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INTEGRATION OF ARTIFICIAL INTELLIGENCE IN PRIMARY EDUCATION: TOOLS AND STRATEGIC FRAMEWORK FOR TEACHERS

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Abstract
This paper investigates the integration of artificial intelligence (AI) tools within the primary education system of Pakistan, focusing on the instructional usefulness and feasible classroom strategies. A qualitative library-based research design was utilized in this study to identify and classify the vast repertoire of AI tools and match them to specific instructional strategies. Instructional assistance AI tools are available for lesson planning (Education CoPilot, Curipod, Twee, LessonPlans.ai), visual narrative (Canva, DALL·E), reading assistance (Read Along, Speechify), adaptive learning (Khan Academy Kids, Diffit.me), and gamification of test-taking (Kahoot!, Wordwall). For assessment and feedback (Formative, TeachMateAI), classroom management (ClassDojo, Remind), collaboration for teachers (Notion AI, Trello), and creativity for students (Osmo, Storybird). When well-localized and well-deployed strategically, they also tend to enhance engagement, personalization among primary-level students.

Keywords: *artificial intelligence, primary education, Pakistan, AI tools, strategic framework*

Introduction

Artificial Intelligence has led to significant transformations in various fields, including education. AI is being integrated into classroom teaching, school management to support personalized learning, increase teacher efficiency, improve students' engagement, and assessment (Luckin et al., 2016; Holmes et al., 2022). In primary education, different AI tools such as intelligent tutoring systems, automated feedback applications, and content generation software are being used to support differentiated instruction, basic literacy and numeracy, and classroom behavior management (Zawacki-Richter et al., 2019). In countries like Pakistan, where the education system faces issues such as overcrowded classrooms, insufficient teachers, limited teaching materials, and varied student learning levels, AI offers opportunities to strengthen modern teaching methods. According to UNESCO (2023), primary education in Pakistan in public schools, remains a concern due to large class sizes and weak infrastructure, which reduce the ability to provide individual attention. In such situations, AI can provide scalable options to improve teaching and learning if the tools are selected appropriately and adapted to local conditions.

In spite of the international enthusiasm regarding the use of AI in teaching, its use at the primary level in Pakistan is still in its formative phase. Lack of technical expertise and teaching techniques to manage the use of AI in the classroom is reported by teachers (Khurshid et al., 2024). Additionally, access to the use of AI tools is mostly restricted to urban areas or private educational settings, widening the gap in access and usage. To bridge the lacunae, there is also an increasing requirement for a strategic approach that identifies context-relevant tools of AI and prescribes evidence-based approaches to introducing them in various classroom settings in the country.

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This research aims to explore the integration of AI tools in primary education in Pakistan by compiling an exhaustive list of related AI tools and context-specific strategies for the effective use of these tools. Various studies have found the effectiveness of AI-integrated learning materials. Makhdum et al. (2023) reported significant increases in learners' participation and learning achievements with the implementation of Kahoot! in primary levels in Lahore. Similarly, Rahim and Mohammed (2024) proved the effectiveness of gamified AI assessment tools in improving mathematical achievement in Gilgit-Baltistan. Rahim, Mohammed, and Haq (2024) also proved that over 90% of grade school pupils reported positive attitudes toward AI-facilitated learning activities in mathematics.

Rationale of the Study

The quality of primary education in Pakistan is facing a variety of issues, including overcrowded classes, inadequacy of resources, and lack of well-equipped teachers, particularly in rural areas (UNESCO, 2023). AI practices enhance teachers and learners' engagement towards effective learning (Luckin et al., 2016; Holmes et al., 2022), however, in Pakistani primary classrooms, the implementation of technological tools remains thrust due to the lack of resources (Khurshid et al., 2024). So far, research has focused the higher education only, leaving a gap in context-based research for the integration of AI in primary schools (Zawacki-Richter et al., 2019). Addressing this gap, this paper analyzes the suitable AI tools and practical, contextualized strategies for their efficient use at the primary school level.

Research Objectives

1. To identify the artificial intelligence (AI) tools that are pedagogically relevant for primary education in the Pakistani context.
2. To investigate context-specific strategies that can support the effective implementation of AI tools in primary school classrooms in Pakistan.

