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**ARTIFICIAL INTELLIGENCE TOOLS FOR DESIGNING  
CLASSROOM INSTRUCTION: A CONSTRUCTIVE MODEL**

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Article Received: 31 December 2025, Article Revised: 18 January 2026, Published on: 09 February 2026

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DOI: <https://doi-doi.org/101555/ijarp.6977>**ABSTRACT**

Artificial Intelligence (AI) is increasingly changing classroom instructional strategies. It transforms design, deliver, and evaluate learning experiences. This article examines the role of AI-powered tools in instructional design. The Artificial Intelligence emphasises the capacity to support lesson planning, content creation, differentiated instruction, assessment, and learning analytics. The study positions AI not as a replacement for teachers but as a collaborative pedagogical partner that enhances professional efficiency and instructional responsiveness analysing the contemporary educational research and technology integration frameworks. AI tools enable the generation of adaptive learning materials, automated feedback systems, and data-informed insights that help educators address diverse learner needs. The article further explores the significance of human oversight, ethical data practices, and professional development in maintaining meaningful AI integration. A constructive paradigm of AI-integrated instruction is developed based on constructivist learning theory. In this model learners actively engage in knowledge construction while AI provides adaptive scaffolding and formative feedback. Teachers remain the key as instructional decision-makers who contextualize AI outputs within pedagogical, cultural, and curricular frameworks. The discussion further recognises best practices for productive AI implementation, including privacy protection, bias awareness, and curriculum alignment. The paper argues that when guided by sound pedagogy and ethical awareness, AI tools can enhance student engagement, support inclusive and personalized learning, and strengthen the instructional design process. AI thus emerges as an intelligent instructional assistant that

empowers educators to focus on higher-order teaching practices and fosters a more responsive and learner-centered classroom environment.

**KEYWORDS:** Artificial Intelligence, Instructional Design, Personalized Learning, Teacher–AI Collaboration, Learning Analytics, Adaptive Instruction, Constructivist Learning

## **INTRODUCTION**

Artificial Intelligence (AI) is increasingly restructuring the educational landscape. This reshapes classroom instruction more dynamic, data-driven, and learner-centered. Artificial Intelligence is growing increasingly integrated into the design, delivery, and enhancement of classroom teaching. AI is helping teachers with lesson planning, development of instructional material, evaluation, and customized learning pathways in addition to automating repetitive administrative work. Contemporary research highlights that AI-enabled tools can analyze learner data in real time, generate adaptive instructional materials, and provide actionable feedback that enhances pedagogical decision-making (Holmes et al., 2019). International policy frameworks also recognize AI as a key driver of educational transformation, emphasizing its potential to improve quality, equity, and efficiency when used ethically and responsibly (UNESCO, 2021). Similarly, OECD reports note that AI can reduce teacher workload by automating repetitive tasks, thereby allowing educators to focus on higher-order instructional roles such as mentoring, facilitation, and learner support (OECD, 2021). This global change reflects a broader movement toward technology-enhanced pedagogy. Rather than taking the position of teachers, AI currently employed as a co-designer and pedagogical assistant. AI tools have the capability to assist differentiated instruction, increase student engagement, and match classroom practices to the demands of 21st-century learning when carefully included.

### **1. AI IN INSTRUCTIONAL DESIGN: A NEW PEDAGOGICAL PARADIGM**

AI tools are enabling teaching community to rethink about instructional design. The discussion is on supporting adaptive content generation, personalized learning pathways, and real-time pedagogical feedback. A most significant contribution of AI is generative AI-based lesson planning. Tools powered by large language models (LLMs) can generate curriculum-aligned lesson plans. These lesson plans account for student demographics, learning objectives, prior knowledge, and preferred pedagogical approaches. Empirical studies indicate that such generative AI tools substantially reduce teacher planning time while

enhancing instructional customization and equity, particularly in classrooms with diverse learner profiles (Zawacki-Richter et al., 2019; Kasneci et al., 2023).

