WP2: State of the Art Analysis

D2.1 Annotated list of AI-assisted learning design tools

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Introduction

Artificial Intelligence (AI) is increasingly shaping the landscape of education by offering new possibilities to enhance teaching and learning processes. AI-assisted learning design tools enable educators to create more personalized, adaptive, and effective learning experiences by leveraging data-driven insights and automation. As schools integrate these technologies, it becomes essential to understand the available tools, identify best practices for their educational use, and ensure that teachers are adequately prepared to apply them through targeted professional development.

Aim and Scope of the Deliverable

This deliverable aims to provide a structured and comprehensive overview of AI-assisted learning design tools, best practices for AI-supported learning design in school education, and professional development initiatives that enable teachers to effectively integrate AI into their instructional design processes. Focusing primarily on primary and secondary education, this deliverable seeks to explore how AI technologies can support educators in creating adaptive, personalized, and effective learning experiences that cater to diverse learner needs.

The scope of this deliverable is organized into three main sections. The first section presents a detailed review and annotated list of AI-assisted learning design tools, highlighting their functionalities, pedagogical applications, and potential impacts on learning processes. The second section focuses on identifying and analyzing best practices in AI-supported learning design, emphasizing inclusivity, ethical use, and pedagogical soundness. The third section examines existing professional development programs that prepare in-service teachers to adopt and apply AI tools in their teaching design, identifying current strengths and gaps in these initiatives.

Together, these sections provide a comprehensive foundation to guide educators, researchers, and policymakers in understanding the current landscape of AI in learning design and in shaping future developments.

Definitions of Key Concepts

- AI-Assisted Learning Design: The use of artificial intelligence technologies to support educators in the design, adaptation, and personalization of learning experiences. These technologies facilitate processes such as lesson planning, content generation, learner assessment, and analytics, leveraging AI methods like machine learning and natural language processing to enhance instructional effectiveness.
- Best Practices in Learning Design: Evidence-based approaches and strategies for integrating AI into learning design that demonstrate pedagogical effectiveness, inclusivity, ethical considerations, and alignment with educational goals.

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- Professional Development for AI Integration: Educational and training programs aimed at equipping current educators with the competencies required to understand, adopt, and integrate AI-assisted learning design tools into their teaching practices.

Expected Outcomes

This deliverable's comprehensive synthesis of AI tools, best practices, and professional development programs will yield several important outputs. It will produce a detailed annotated catalog of AI-assisted learning design tools, a clear identification of effective and inclusive learning design practices supported by AI, and a thorough review of teacher training initiatives in this domain. These outcomes will inform recommendations for future research, implementation pilots, and development of training frameworks, thereby contributing significantly to the responsible and effective integration of AI in school education.

Reviewing existing AI-assisted learning design tools and best practices for learning design for school education and inclusion.

The Role of AI-Powered Lesson Planning Tools in School Education

The contemporary K-12 educational landscape is dynamic, demanding more from teachers than ever before. Beyond instruction, educators are tasked with differentiating learning, providing personalized feedback, managing diverse classrooms, and navigating an ever-evolving curriculum. This escalating workload, coupled with the desire to foster deeper student engagement and critical thinking, highlights a profound need for innovative solutions. Generative AI (GenAI) lesson planning tools are emerging as a transformative answer, offering unprecedented efficiency and creative support for school teachers in their daily practice.

Purpose of GenAI Tools for Lesson Planning

Generative AI (GenAI) tools like ChatGPT (by OpenAI) and Gemini (by Google) offer a practical, time-saving solution. These AI assistants can act as powerful co-planners, helping teachers generate tailored content, brainstorm creative activities, align with curriculum standards, and even adapt materials for different learning styles and levels. Integrating general-purpose GenAI tools into lesson planning offers several compelling advantages for educators:

1. **Time Efficiency:** These tools can generate lesson frameworks, learning objectives, and even full activities in seconds. This frees up invaluable time for teachers to focus on instructional delivery, provide individualized student interaction, and address the nuanced social-emotional needs of their learners.
2. **Curriculum Alignment:** Teachers can prompt the AI to align materials with Common Core, Next Generation Science Standards (NGSS), or other national and local standards, helping to ensure academic rigor and coherence across lessons.
3. **Differentiation Support:** AI can readily offer suggestions for adapting lessons for diverse learners, including English Language Learners (ELLs), students with learning

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difficulties, or advanced learners. This enables educators to cater to a wider range of student needs more efficiently.

4. **Creativity Booster:** Faced with writer's block or planning fatigue, AI can serve as an invaluable brainstorming partner. It can propose new themes, suggest cross-curricular ideas, or generate engaging hooks to refresh existing units, sparking innovative approaches to teaching.
5. **Scaffolded Planning:** These AI platforms can assist in breaking down complex concepts into grade-appropriate explanations, making challenging topics more accessible and suitable for various age groups within the K–12 spectrum.