Methodology

This research adopts library research. Library research focuses on analyzing past sources and data through utilizing past theories and concepts to be explained in line with writings that create the discussion (Sari, 2021). In this case, only library research can address the research problem and vice versa; nobody can predict the data and field research (Zed, 2004). The data collection approach was the analysis of the document. In searching for data to answer to research problem in documents or library material, the process of collecting that data is termed as documentation (Adi, 2021). The documents can be in the form of written documents, photographs, pictures, and electronic documents that assist the research. Document example in this research taken from websites, books, articles journals that were related to the research. The data analysis approach adopts several steps these are compiling related data in terms of websites, books, and journals, analyzing the data (content) in words and pictures, and then drawing a conclusion.

FINDINGS AND DISCUSSION

Findings

The present research aims to explore the integration of AI tools in primary education in Pakistan by compiling an exhaustive list of related AI tools and context-specific strategies for the effective use of the tools, as discussed below.

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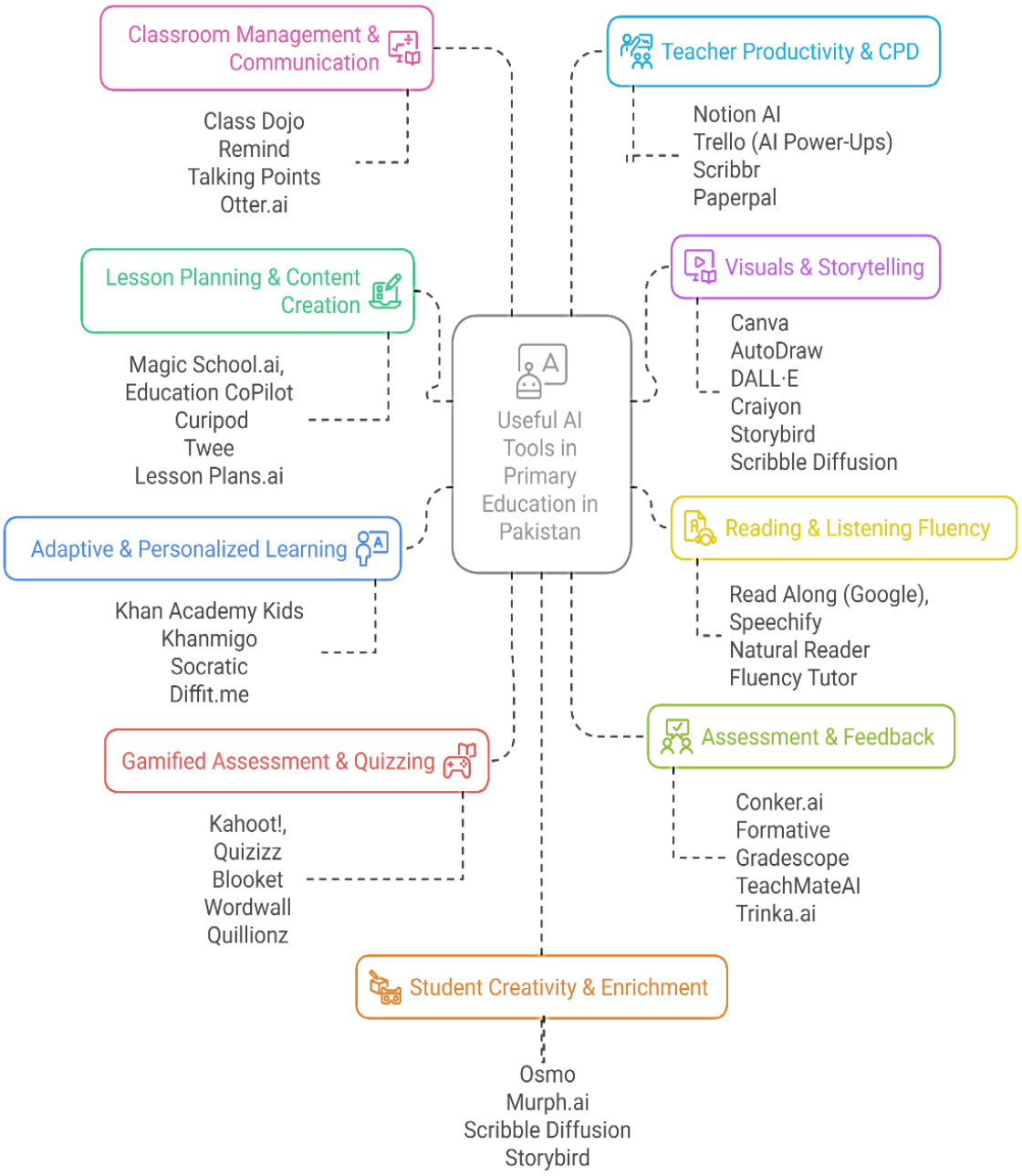
Figure 1. *Instructional Tasks and Relevant AI Tools at Primary Education*



Source: *Self-developed by using different websites*

a. AI-Assisted Tools for Lesson Planning and Content Creation

Tools: Education CoPilot, LessonPlans.ai, ChatGPT, Curipod, Twee, MagicSchool.ai,

In order to make effective use of lesson planning tools in the Pakistani context, teachers must be trained to create bilingual (English-Urdu) content that adheres to national and provincial curricula.