GAIDE (Generative AI for Instructional Development in Education) framework is equally important as it is structured frameworks for AI-assisted content development. This provides systematic guidance for integrating AI into instructional design. GAIDE emphasizes a balanced partnership between teacher expertise and AI-generated outputs, ensuring pedagogical soundness, contextual relevance, and quality assurance in learning materials (Kumar et al., 2023). Such frameworks help educators move beyond ad hoc AI use toward intentional, theory-informed instructional design.

Integration of AI into instructional planning enable teachers to shift their focus from repetitive preparatory tasks to core pedagogical functions such as facilitation, learner engagement, and formative support. In this context, AI acts as an intelligent teaching assistant because it is offering recommendations based on data while maintaining the teacher's primary role in classroom teaching.

## **2. CATEGORIES OF AI TOOLS THAT SUPPORT CLASSROOM INSTRUCTION**

AI solutions that support classroom learning oriented activities can be meaningfully categorized according to how they align with the key phases of instructional planning, knowledge creation, and evaluation. This classification highlights how artificial intelligence augments the work of educators by enhancing efficiency, personalization, and data-driven decision-making across teaching practice.

### **2.1. Content & Lesson Creation**

AI tools greatly improve the creation of instructional materials, assisting teachers in creating interesting, and standardised content more quickly.

*AI Assistants (LLM-based):* Large language model (LLM) assistants such as ChatGPT, perplexity, Claude, etc. are increasingly used to generate text-based instructional components. These tools are used to develop lesson ideas, prompts for inquiry, reading passages, and differentiated student activities. These tools can reduce time for planning into minutes while ensuring content relevance and alignment with curriculum output. Research frameworks (e.g., GAIDE) point to generative AI's ability to help teachers create diverse and academically rigorous materials by integrating AI into instructional design processes, allowing teachers to concentrate on pedagogical refinement rather than routine drafting.

**Interactive Material Generators:** Tools such as Magic Write of Canva, Curipod, Synthesia, and Disco AI create visually rich and interactive contents like slide decks, infographics, and short videos that enhance concept retention and student engagement. These AI-driven platforms support multimodal learning that enable rapid transformation of planning inputs into multimedia instructional resources.

Platforms that assist in content creation are part of a broader NEP 2020-aligned push for teacher support systems that leverage AI to improve accessibility and effectiveness of learning activities.

## 2.2. Differentiated and Personalized Instruction

AI tools have strong potential to tailor instruction based on individual learner needs, especially in diverse classrooms where readiness and interests vary widely (Tomlinson & Imbeau, 2010; Pane et al., 2015).

**Adaptive Materials:** Tools like Brisk Teaching and other AI-enabled adaptive systems generate levelled content, including reading passages with varying complexity, vocabulary supports, and scaffolded questions, enabling teachers to match tasks to student readiness levels (VanLehn, 2011; Knewton, 2019). This level of personalization promotes equity by providing learners with instruction appropriate to their current understanding and growth trajectory, a key principle in differentiated instruction frameworks (Hall, Strangman & Meyer, 2003; Dai & Chen, 2016).

**Intelligent Workspaces:** AI systems like Eduaide and similar platforms provide comprehensive teacher workspaces that suggest targeted syllabi, curated resource collections, and even insights for individualized education program (IEP) goal setting (Luckin et al., 2016; Holmes, Bialik & Fadel, 2019). These systems help teachers manage complexity and deliver tailored instructional plans that support learners with diverse needs (Roll & Wylie, 2016; Baker & Inventado, 2014).

Research emphasizes that AI-driven personalized instruction can bridge learning gaps by adapting content sequence, complexity, and pacing to individual learners, thus supporting inclusion and differentiated practice (Pane et al., 2017; Woolf, 2010).

All things considered, differentiated and personalised instruction is greatly strengthened by AI-powered technologies that allow teachers to match content, tempo, and support to the readiness and requirements of each individual student. When carefully incorporated, these technologies support teachers' ability to create learner-centred, responsive lessons at scale rather than taking the place of them.