Scope and Main Features of Lesson Planning Tools in Practice

The scope of these tools extends across the entire lesson planning lifecycle, from initial ideation to post-lesson reflection and adaptation. They are not merely content generators but comprehensive assistants that support various facets of instructional design and delivery. Leading AI-powered lesson planning tools embody a range of functionalities designed to meet the diverse needs of educators. Tools like Magic School AI, LessonPlan.ai, Eduaide.AI, Brisk Teaching, **Monsha.ai**, **ClassPlanner.ai**, **Education Copilot**, and Redmenta showcase these core features:

- **Lesson Plan Generation:** All these tools offer the capability to generate comprehensive lesson plans from simple prompts, including objectives, materials, procedures, and assessment ideas. Magic School AI provides various specialized tools for this, while LessonPlan.ai emphasizes customizable templates and differentiated instruction plans. **Education Copilot**, as an **AI Lesson Planner**, also focuses on generating quality, structured lesson and unit plans rapidly.
- **Content Adaptation and Leveling:** Features allowing teachers to adjust the reading complexity or translate existing text for different grade levels or languages. Magic School AI and Brisk Teaching excel in text leveling and translation, making content more accessible. **ClassPlanner.ai** emphasizes this capability, offering tool-built AI for teachers in **40+ Languages** for quick adaptation and resource creation.
- **Assessment Creation:** The ability to rapidly generate quizzes, exit tickets, and rubrics based on specific content or learning objectives. Eduaide.AI offers a robust "Assessment Builder" and "Feedback Bot," and Redmenta focuses on generating interactive quizzes and varied assessment types.
- **Activity and Resource Ideation:** Suggesting engaging activities, discussion questions, and relevant digital resources. Eduaide.AI includes an extensive "Content Generator"

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with over 100 tools, and Redmenta can generate project-based tasks and interactive activities from simple inputs like a textbook chapter photo.

- **Seamless Integration (e.g., Browser Extensions):** Tools like Brisk Teaching operate as Chrome/Edge extensions, working directly within existing platforms (Google Docs, web articles, PDFs), eliminating the need to switch between applications and streamlining workflow.
- **Differentiation Suggestions:** AI-driven recommendations for tailoring instruction to individual student needs, including extensions for advanced learners and scaffolding for those needing more support. LessonPlan.ai explicitly focuses on this by analyzing student learning patterns.
- **Curriculum Alignment:** Ensuring generated plans and materials are aligned with national or state educational standards, saving teachers significant verification time. This is a core feature of the **Monsha.ai / Almanack.ai**, which provides an **all-in-one plan for Lesson planning & Course design** that includes curriculum mapping and strategic standards alignment.

By embracing these sophisticated AI-powered lesson planning tools, school teachers can reclaim valuable time, enhance the quality and personalization of their instruction, and ultimately foster more dynamic and effective learning environments for all students. A comparative matrix of the aforementioned tools, follows.

Tool Name	Company	Payment Model	Key Features
Magic School AI	Magic School	Paid	AI-powered lesson planning, content generation, grading, homework creation, customizable templates
LessonPlan.ai	LessonPlan.ai	Freemium/Paid	Automated lesson plan generator, curriculum alignment, activity suggestions, editable lesson structures
Eduaide.AI	Eduaide	Paid	AI teaching assistant, content creation, real-time feedback, curriculum mapping, learner analytics
Brisk Teaching	Brisk Education	Paid	AI-enhanced lesson planning, multimedia content production, personalized learning objectives alignment
Redmenta	Redmenta	Freemium/Paid	Online test creator and grading, interactive quizzes, assessment analytics, curriculum standards mapping
Monsha.ai / Almanack.ai	Monsha	Paid	All-in-one platform for Lesson Planning & Course Design, Curriculum Mapping, long-term unit planning, multi-language adaptation (60+ languages).

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Tool Name	Company	Payment Model	Key Features
ClassPlanner.ai	ClassPlanner	Free	AI Built for Teachers (In 40+ Languages), instant generation of worksheets, assignments, and lesson plans, differentiation by language.
Education Copilot	Education Copilot	Paid	AI Lesson Planner, rapid generation of structured lesson plans and unit plans, creation of supplementary materials and handouts.

Best Practices for AI-Powered Lesson Planning Tools

1. Combine AI Efficiency with Teacher Expertise: AI tools can save teachers valuable time by automating routine tasks like drafting lesson outlines or aligning content with standards. However, effective lesson planning requires teachers to remain in control by reviewing and tailoring AI-generated plans to fit their unique classroom contexts and student needs. This hybrid approach balances AI-driven efficiency with professional judgment and creativity.

2. Provide Clear, Detailed Prompts to AI: The quality of AI-generated lesson plans depends heavily on the input prompts teachers give. Best practices include:

- Starting with clear learning objectives aligned to specific curriculum standards
- Including contextual details such as grade level, class size, special learning needs, and available resources
- Asking for differentiated versions or scaffolding to accommodate varied student readiness
- Iteratively refining AI prompts based on feedback and outcomes to optimize plan relevance

3. Focus on Pedagogical Alignment: AI-generated plans should emphasize deeper learning objectives beyond mere recall, such as higher-order thinking skills based on frameworks like Bloom's Taxonomy or Webb's Depth of Knowledge. Teachers should verify that activities, assessments, and success criteria align with these goals and support meaningful student engagement.

4. Adapt and Differentiate for Learner Needs: Effective AI lesson planning integrates Universal Design for Learning (UDL) principles by suggesting multiple pathways and differentiated materials tailored to diverse student profiles, including English learners and students with special education needs. Using AI's capacity to analyze learner data, plans can be personalized to optimize accessibility and inclusion.

5. Use AI as a Collaborative Partner, Not a Replacement: AI should augment teachers' planning by providing creative inspiration, structure, and practical suggestions—not replace

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human expertise. Teachers remain essential for reflecting on student progress, adapting teaching strategies, and fostering rich learning interactions.

6. Reflect, Iterate, and Archive: AI-assisted lesson planning benefits from ongoing iteration. Teachers should document what worked well or needed improvement, update their AI prompts accordingly, and build a repository of refined plans for future use.