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Regular professional development sessions for each month that address prompt writing and content preparation can help teachers become better at making use of AI platforms for lesson planning. Teachers must be motivated to critically review AI outputs for cultural sensitivities, age-friendliness, and pedagogical purposes (Hussain et al., 2024)

b. Visual Learning, Creativity, and Storytelling

Tools: Craiyon, Canva (Magic Design), DALL·E, AutoDraw, Scribble Diffusion, Storybird,

To utilize visual and storytelling AI-assisted tools successfully, educators should create culturally relevant visualizations showing, for instance, local attire and rural environment and print them for use in resource-constricted classrooms. Schools can share these resources over school networks or WhatsApp groups to reinforce learning at home. In addition, teachers can create learner-centered storytelling tasks with pictures created with AI to encourage creativity and contextualized language development (Chen, 2024).

c. AI for Reading Support and Listening Skills

Tools: Natural Reader, Speechify, Fluency Tutor, Read Along (Google),

Where digital resources are not available in classrooms, teachers can utilize paired reading strategies where a student listens to an audio of a passage developed through an AI while their classmate reads. Audio recordings of learning materials can be delivered via mobile phones for practice at home. Remedial programs for reading can even incorporate these resources to provide differentiated support for poor readers (Li, 2025).

d. Adaptive and Personalized Learning

Tools: Diffit.me, Khan Academy Kids, Socratic, Khanmigo,

Rotational learning models can utilize adaptive tools in the classroom. During this time, students work with AI-adaptive software, and direct instruction can be delivered to others by the teacher. Diffit.me can be utilized to adjust reading material to varying reading levels and reduce its complexity in a multilingual environment. Insights from AI-based performance tracking can inform instructional decisions and targeted intervention (Lawrance et al., 2024).

e. Interactive Quizzing and Gamified Assessment

Tools: Kahoot!, Quizizz, Blooket, Wordwall, Quillionz

Gamified assessment tools can be included in weekly learning review meetings to strengthen understanding and engagement. In classrooms, where internet access is inconsistent, teachers can replicate digital quiz designs in hard copy with flashcards or oral questioning. Quillionz can be used to create comprehension questions for teachers straight from set text. Allowing students to create their own questions for a quiz through Wordwall can further stimulate motivation and critical thinking (Makhdum et al., 2023).

f. Assessment, Feedback, and Report Writing

Tools: TeachMateAI, Formative, Gradescope, Conker.ai, Trinka.ai

Teachers can produce formative assessments with Conker.ai and Formative that align with the standards of curriculum. Feedback prepared with Teach Mate AI need to be reviewed and edited by teachers to address students' learning environments and communicated in both English and Urdu languages. Teachers can maintain portfolios that maintain these assessments and marks over the term to report to parents and monitor throughout academic sessions (Irving, 2016).

g. Classroom Management and Communication

Tools: TalkingPoints, Remind, Otter.ai, ClassDojo,

In improving classroom management, ClassDojo can be utilized to track and reinforce student behavior for factors like submitting homework, punctuality and academic engagement. In terms of

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parent communication, Remind and TalkingPoints can handle multilingual messaging to make school announcements available irrespective of literacy and language challenges. Teachers can also utilize transcription tools such as Otter.ai to record and follow up on meetings with parents so that there can be continuity in support for students.

h. Teacher Productivity and Professional Collaboration

Tools: Trello (AI plug-ins), Paperpal, Notion AI, Scribbr,

Teachers can develop their planning and organizational skills through building collaborative planning boards in programs like Notion AI. Plugins of Trello based on artificial intelligence can be used for building tasks, managing time schedules for the preparation of lessons, and tracking professional development. Artificial intelligence-based writing assistants like Scribbr and Paperpal can help in reflective teaching portfolios, lessons' reports, scholarly writings for promotions/professional development reports.

i. Student Creativity and AI-Assisted Enrichment

Tools: Murph.ai, Osmo, Storybird, Scribble Diffusion,

AI applications can also be utilized to encourage experiential learning in languages, art, and science subjects. Osmo and Murph.ai can be included where learners involve in learning games or in telling digital stories. Students can even create their own stories or pictures with the assistance of AI that can become part of class exhibitions or be included in project-based learning.