### 2.3. Feedback, Assessment & Analytics

AI enhances formative and summative evaluation by automating routine tasks and generating insights that would otherwise be time-intensive to derive manually (Luckin et al., 2016; Holmes, Bialik & Fadel, 2019).

**Automated Grading:** Platforms like Gradescope and other AI-supported grading systems use pattern recognition and natural language processing to score student work, particularly objective and semi-structured responses (Burrows, Gurevych & Stein, 2015; Dikli, 2006). These systems provide rapid turnaround on assessments and can highlight patterns of misunderstanding that require instructional adjustment (Shermis & Burstein, 2013). Automated feedback tools also support consistency in evaluation while reducing teacher workload, allowing educators to focus on higher-order instructional tasks (Zawacki-Richter et al., 2019).

**Performance Dashboards & Analytics:** AI-powered analytics tools transform raw performance data into actionable insights, helping teachers identify learning gaps, monitor progress over time, and make evidence-based instructional decisions (Siemens & Baker, 2012; Ferguson, 2012). These systems support timely interventions and just-in-time instructional differentiation that keeps learners on track (Arnold & Pistilli, 2012; Wise & Jung, 2019).

Emerging research demonstrates how conversational AI tutors and learning analytics frameworks can integrate learner interaction data into teacher dashboards, providing real-time insights and enabling adaptive learning pathways that respond dynamically to student performance (Woolf, 2010; Roll & Wylie, 2016; Holmes et al., 2021).

AI-driven assessment and analytics tools make evaluation more efficient, timely, and data-informed by automating feedback and revealing meaningful learning patterns. These tools empower teachers to provide targeted interventions and continuously refine instruction based on real-time evidence of student progress.

## 3. RESEARCH-BACKED BENEFITS OF AI IN INSTRUCTIONAL DESIGN

A growing body of research highlights the instructional value of integrating artificial intelligence into classroom design when implementation is guided by sound pedagogy and teacher involvement (Luckin et al., 2016; Holmes, Bialik & Fadel, 2019). Artificial Intelligence works best as a constructive partner that enhances teachers' professional knowledge rather than as an independent agent of change.

### **3.1. Collaborative Co-Design Approaches**

Studies examining teacher–AI co-design models show that when educators actively participate in developing AI-supported lesson materials, student engagement and curricular alignment improve significantly (Popenici & Kerr, 2017; Zawacki-Richter et al., 2019). Co-designed AI resources were found to more accurately reflect contextual classroom realities, student preparation levels, and local learning goals in elementary school settings. This aligns with participatory design principles in educational technology, which emphasize that teacher agency is essential for meaningful and sustainable innovation (Holmes et al., 2021).

### **3.2. Pedagogical Support and Professional Efficiency**

Research consistently stresses that AI enhances—rather than replaces—human instructional capability (Luckin et al., 2016; Woolf, 2010). AI systems can process large volumes of learner data, suggest instructional resources, and automate administrative tasks, but pedagogical judgment, ethical oversight, and relational teaching remain distinctly human responsibilities (Williamson & Eynon, 2020). This "human-in-the-loop" model makes sure that technology aids in instructional decision-making rather than controlling it.

Teachers equipped with AI tools report spending less time on routine planning, grading, and material preparation, allowing more time for feedback, relationship-building, and adaptive instruction (Zawacki-Richter et al., 2019; Holmes et al., 2021). Such enhancement in efficiency is especially beneficial in diverse classrooms where teachers have to strike a balance between meeting curriculum requirements and providing individualised learning support. All things considered, research indicates that the biggest advantage of AI is not just automation but also the freedom it gives teachers to concentrate on powerful teaching strategies that promote deeper learning.

Research clearly indicates that AI is most effective in instructional design when it functions as a collaborative partner that supports teacher expertise rather than replacing it. By enhancing efficiency and enabling data-informed, responsive teaching, AI ultimately allows educators to focus more on meaningful pedagogy and deeper student learning.