GenAI Tutors in K–12 Education: Promise & Practice

The integration of Generative AI (GenAI) in education has introduced a new class of AI tutors—intelligent, conversational agents that personalize learning experiences. Tools like Khanmigo, Flint, and EduGPT represent a significant shift toward scalable, individualized support for K–12 students. These GenAI tutors, often built on large language models (LLMs), simulate interactive, human-like dialogues to guide learners, answer questions, and scaffold understanding.

Purpose of GenAI Tutors

GenAI tutors are grounded in principles of Intelligent Tutoring Systems (ITS) and align with educational psychology frameworks such as Vygotsky's Zone of Proximal Development (ZPD) (Luckin et al., 2016; Vygotsky, 1978). They aim to provide individualized instruction and feedback, fostering a more efficient and effective learning process by catering to diverse needs and learning styles (Long & Magerko, 2020; Hwang et al., 2021).

Key mechanisms through which GenAI tutors are described as enhancing student engagement and learning include:

- **Personalized and Adaptive Learning Pathways:** By extracting specific knowledge components and building student models that track strengths and weaknesses, AI tutors can personalize instruction and offer targeted interventions to enhance skill development (Graesser et al., 2005). This tailored approach can lead to increased student engagement, as content and support are specifically relevant to individual learning needs (Kumar et al., 2023).
- **Interactive Dialogue and Socratic-style Questioning:** Tools like Khanmigo are designed to encourage critical thinking and deep learning by employing Socratic-style questioning (Khan Academy, n.d.). They prompt students to explain their reasoning and analyze problems step-by-step, fostering metacognition and active learning over rote memorization (Rosé et al., 2011; Mollick & Mollick, 2023). Students can engage in iterative conversations, asking follow-up questions and refining their understanding over multiple interactions, supporting deeper inquiry (Baker et al., 2008).
- **Hints, Scaffolded Support, and Real-World Relevance:** Instead of providing direct answers, AI tutors offer hints, partial clues, and stepwise guidance, helping students work through problems independently and master concepts similar to a human tutor (Koedinger & Corbett, 2006). When students inquire about a topic's relevance, AI tutors can tailor explanations based on their interests or goals, illustrating real-world applications that make learning more meaningful (Woolf et al., 2013).
- **Enhanced Satisfaction and Control:** Higher user satisfaction with AI tutors is often associated with their ability to respond quickly with appropriate answers, fostering a sense of control over their learning pace (Huang et al., 2020). This perception of

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control can further motivate and invest users in their learning efforts (Ryan & Deci, 2000).

- **Positive Observed Engagement Levels:** Broader research supports generally high engagement levels with AI tutors in various contexts, including language learning (Lane et al., 2016). These systems can adapt and improve individual engagement dynamically through AI-measured feedback (Lane et al., 2016).

Exemplars and the Expanding Landscape

In addition to Khanmigo (Khan Academy, n.d.) which is perhaps the most well known GenAI tutor, the ecosystem of GenAI tutors includes:

- **Flint** (Flint K12)
- **EduGPT** (EduGPT)
- **Mia** (LearnQ.ai)
- **Jagoda.ai** (Jagoda)
- **AI Math Coach** (AI Math Coach)
- **Answer AI** (Answer AI)
- **Colleague AI** (Colleague AI)

These platforms provide subject-specific and general tutoring capabilities, often integrating chat, quizzes, visualizations, and real-time analytics to tailor instruction, indicating a rapidly growing landscape of AI in education (UNESCO, 2023).

The following comparative matrix sums up the key features of each tool.

Tool Name	Company	Payment Model	Key Features
Khanmigo	Khan Academy	Freemium/Donation-based	AI-powered tutor and coach guiding personalized learning, interactive Q&A, subject-specific support
Flint (Flint K12)	Flint K12	Paid	AI platform for K–12 schools providing tutoring, student engagement analytics, personalized learning paths
EduGPT	EduGPT	Paid	AI tutor and content generator for education, real-time assistance, curriculum-based learning support
Mia (LearnQ.ai)	LearnQ.ai	Paid/Subscription	Conversational AI tutor for K–12, adaptive Q&A, lesson reviews, and interactive learning sessions
Jagoda.ai	Jagoda	Paid	AI teaching assistant, lesson plan generation, student interaction analysis, homework help tools

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Tool Name	Company	Payment Model	Key Features
AI Math Coach	AI Math Coach	Freemium/Paid	Specialized AI tutor for math, adaptive exercises, step-by-step problem solving, performance tracking
Answer AI	Answer AI	Paid	AI assistant for question answering, personalized explanations, supports various subjects in K–12
Colleague AI	Colleague AI	Paid	AI collaboration tool for educators, resource sharing, lesson planning assistance, communication support

Best Practices for Generative AI Tutors in K–12 Education

To maximize the benefits of GenAI tutors while mitigating their risks, policymakers should consider the following:

- **Pedagogical Integration:** AI tutors should be designed and implemented to enhance, not replace, human instruction. Their use must align with clear curricular goals and support pedagogically sound teaching strategies.
- **Data Governance:** Establish robust data governance frameworks that ensure compliance with relevant regulations (e.g., GDPR, FERPA). Implement data minimization, transparency, and robust security practices to protect student and educator privacy.
- **Educator Involvement and Training:** Teachers must receive comprehensive training in AI ethics, prompt engineering, and effective classroom application of GenAI tools (Holmes et al., 2022). Their perspectives should be central to the development and implementation of AI policies and practices.
- **Equity Measures:** Focus on ensuring equitable access to GenAI tools, addressing language inclusivity, and guaranteeing cultural relevance to avoid exacerbating existing digital divides among students and communities.
- **Evaluation Mechanisms:** Establish continuous monitoring and evaluation mechanisms to assess the instructional quality of AI tutors, their true impact on learning outcomes, and any unintended consequences, including effects on student social-emotional development.
- **Human-Centered Approach:** Policy must explicitly prioritize a human-centered approach to AI in education, emphasizing that AI tools should augment, not diminish, the vital roles of teachers and the unique value of human relationships in learning.