Table 1

Summary of Findings

Tool Category	AI Tools	Educational Purpose	Implementation Strategy
Lesson Planning & Content Creation	MagicSchool.ai, Education CoPilot, Curipod, Twee, LessonPlans.ai	Generate bilingual lesson plans and content	Align content with national/provincial curriculum; conduct teacher training on prompt use; peer-review for cultural relevance (Hussain et al., 2024)
Visuals & Storytelling	Canva, AutoDraw, DALL·E, Craiyon, Storybird, Scribble Diffusion	Visual support and creative writing	Generate localized illustrations; use in storytelling sessions; distribute visuals via school networks (Chen, 2024).
Reading & Listening Fluency	Read Along (Google), Speechify, Natural Reader, Fluency Tutor	Improve pronunciation and comprehension	Conduct paired reading; share recorded texts on mobile; use in remedial reading programs (Li, 2025).
Adaptive & Personalized Learning	Khan Academy Kids, Khanmigo, Socratic, Diffit.me	Differentiate instruction and adjust reading levels	Use station-based learning; simplify texts with Diffit; monitor AI dashboards to adjust instruction (Lawrance et al., 2024).

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Tool Category	AI Tools	Educational Purpose	Implementation Strategy
Gamified Assessment & Quizzing	Kahoot!, Quizizz, Blooket, Wordwall, Quillionz	Increase engagement and assess learning	Conduct weekly digital or offline quizzes; use Quillionz for comprehension questions; involve students in quiz creation (Makhdum et al., 2023).
Assessment & Feedback	Conker.ai, Formative, Gradescope, TeachMateAI, Trinka.ai	Conduct assessments and generate student feedback	Align quizzes with syllabus; translate AI feedback to Urdu/English; maintain progress portfolios (Irving, 2016).
Classroom Management & Communication	ClassDojo, Remind, TalkingPoints, Otter.ai	Manage behavior and facilitate parent communication	Reward student behavior via ClassDojo; send updates in local languages; transcribe meetings using Otter.ai.
Teacher Productivity & CPD	Notion AI, Trello (AI Power-Ups), Scribbr, Paperpal	Organize planning and academic writing	Maintain collaborative planning boards; assign tasks with Trello; support report writing using Scribbr and Paperpal.
Student Creativity & Enrichment	Osmo, Murph.ai, Scribble Diffusion, Storybird	Foster creativity through interactive AI tools	Use AI for creative storytelling, voice dubbing, and interactive exhibitions; integrate outputs into project-based learning.

Discussion and Conclusion

The findings of this study identify the transformative potential of artificial intelligence tools in enhancing learning and teaching at the primary level. Categorizing AI-assisted tools along with their learning goals indicated their use in lesson planning, student engagement, individualized learning, and feedback. Tools such as ChatGPT, Canva, Read Along, and Kahoot! have immense potential to add instructional value in resource-constrained environments, especially when aligned with national curricula and conducted with contextual awareness strategies (Hussain et al., 2024; Li, 2025).

The work aligns with existing literature emphasizing teacher professional development, locally adapted content, and infrastructural adaptation for efficient integration of AI (Khurshid et al., 2024; Holmes et al., 2022). Besides this, integration of AI tools for behavior management and communication with parents (e.g., ClassDojo, TalkingPoints) aligns with research advocating for inclusive, tech-enabled classroom environment.

Despite the effectiveness of these tools, challenges such as limited digital access, lack of AI-focused training, and policy gaps remain critical barriers. Therefore, this study advocates for a strategic, scalable framework tailored to Pakistan's educational context, addressing both instructional and infrastructural constraints to ensure AI tools may not only be embraced but also utilized productively and in an equitable manner.

This study highlights the significant potential of artificial intelligence tools to align primary education with today's needs by supporting lesson planning, classroom management, differentiated instruction, and assessment. While numerous AI tools are available and applicable, their effectiveness depends on thoughtful integration, contextual relevance, and teacher preparedness. To ensure sustainable impact, it is essential to develop a strategic framework that addresses infrastructural limitations, aligns with the national curriculum, and incorporates continuous professional development of primary teachers in Pakistan.

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