of all relevant stakeholders were captured.

**Research Instrument**

Data were collected using a structured questionnaire developed for this study. The instrument contained 20 closed-ended items organized into four domains:
1. AI and student engagement
2. AI and academic outcomes
3. AI and teacher workload
4. Challenges in AI adoption

Responses were measured on a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). The questionnaire was validated through expert review and piloted with a small group to ensure clarity and reliability.

**Data Collection Procedures**

Data were collected in Spring 2025. Permission was obtained from school authorities, and questionnaires were administered in printed form. Participation was voluntary, and respondents were informed that their responses would remain confidential. No identifying information was collected.

**Data Analysis**

Data were analysed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics—including frequencies, percentages, means, and standard deviations—were calculated to summarize respondents' perceptions of AI's impact on student engagement, academic outcomes, teaching practices, and integration challenges.

**Ethical Considerations**

The study adhered to ethical guidelines. Participation was voluntary, informed consent was obtained, and respondents were informed about the study's purpose and their right to withdraw at any stage. Data were kept anonymous, and findings were reported in aggregate form only.

**Table 1**

*Demographic Profile of Respondents*

| Variable | Category | Frequency | Percentage |
|---|---|---|---|
| Age Group | 18–25 years | 65 | 42.5% |
|  | 26–35 years | 27 | 17.6% |
|  | 36–45 years | 19 | 12.4% |
|  | 46+ years | 11 | 7.2% |
|  | Total (Age) | 122 | 100% |
| Gender | Male | 46 | 37.7% |
|  | Female | 76 | 62.3% |
|  | Other | 0 | 0.0% |
|  | Total (Gender) | 122 | 100% |
| School Type | Public | 42 | 34.4% |
|  | Private | 80 | 65.6% |
|  | Total (School) | 122 | 100% |
| Role of Respondents | Teacher | 30 | 24.6% |
|  | Student | 80 | 65.6% |
|  | Administrator | 12 | 9.8% |
|  | Total (Role) | 122 | 100% |
| Experience | 1–3 Years | 52 | 42.6% |
|  | 4–6 Years | 39 | 31.9% |
|  | 7–9 Years | 20 | 16.4% |
|  | 10–12 Years | 7 | 5.7% |
|  | More Than 12 Years | 4 | 3.3% |
|  | Total (Experience) | 122 | 100% |

Table 1 shows that students constituted the majority (65.6%), followed by teachers (24.6%) and administrators (9.8%). This distribution ensured that multiple perspectives were captured, with students providing insights on classroom experiences, teachers reflecting on instructional practices, and administrators highlighting school policies. The balanced participation enhances the credibility of the findings.

**Table 2**
*Perceptions of AI and Student Engagement (N = 122)*

| Item | Mean | SD |
|---|---|---|
| AI tools make learning more interesting and engaging | 4.21 | 0.68 |
| AI increases students' motivation to participate | 4.10 | 0.74 |
| AI provides easier access to learning resources | 4.35 | 0.59 |
| AI helps students learn at their own pace | 4.18 | 0.71 |

*Note.* Scale = 1 (Strongly Disagree) to 5 (Strongly Agree).

Respondents viewed AI as beneficial for student engagement. The highest-rated item was "AI provides easier access to learning resources" (M = 4.35, SD = 0.59), followed by "AI tools make learning more interesting and engaging" (M = 4.21, SD = 0.68). Overall, AI was perceived to enhance motivation, interactivity, and self-paced learning.

**Table 3**
*Perceptions of AI and Teaching Practices (N = 122)*

| Item | Mean | SD |
|---|---|---|
| AI helps teachers in lesson planning and preparation | 4.12 | 0.71 |
| AI reduces teacher workload through automated grading | 4.05 | 0.77 |
| AI enhances efficiency in classroom management | 3.98 | 0.82 |
| AI supports teachers in providing timely feedback | 4.20 | 0.66 |

*Note.* Scale = 1 (Strongly Disagree) to 5 (Strongly Agree).

Table 3 indicates that AI positively influenced teaching practices and workload management. Teachers agreed that AI supported lesson planning (M = 4.12, SD = 0.71) and provided timely feedback (M = 4.20, SD = 0.66). AI was also seen as improving classroom management efficiency (M = 3.98, SD = 0.82). Overall, AI was perceived to reduce workload and enhance teaching effectiveness.

**Table 4**
*Barriers to AI Integration in Secondary Education (N = 122)*

| Item | Mean | SD |
|---|---|---|
| Lack of teacher training in AI tools | 4.30 | 0.62 |
| High cost of AI-based technologies | 4.18 | 0.70 |
| Poor internet connectivity and infrastructure | 4.25 | 0.68 |
| Limited institutional support and policy framework | 4.05 | 0.75 |

*Note.* Scale = 1 (Strongly Disagree) to 5 (Strongly Agree).

Table 4 identifies the main barriers to AI integration. Lack of teacher training was the primary challenge (M = 4.30, SD = 0.62), followed by poor internet connectivity (M = 4.25, SD = 0.68) and high costs (M = 4.18, SD = 0.70). Limited institutional support was also noted (M = 4.05, SD = 0.75). These findings suggest that effective AI adoption requires training, infrastructure, and supportive policies.

## Discussion

This study explored how Artificial Intelligence (AI) affects education in Pakistan, focusing on student engagement, teaching practices, and barriers to integration. The findings indicate that AI has the potential to transform education, but systemic and school-level challenges must be addressed to ensure sustainable implementation.