While AI tutors and chatbots demonstrate considerable promise in enhancing student engagement and academic performance through personalized, interactive, and scaffolded support, their impact on the depth and breadth of learning may currently be confined to specific, smaller learning units. They may neglect crucial human, social, and contextual elements vital for comprehensive educational growth.

For K–12 education, the integration of GenAI tutors should proceed with careful consideration and a commitment to continuous evaluation. Future research is crucial to validate observed impacts with empirical data, explore long-term effects on academic achievement and motivation, and understand user preferences. Policymakers and educators must foster a

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nuanced understanding of education, moving beyond the aggregation of small learning units, to truly integrate AI in a way that supports, rather than detracts from, the comprehensive and human-centered goals of schooling.

GenAI Assessment Tools in K–12 Education: Opportunities & Implications

The emergence of Generative AI (GenAI) tools marks a significant shift in how K–12 teachers approach assessment design, implementation, and feedback. These technologies empower educators to generate customizable assessments based on curriculum-aligned inputs such as learning objectives, existing texts, or uploaded documents. By leveraging natural language processing and adaptive algorithms, GenAI promises to transform traditional testing into a more flexible, inclusive, and data-informed process, aligning assessment more closely with individualized learning pathways (Holmes et al., 2022).

Benefits and Educational Value

GenAI assessment platforms offer several profound pedagogical advantages in the K–12 setting, extending beyond mere automation to support more effective and equitable educational practices:

- **Rapid Generation and Efficiency:** GenAI tools can swiftly generate a wide array of assessment items, including quizzes, polls, short-answer questions, and project prompts, all aligned with specified learning outcomes. This significantly reduces the time teachers traditionally spend on test preparation, allowing them to redirect their energy towards instructional delivery, individualized student support, and deeper pedagogical reflection (Mollick & Mollick, 2023).
- **Personalization and Differentiation:** One of the most compelling benefits is the ability to personalize assessment content and difficulty based on individual student performance, learning styles, or specific learning needs. GenAI can adapt questions in real-time or create multiple versions of an assessment to cater to diverse learners, including English Language Learners (ELLs) and students with learning difficulties, thereby fostering truly differentiated instruction (Hwang et al., 2021).
- **Real-Time Feedback and Actionable Analytics:** Many GenAI assessment tools provide immediate feedback to students and real-time analytics dashboards for teachers. This instantaneous insight into student understanding allows educators to identify learning gaps promptly, adjust teaching strategies on the fly, and make data-informed instructional decisions, moving towards more agile and responsive teaching (Siemens, 2013).
- **Enhanced Accessibility Features:** These tools can support diverse learners through built-in accessibility features such as text-to-speech, translation capabilities, and simplified language options. By lowering barriers to participation, GenAI helps ensure

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that assessments are inclusive and accurately reflect a student's knowledge rather than their ability to navigate a traditional test format (UNESCO, 2023).

- **Promotion of Engagement:** Interactive and gamified features, common in platforms like Quizizz, promote student engagement and can reduce test anxiety, transforming assessment from a stressful evaluation into a more active and even enjoyable part of the learning process (Huang et al., 2020).

Overview of Selected GenAI Assessment Tools

The market for GenAI assessment tools is rapidly expanding, with several platforms offering distinct functionalities for K–12 educators, the following AI tools are notable for their contributions to educational practice:

- AssessPrep: AI-powered platform for creating, delivering, and grading curriculum-aligned assessments.
- PrepAI: AI-driven lesson planning and content creation assistant for K–12 educators.
- Quizizz: Interactive quiz platform using AI to enhance student engagement and provide real-time analytics.
- TeachMateAI: AI assistant that supports lesson planning, curriculum mapping, and differentiated instruction.
- TeacherMatic: Automated lesson plan generator for personalized and adaptable learning designs.
- QuizGecko: Generative AI tool that transforms text content into interactive quizzes for classroom or remote learning.
- ClassPoint AI: AI-integrated presentation tool that facilitates live quizzes and instant student feedback within lessons.
- Gradescope: AI-assisted grading software supporting rubric-based assessment workflows for both typed and handwritten assignments.
- Brisk Teaching: AI-enabled platform to generate lesson plans and multimedia educational materials aligned with learning objectives.

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- Conker.ai: Collaborative AI tool for dynamic lesson plan generation and resource creation aligned to curriculum standards.

In summary, GenAI assessment tools represent a significant leap in educational technology for K–12 classrooms. They offer compelling opportunities to support inclusive, personalized, formative, and summative assessments tailored to individual learners. By automating tedious tasks and providing data-driven insights, these tools have the potential to enhance teaching efficiency and improve learning outcomes.

The following comparative matrix sums up the key features of each tool.