## **4. IMPLEMENTING AI TOOLS IN CLASSROOMS: BEST PRACTICES**

Successful adoption of AI for instructional design requires thoughtful planning, ethical awareness, and strong teacher leadership (Luckin et al., 2016; Holmes, Bialik & Fadel, 2019). Research emphasizes that technology integration is most effective when guided by clear pedagogical goals rather than novelty or automation alone (Popenici & Kerr, 2017).

#### **4.1. Prioritize Data Ethics and Student Privacy**

AI systems generate, collect, and process large volumes of student data, including performance records, interaction logs, and behavioral indicators. Ethical implementation requires transparent data policies, secure storage systems, and informed consent procedures that protect learners' rights and dignity (Williamson & Eynon, 2020; UNESCO, 2021). Schools and educators must ensure that AI tools comply with privacy regulations and avoid reinforcing bias or inequity through opaque algorithms (Holmes et al., 2021). Building digital trust is essential for sustaining AI-supported learning environments.

#### **4.2. Use AI as a Co-Creator, Not a Replacement**

Research strongly supports a human-in-the-loop approach, where teachers remain the central decision-makers in instructional planning and evaluation (Luckin et al., 2016; Woolf, 2010). AI-generated recommendations should be reviewed, contextualized, and adapted by educators who understand classroom dynamics and individual student needs (Zawacki-Richter et al., 2019). When used as a collaborative partner rather than a substitute, AI enhances professional judgment, supports reflective practice, and strengthens the overall quality of teaching and learning (Holmes et al., 2019).

#### **4.3. Invest in Professional Development**

Effective AI integration depends on sustained teacher professional development rather than one-time technical training (Darling-Hammond et al., 2017; Holmes, Bialik & Fadel, 2019). Educators need structured learning opportunities to understand how AI systems function, how to craft effective prompts, and how to critically interpret AI-generated outputs (Luckin et al., 2016; Zawacki-Richter et al., 2019). Professional learning should also address ethical considerations, bias awareness, and data literacy so teachers can make informed instructional decisions (UNESCO, 2021; Williamson & Eynon, 2020). Research shows that when teachers develop confidence in evaluating AI suggestions, they are more likely to integrate tools meaningfully rather than use them superficially (Ertmer & Ottenbreit-Leftwich, 2010). Collaborative workshops, peer learning communities, and hands-on design tasks further strengthen teachers' ability to adapt AI tools to diverse classroom contexts (Trust et al., 2016).

#### **4.4. Align with Curriculum Goals**

AI-generated outputs must support clearly defined curricular objectives and established learning standards (Tyler, 1949; Biggs, 1996). While AI can rapidly generate lesson

materials, assessments, and activities, teachers must ensure these resources maintain conceptual accuracy, developmental appropriateness, and alignment with intended learning outcomes (Pellegrino, Chudowsky & Glaser, 2001). Research in instructional design emphasizes constructive alignment—linking learning objectives, teaching strategies, and assessment methods—as essential for meaningful learning (Biggs & Tang, 2011). When AI tools are used within this framework, they enhance curriculum coherence rather than distract from instructional goals (Holmes et al., 2019).

Ethical responsibility, ongoing professional development for teachers, and unambiguous alignment with curriculum objectives are necessary for the successful integration of AI in the classroom. AI may significantly improve the quality of instruction while preserving equity, privacy, and pedagogical integrity when it is employed as a collaborative partner and directed by human judgement.