## AI and Student Engagement

AI enhances student engagement by making learning more motivating and accessible. AI tools increased student interest in lessons, facilitated self-paced learning, and provided access to educational resources. These findings align with research indicating that AI-based adaptive platforms personalize learning to student needs and promote motivation and deeper involvement (Zawacki-Richter et al., 2019; Holmes et al., 2019). Gamified AI applications, such as intelligent tutoring systems and virtual simulations, have been shown to increase participation and motivation among secondary students globally (Luckin et al., 2016). In resource-limited environments, students perceive AI as a useful tool for engagement. International studies highlight applications such as virtual labs and intelligent chatbots (Selwyn, 2019). In Pakistan, the use of basic AI-driven platforms limits the potential engagement benefits, reflecting resource gaps between developed and developing education systems.

## AI and Teaching Practices

Teachers reported that AI reduced workload, assisted with lesson planning, and provided timely feedback. AI automated tasks such as grading and attendance, allowing teachers to focus on instructional activities. These findings support Selwyn (2019), who argues that AI complements rather than replaces teachers by relieving them of administrative duties. They also align with Holmes et al. (2019), who emphasize that AI provides data-driven insights to improve teaching practices. While AI can support classroom management, relational aspects of teaching—such as discipline, empathy, and motivation—remain human responsibilities. Williamson and Piattoeva (2020) caution that overreliance on AI may reduce teacher autonomy, a concern echoed by Pakistani educators. The findings confirm that AI enhances teaching efficiency and effectiveness in schools while supporting teacher agency.

## Barriers to AI Integration

Despite positive perceptions, respondents identified several barriers to AI adoption. The most pressing barrier is the lack of teacher training in AI tools, followed by limited internet connectivity, high technology costs, and insufficient institutional support. These challenges reflect previous research, which highlights infrastructural, financial, and professional constraints in developing contexts (Williamson & Piattoeva, 2020; Holmes et al., 2019). Limited teacher digital literacy reduces the effective use of AI, while inadequate infrastructure, including unreliable internet and lack of devices, restricts implementation. The gap between urban private schools and rural or public schools exacerbates the digital divide. High costs of AI platforms and tools limit scalability without government subsidies or institutional funding. Additionally, the absence of policies and frameworks hinders integration, as formal strategies for digital and AI-based education are largely lacking in Pakistan.

## Implications of Findings

The findings have practical and policy implications. For teachers, AI provides tools that improve instruction and reduce workload, but professional development is necessary to build confidence and capability. Teacher training institutions should incorporate AI teaching methods and digital literacy into their programs. AI can enhance student engagement and learning outcomes, but equitable access is essential to prevent exacerbating educational

inequalities. Policymakers should invest in infrastructure, make AI tools affordable, and develop comprehensive policy frameworks. National strategies should address the divide between public and private schools, allocate resources to schools in need, and implement ethical guidelines to protect student data and ensure transparent decision-making.

**Unique Contribution of the Study**

While international research on AI in education is expanding, most studies focus on higher education or well-resourced settings. This study contributes by providing data from Pakistani schools with limited resources, weak infrastructure, and diverse capabilities. The findings highlight both the promise and challenges of AI adoption in such contexts and provide insights relevant to other developing countries.

**Summary of Discussion**

In summary, AI has the potential to transform education by enhancing student engagement, improving teaching practices, and reducing teacher workload. However, its adoption is constrained by barriers such as lack of training, high costs, and inadequate infrastructure. The study confirms previous research while offering context-specific insights, demonstrating that systemic improvements are necessary for effective and sustainable AI integration in Pakistani secondary schools.

**Conclusion and Recommendations**

Artificial Intelligence (AI) has the potential to transform education in Pakistan. AI can enhance student engagement, provide personalized learning opportunities, and support teachers in lesson planning, grading, and classroom management. Respondents reported that AI increases student motivation, facilitates self-paced learning, and reduces teacher workload through automation. However, several obstacles were identified, including lack of teacher training, inadequate infrastructure, and high costs of technology. The findings highlight that successful AI adoption in Pakistan requires an enabling environment, including well-prepared teachers, adequate school infrastructure, and policy frameworks addressing fairness and ethical concerns.

**Recommendations**
1. Teacher Training**:** Professional development programs should be designed to build teachers' competence and confidence in using AI tools effectively in classrooms.
2. Infrastructure Investment: Schools require reliable internet connectivity, digital devices, and affordable AI platforms to ensure equitable access for all students.
3. Policy Framework: National education authorities should establish guidelines for AI integration, covering ethical concerns such as data privacy, algorithmic bias, and equitable access.
4. Curriculum Integration: AI applications should be embedded in secondary school curricula to prepare students for participation in a technology-driven society.
5. Future Research: Further studies should explore long-term impacts of AI on student outcomes, teacher roles, and institutional development, with attention to rural and under-resourced contexts.

**Limitations of the Study**

The study has several limitations. First, the sample was limited to teachers and students from a specific region, which may affect the generalizability of the findings. Second, data were self-reported through questionnaires, which may introduce response bias. Third, time constraints and limited access to AI tools restricted the scope of experimental analysis. External factors, such as socio-economic status and variation in school resources, may have influenced

participants' engagement with AI in education.

**Future Research Directions**

Future studies should include larger and more diverse samples across multiple regions to validate and expand these findings. Longitudinal research is recommended to examine how AI integration affects student learning and teacher performance over time. Experimental studies comparing AI-enhanced learning environments with traditional instruction could provide further evidence of AI's impact. Additionally, research should investigate the ethical, privacy, and accessibility implications of AI adoption in education.

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