Tool Name	Company	Payment Model	Key Features
AssessPrep	AssessPrep Ltd.	Paid	AI-powered assessment creation, automated grading, analytics, curriculum-aligned content, secure exam delivery
PrepAI	PrepAI (Independent)	Freemium/Paid	AI lesson planning, content generation, curriculum mapping, customizable templates
Quizizz	Quizizz Inc.	Freemium/Paid	Interactive quizzes, game-based learning, real-time analytics, LMS integrations
TeachMateAI	TeachMateAI	Paid	AI lesson planning assistant, differentiated instruction, collaboration tools
TeacherMatic	TeacherMatic	Paid	Automated lesson plan generation, personalized learning pathways, assessment suggestions
QuizGecko	QuizGecko	Paid	AI quiz creation from text, multiple question types, instant customization
ClassPoint AI	ClassPoint Inc.	Paid	Interactive presentations, live quizzes, student response analytics, PowerPoint integration
Gradescope	Turnitin (acquired)	Paid	AI-assisted grading workflow, rubric-based scoring, supports handwritten and digital submissions
Brisk Teaching	Brisk Education	Paid	AI-generated lesson planning, multimedia content creation, learning objective alignment

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Tool Name	Company	Payment Model	Key Features
Conker.ai	Conker.ai	Paid	AI lesson plan generation, curriculum alignment, resource library, collaborative features

Best practices: How Teachers Use GenAI Assessment Tools

In real classroom settings, teachers leverage GenAI assessment tools through intuitive and efficient workflows that dramatically cut down preparation time and enhance instructional precision. The versatility of these platforms allows for diverse applications, from rapid quiz generation to sophisticated content adaptation.

- **Generating Quizzes from Existing Materials:** A common application involves teachers uploading existing learning materials, such as a PDF of a textbook chapter, a Word document with lecture notes, or even pasting raw text. For example, a 7th-grade history teacher preparing for a unit quiz on Ancient Egypt might upload their lecture notes from the week. They could then use a tool like **QuizGecko** or **PrepAI** to automatically generate a multiple-choice quiz. The teacher can then refine the questions, adjust the difficulty level, or change question types with simple prompts like:
    - "Create 10 multiple-choice questions about the role of the Nile River in Ancient Egyptian civilization."
    - "Make these questions more challenging, focusing on critical thinking rather than recall."
    - "Generate three short-answer questions for a 5th-grade science lesson on the water cycle, ensuring they align with NGSS standards." (TeachMateAI or TeacherMatic could assist here for standards alignment and differentiation).
- **Creating Differentiated Assessments:** For classrooms with varying student needs, teachers can use tools like **TeacherMatic** or **Brisk Teaching** to generate differentiated versions of an assessment. For instance, an English language arts teacher might paste a reading passage into **Brisk Teaching** and use its "Change Levels" feature to create simplified versions for ELL students or more complex versions with higher-order thinking questions for advanced learners, instantly tailoring the assessment to individual proficiency levels.
- **Designing Interactive and Gamified Reviews:** Tools such as **Quizizz** and **ClassPoint AI** are frequently used to transform review sessions into engaging, gamified experiences. A teacher can input a topic or key terms, and the AI will suggest interactive quiz formats. With **ClassPoint AI**, questions can be generated directly from PowerPoint

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slides during a live presentation, allowing for spontaneous formative assessment that keeps students engaged and provides immediate feedback.

- **Automating Rubric Creation and Feedback:** For more subjective assessments like essays or projects, teachers can use GenAI tools to generate rubrics or assist with providing feedback. A high school English teacher, after students submit an essay, could use a tool like **Gradescope** which leverages AI to streamline grading against a custom or AI-generated rubric. **Brisk Teaching** can also provide "Glows & Grows" feedback directly in student documents, significantly reducing manual grading time.

- **Adapting Assessments from Videos:** Some tools allow teachers to generate questions directly from video content. A science teacher might paste a YouTube video URL about photosynthesis into an AI assessment tool to generate comprehension questions for students to complete after watching, ensuring understanding of the video's core concepts.

These practical applications highlight how GenAI assessment tools act as powerful co-pilots, enabling teachers to efficiently create tailored, engaging, and insightful assessments that cater to the diverse learning needs within their K–12 classrooms.

Integrating Generative AI in Learning Management Systems for K–12 Education

The K–12 educational landscape is rapidly evolving, driven by the increasing demand for personalized, interactive, and efficient online learning experiences. Learning Management Systems (LMS) serve as the backbone for digital education, and their integration with Generative AI (GenAI) is marking a transformative shift. This document outlines how leading LMS platforms are leveraging GenAI to empower teachers in designing and deploying online courses more easily and effectively, significantly reducing workload while enhancing the overall learning experience.

The Strategic Importance of GenAI Integration in LMS

The integration of GenAI into LMS platforms addresses several critical needs in modern education:

- **Teacher Workload Reduction:** Manual course design, content creation, and assessment development are immensely time-consuming. GenAI automates these repetitive tasks, freeing up valuable teacher time to focus on direct student interaction, pedagogical innovation, and professional development (Mollick & Mollick, 2023).

- **Enhanced Personalization and Differentiation:** GenAI allows for the dynamic creation and adaptation of learning content and pathways tailored to individual student needs, learning styles, and progress. This moves beyond a "one-size-fits-all" approach to truly individualized instruction (Hwang et al., 2021).