## **5. CONSTRUCTIVE MODEL OF AI-INTEGRATED INSTRUCTION**

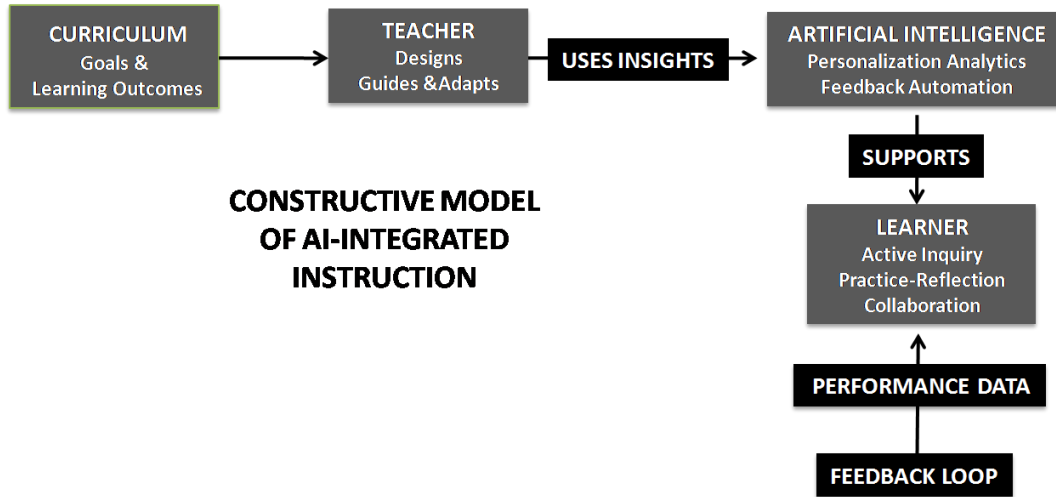
The constructive model of AI-integrated instruction is grounded in constructivist learning theory, which views learners as active participants who build knowledge through interaction, reflection, and meaningful engagement. In this model, artificial intelligence does not replace the teacher or the learner; instead, it functions as an adaptive support system that enriches the learning environment and strengthens the instructional cycle (Luckin et al., 2016; Holmes et al., 2019).

At the core of the model is the learner, who engages with tasks that promote inquiry, collaboration, and problem-solving. AI tools contribute by personalizing content, offering scaffolded feedback, and adjusting task complexity based on learner performance. This adaptive support enables students to work within their zone of proximal development, where learning is most effective (Vygotsky, 1978; Woolf, 2010).

The teacher remains the instructional architect. AI provides insights through analytics, suggests differentiated materials, and automates routine processes, but pedagogical decisions—such as strategy selection, ethical considerations, and contextual adaptation—remain under teacher control (Zawacki-Richter et al., 2019). This reflects a human-in-the-loop approach where professional judgment guides AI use.

The learning environment becomes a dynamic ecosystem in which AI continuously gathers learning evidence, supports formative assessment, and feeds actionable insights back to both teacher and learner. This creates a feedback-rich loop that strengthens reflection and metacognition (Shute, 2008; Siemens & Baker, 2012).

Overall, the constructive Artificial intelligence model enhances interaction, adaptation, and reflection, ensuring that technology enhances deep learning rather than promoting passive content consumption. The diagram provides an insight to a proposed constructive model of artificial integrated instruction.



## CONCLUSION

The design and experience of classroom instruction are continuous to be redefined by artificial intelligence. AI performs best as a pedagogical partner that strengthens instructor knowledge and improves student engagement. It never functions as a stand-alone teaching authority. More inclusive, data-driven, and responsive teaching methods are made possible by the incorporation of AI tools into lesson design, content creation, assessment, and feedback systems.

Research consistently highlights that the educational value of AI depends on maintaining a strong human-in-the-loop model. Teachers remain in vital role as facilitators of meaningful learning, instructional designers, and moral advisors. Although AI adds efficiency, personalisation, and depth to analysis, human judgement, cultural sensitivity, and relational interaction are still essential components of education.

The constructive model of AI-integrated instruction further demonstrates that AI can support active, inquiry-driven learning by providing adaptive scaffolds and real-time feedback aligned with learners’ evolving needs. When supported by professional development, ethical safeguards, and curriculum alignment, AI integration can reduce routine workload while enhancing instructional quality.

Ultimately, the future of AI in education lies not in automation alone but in thoughtful collaboration between human educators and intelligent systems. Such synergy holds the

potential to create more equitable, engaging, and future-ready classrooms while preserving the essential human dimensions of teaching and learning.

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