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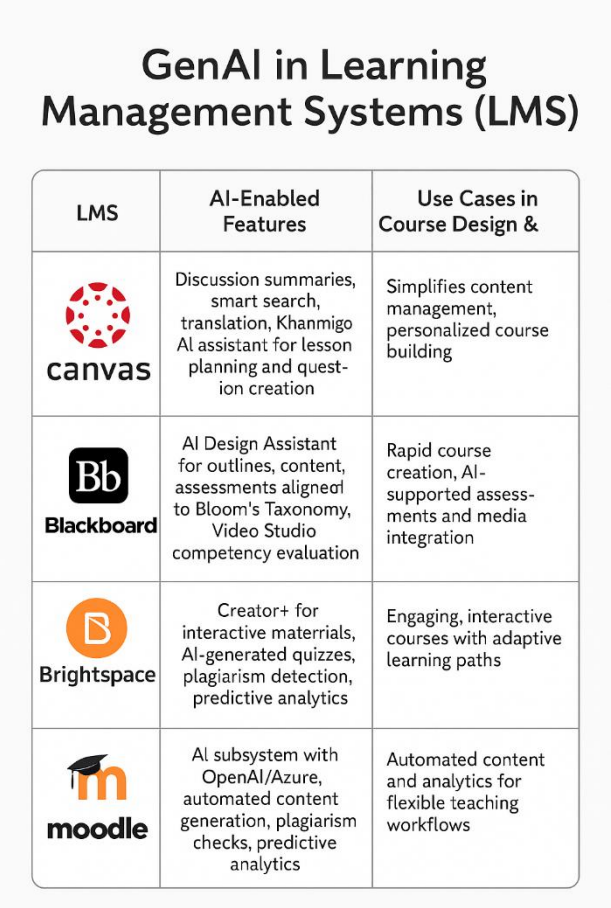
- **Increased Interactivity and Engagement:** AI-powered features can generate engaging multimedia content, interactive quizzes, and Socratic dialogues, making online learning more dynamic and captivating for students (Huang et al., 2020).
- **Data-Informed Instruction:** GenAI-enhanced LMS platforms can provide real-time analytics and predictive insights into student performance, allowing teachers to identify learning gaps and intervene effectively and proactively (Siemens, 2013).
- **Scalability of Quality Education:** By streamlining content creation and personalizing delivery, GenAI within LMS can help scale high-quality educational experiences to a larger number of students without disproportionately increasing teacher burden.

How Leading LMS Platforms are Integrating GenAI

Major LMS providers are actively incorporating GenAI capabilities into their ecosystems, each with unique approaches to support teachers in course design and deployment.



GenAI in Learning Management Systems (LMS)

LMS	AI-Enabled Features	Use Cases in Course Design &
canvas	Discussion summaries, smart search, translation, Khanmigo AI assistant for lesson planning and question creation	Simplifies content management, personalized course building
Blackboard	AI Design Assistant for outlines, content, assessments aligned to Bloom's Taxonomy, Video Studio competency evaluation	Rapid course creation, AI-supported assessments and media integration
Brightspace	Creator+ for interactive materials, AI-generated quizzes, plagiarism detection, predictive analytics	Engaging, interactive courses with adaptive learning paths
moodle	AI subsystem with OpenAI/Azure, automated content generation, plagiarism checks, predictive analytics	Automated content and analytics for flexible teaching workflows

Canvas

Canvas, a widely used LMS, integrates AI to streamline course content management and enhance pedagogical support:

- **Content Management Tools:** Canvas utilizes AI for features like discussion summaries, smart search capabilities, and translation tools, which assist in managing vast amounts of course content efficiently (Canvas, n.d.).
- **AI Teaching Assistant Integration:** Notably, Canvas integrates with Khanmigo, Khan Academy's AI-powered teaching assistant. This allows teachers to leverage AI directly within Canvas for lesson planning and question generation, tailoring materials for diverse learners (Khan Academy, n.d.).

Blackboard Learn

Blackboard Learn is enhancing its platform with AI to accelerate content creation and assessment design:

- **AI Design Assistant:** This feature helps instructors quickly create course content outlines, build learning modules, and generate assessments that are aligned with established pedagogical frameworks such as Bloom's Taxonomy (Blackboard, n.d.).

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- **Automated Resource Sourcing:** It can source royalty-free images and create pedagogically sound assessment items, reducing the manual effort required for content development.
- **Competency Evaluation and Dialogue:** Blackboard supports AI-powered competency evaluation to identify student strengths and areas needing support. Additionally, features like "AI Conversations" facilitate Socratic dialogue, while an integrated "Video Studio" supports multimedia content creation.

Brightspace (D2L)

Brightspace focuses on creating interactive and engaging learning materials through its AI enhancements:

- **Creator+:** This AI-enhanced course creation tool allows teachers to build interactive and engaging learning materials directly within the LMS.
- **AI-Powered Assessments and Analytics:** Brightspace includes AI-based quiz creation, automatic discussion prompt generation, plagiarism checking, and predictive analytics. Its AI also supports adaptive release and personalized learning pathways, enabling teachers to design highly responsive learning experiences.

Moodle

Moodle, an open-source LMS, is integrating AI capabilities through its flexible architecture:

- **AI Subsystem Integration:** Moodle has an AI subsystem that allows for the integration of external AI services, such as OpenAI and Azure AI. This enables features like automated content generation, plagiarism checks, and predictive analytics (Moodle, n.d.).
- **Plugin Ecosystem:** Through plugins like Coursensu, Moodle extends its AI capabilities for more dynamic course design and enhanced analytics, easing the workload on educators by automating various content and performance analysis tasks.

Common Features and Benefits Across LMS Integrations

The widespread adoption of GenAI across these platforms highlights a common set of features and benefits for K–12 educators:

- **AI-Assisted Course and Lesson Design:** Teachers can leverage AI tools to automate the structuring of courses, generate initial content drafts, create quizzes, develop discussion prompts, and even suggest multimedia resources.
- **Adaptive Learning Support:** A core benefit is the AI's ability to adjust learning paths, recommend resources, and modify assessment difficulty based on real-time student data, leading to truly personalized instruction.
- **Efficiency and Time Saving:** The most immediate impact is the significant reduction in time teachers spend on manual content creation, organization, and administrative tasks.
- **Interactive and Multimedia Enhancement:** AI-powered features, such as video creation and smart image sourcing, enable the development of richer, more engaging, and visually appealing course materials.
- **Advanced Assessment Capabilities:** GenAI facilitates the creation of assessments aligned with educational taxonomies, incorporates plagiarism checks, and can assist in designing "cheat-proof" quiz types, thereby supporting academic integrity.

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- **Analytics and Competency Evaluation:** Real-time data processing and predictive analytics provide teachers with granular insights into student progress, allowing for timely interventions and more precise competency evaluation.

The integration of Generative AI into Learning Management Systems represents a significant leap forward for K–12 education. By strategically leveraging AI's capabilities, policymakers can support the creation of more personalized, interactive, and effective online learning environments, while simultaneously alleviating the substantial workload faced by teachers. A human-centered approach, coupled with thoughtful policy and robust professional development, will be key to unlocking the full transformative potential of GenAI in LMS for the benefit of all students and educators.

Identifying Existing Programs for Professional Development of In-Service Teachers Regarding AI in Learning Design

Introduction

The rapid adoption of artificial intelligence (AI) in education is transforming teaching and learning paradigms, necessitating targeted professional development (PD) for educators to navigate this evolving landscape effectively. PD programs focused on AI integration in learning design help teachers build essential competencies in understanding AI concepts, ethical considerations, and practical application of AI tools to support personalized, inclusive, and effective instruction. As AI-enabled technologies become more prevalent in classrooms, equipping teachers with ongoing training and support is critical for maximizing educational benefits and minimizing risks.

Existing PD models encompass various formats such as online courses, workshops, university curricula, micro-credentials, and professional learning communities. These interventions differ in scope, pedagogical design, and accessibility, reflecting the diverse needs of educators and educational contexts. Although many programs offer foundational AI literacy, there is also a growing emphasis on practical, hands-on experiences aligned with real classroom scenarios, including ethical and equity-focused approaches.

This section reviews prominent professional development programs aimed at in-service teachers, highlighting their goals, approaches, delivery methods, and challenges. Empowering teachers through robust PD is essential for cultivating responsible, innovative, and inclusive AI use in education.

List of existing programs for professional development of in-service teachers regarding AI in learning design

The following table includes online programs and online courses on AI for lesson planning & assessment targeted to school teachers.

	Program/Course Title	Organization	URL	Duration	Description

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1	Generative AI for Educators with Gemini	Google for Education	grow.google/ai-for-educators/	2 hours	Self-paced course teaching educators to use Gemini and NotebookLM for lesson planning, personalized instruction, and creative classroom activities. Focus on practical AI integration for teaching and learning enhancement.
2	AI in the Classroom	Canva Design School	canva.com/design-school/courses/ai-in-the-classroom	73 minutes (8 lessons)	Comprehensive course covering AI tools for lesson planning and creating teaching materials. Teaches Magic Write for lesson plans, AI-generated visuals, and content adaptation techniques for educators.
3	AI Course for Educators	AI for Education	aiforeducation.io/ai-course	2 hours	Free hands-on course focusing on ChatGPT for time-saving lesson preparation and student engagement. Covers responsible AI implementation and practical classroom applications for educators.
4	AI Assessment Techniques	Teacher Academy (Erasmus+)	teacheracademy.eu/course/ai-for-assessment/	6 days	Intensive course covering traditional and AI-enhanced assessment methods. Focuses on integrating AI tools into evaluation processes while maintaining educational standards and best practices.
5	AI in Education	Teacher Academy (Erasmus+)	teacheracademy.eu/course/artificial-intelligence/	Not specified	Comprehensive AI integration course for educators covering various aspects of artificial intelligence in educational settings. Designed for teachers seeking to implement AI tools effectively in their practice.
6	AI Lesson Plan Workshop for Teachers	Teacher to Techie	teachertotechie.org/ai-lesson-plan-workshop-for-teachers/	Not specified	Professional development workshop with certification focusing on AI prompting techniques, curriculum alignment, and assessment creation. Includes digital resources and templates for practical application.
7	Artificial Intelligence (AI) Education for Teachers	Coursera (Macquarie University & IBM)	coursera.org/learn/artificial-intelligence-education-for-teachers	Not specified	University-level course teaching foundational AI concepts to educators. Focuses on understanding how AI works and its applications in educational contexts for classroom implementation.
8	Safe and Effective Use of AI in Education	Chartered College of Teaching (UK)	chartered.college/safe-and-effective-use-of-ai-in-education/	Not specified	Training program offering certified assessment and credits toward Chartered Teacher Status. Focuses on safe, effective, and ethical AI use in school environments with practical guidance.
9	Designing Assessments with AI Workshop Series	Cambridge Assessment (UK)	cambridgeassessment.org.uk/events/apw-designing-assessments-with-ai/	3 workshops	Interactive workshop series focusing on AI for item generation and assessment design. Covers foundational to advanced techniques for integrating AI into assessment practices and evaluation methods.

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10	Designing Authentic Assessment in the Age of AI	UC Online (University of Canterbury)	uconline.ac.nz/courses/designing-authentic-assessment	Not specified	Course focusing on using AI to streamline assessment processes while maintaining authenticity. Covers strategies for creating assessments, supporting grading, and providing feedback using AI tools.
11	AI in Education – Tools & Innovation for Future-Ready Teachers	International Hellenic University	kedivim-apply.ihu.gr/en/progs/prog-392	Not specified	Graduate-level program targeting educators worldwide seeking comprehensive AI skills. Focuses on innovation tools and practical implementation strategies for future-ready teaching practices.
12	Artificial Intelligence in Schools: ChatGPT and AI for Teachers	Erasmus Training Courses	erasmustrainingcourses.com/artificial-intelligence.html	Not specified	Structured Erasmus+ funded course covering ChatGPT and AI tools for teachers. Focuses on AI strategies, best practices, and school integration techniques for European educators.

Based on the programs and courses listed above, here's a comprehensive overview focused specifically on fully online delivery:

Underlying Philosophy and Approach

Human-Centered AI Integration

These programs consistently emphasize that AI should enhance rather than replace human educators. The philosophy centers on maintaining teacher agency while leveraging AI as a powerful assistant tool. Programs like Google's Generative AI for Educators and the Chartered College's Safe and Effective Use course prioritize **responsible AI implementation** that preserves the human connection in education while amplifying teacher capabilities.

Practical Application Over Theory

Most successful programs adopt a **hands-on, workshop-based approach** rather than theoretical lectures. The Teacher Academy courses and Teacher to Techie workshops emphasize immediate applicability, providing templates, digital notebooks, and real classroom scenarios. This philosophy recognizes that teachers need concrete tools they can implement immediately rather than abstract AI concepts.

Ethical Foundation

Programs consistently integrate **ethical considerations** from the beginning rather than as an afterthought. The UK's Chartered College program and Cambridge Assessment workshops emphasize responsible use, bias awareness, and maintaining academic integrity while using AI tools.

Core Topics Covered Across Programs

1. AI Prompting and Interaction Techniques

Learners explore how to write effective prompts, adjust AI responses, and apply subject-specific strategies.

- Crafting effective prompts for lesson planning

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- Understanding AI limitations and capabilities
- Iterative refinement of AI-generated content
- Subject-specific prompting strategies

2. Lesson Planning and Content Creation

Participants learn how to use AI tools to plan lessons, align with standards, and create engaging learning materials.

- Automated lesson plan generation and customization
- Curriculum alignment and standards mapping
- Differentiation strategies using AI tools
- Resource creation and adaptation
- Multi-modal content development (text, visual, interactive)

3. Assessment Design and Implementation

Educators discover ways to design fair, valid assessments with AI while ensuring accuracy and minimizing bias.

- AI-assisted question and rubric creation
- Automated grading and feedback systems
- Formative vs. summative assessment with AI
- Maintaining assessment authenticity and validity
- Bias detection and mitigation in AI-generated assessments

4. Personalization and Differentiation

Teachers learn to adapt AI tools for personalized learning experiences that meet diverse student needs.

- Creating individualized learning pathways
- Adaptive content delivery based on student needs
- Special education accommodations using AI
- Multi-language support and translation

5. Ethical Use

Participants understand how to use AI responsibly, protect student data, and promote ethical use in educational settings.

- Understanding AI bias and limitations
- Student privacy and data protection
- Academic integrity in the age of AI
- Teaching students about responsible AI use

Best Practices for Fully Online Delivery

Modular and Flexible Structure

Successful programs like Google's 2-hour course and Canva's 8-lesson format use **bite-sized modules** that teachers can complete during planning periods or after school. The most effective approach combines:

- **15-30 minute focused video lessons** with practical demonstrations
- Self-paced progression with suggested weekly milestones
- **Optional deep-dive modules** for advanced learners

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- Mobile-responsive design for learning on any device

Interactive and Hands-On Learning
Learners practice using AI tools directly in the course through demos, exercises, and real-time feedback.
Programs that show highest completion rates (like Google's 95% implementation rate) incorporate:

- **Embedded AI tool practice** directly within the course platform
- Screen-recorded demonstrations with step-by-step walkthroughs
- **Interactive assignments** where teachers generate and submit AI-created content
- Virtual sandbox environments for safe AI experimentation
- **Real-time feedback systems** on submitted work

Engaging Multimedia Content
Videos, simulations, and other media make learning more engaging and easier to follow.
The most effective online programs utilize:

- **Short video tutorials** (5-10 minutes each) with clear visuals
- Interactive simulations of AI tool interfaces
- **Downloadable resources** and cheat sheets for offline reference
- Audio-only options for accessibility and mobile learning
- **Gamified elements** like progress badges and completion certificates

Community Building in Virtual Spaces
Online spaces help participants share ideas, connect, and learn from each other.
Successful online programs create connection through:

- **Discussion forums** organized by topic and experience level
- Virtual coffee hours and networking sessions via video conferencing
- **Peer review activities** for AI-generated lesson plans and assessments
- Collaborative projects using shared online workspaces
- **Mentorship matching** between experienced and novice AI users

Practical Resources and Templates
Ready-made tools, templates, and guides give teachers practical resources they can use immediately.
The most valued programs provide:

- **Downloadable template libraries** for immediate classroom use
- Copy-and-paste prompt collections organized by subject area
- **Integration tutorials** for popular LMS platforms (Moodle, Canvas, etc.)
- Troubleshooting guides with video solutions
- **Quick reference cards** for AI tool functionalities

Assessment and Certification in Online Format
Assessment happens through online portfolios, quizzes, and certificates that recognize progress and achievement.
Programs with high engagement rates include:

- **Portfolio submissions** through online platforms with peer feedback
- **Digital badges** and micro-credentials for module completion

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- Virtual presentation opportunities to showcase AI-created materials
- **Automated quiz systems** with instant feedback
- Final project presentations via video submission or live virtual sessions

Synchronous and Asynchronous Balance
A mix of self-paced study and live sessions provides both flexibility and real-time support. Most successful programs combine:

- **Core content delivered asynchronously** for maximum flexibility
- Weekly virtual office hours for live Q&A and troubleshooting
- **Optional live webinars** for advanced topics and guest speakers
- Scheduled peer collaboration sessions via video conferencing
- Real-time chat support during course activities

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