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Designing adaptive lessons with GenAI to meet diverse learning preferences

Sara Ahmer, Pakistan

Designing adaptive lessons with GenAI to meet diverse learning preferences

School context

Aitchison College is one of the leading educational institutions in Pakistan, known for its rich history and tradition of academic excellence. Established in 1886, the school is located in Lahore and has educated generations of leaders for the country and is also a member of the G30 schools. It offers a broad curriculum that includes Cambridge IGCSE and A Level, with a strong emphasis on developing well-rounded individuals. The school provides an environment that nurtures academic achievement, sportsmanship and leadership qualities among its students. With extensive facilities like riding and a diverse student body from all over the country, Aitchison College is dedicated to maintaining high standards of education by gaining admissions in top universities of the world every year. The school's commitment to holistic education is evident through its focus on extracurricular activities and sports.

About the author



Sara Ahmer is an art educator, designer and researcher with over 20 years of experience in education. As Head of the Art and Design Department at Aitchison College, Lahore, she has reshaped art education by integrating digital technology into the classroom. Under her leadership, the Art Department has seen significant growth, with her students achieving high academic success, including worldwide distinctions. Sara is known for providing students with multifaceted learning platforms that encourage creativity and for fostering practical, hands-on learning through initiatives like the widely renowned Art & Performing Arts Festival. As the driving force behind the pioneering Art Discourse, she has successfully created a platform for national and international students to voice their perspectives. Showcasing her artistic prowess by designing sets and curating art exhibitions, Sara is passionate about staying up to date with new trends in Art and Design, ensuring her students are well prepared for their creative journeys in the evolving world of art.

Key findings

- While AI improves differentiation and multimodal engagement, teachers remain the primary decision makers in determining the best strategies for their students.
- Moving forward, AI should serve as a complementary tool, promoting student-centred learning and critical thinking rather than replacing traditional pedagogical methods.
- The data reflects strong teacher interest in AI integration, but 63 per cent report only moderate AI proficiency, indicating a training gap. To ensure effective AI adoption, teachers request hands-on training, AI lesson examples and mentoring.
- The findings highlight AI's potential to enhance lesson adaptability and engagement, particularly in catering to diverse learning styles. However, practical implementation challenges remain, with teachers citing over-reliance on AI (67 per cent). While 85 per cent found AI useful for differentiated activities, 50 per cent felt tools needed refinement for subject-specific content. Ethical concerns, including AI hallucinations (40 per cent), underscore the need for human oversight.

Exploratory Action Research questions

1. **Why do I think it is important to develop diverse/individualised lesson plans for varied learners?**
2. **How do students and teachers perceive the role of AI in enhancing their learning experiences?**
3. **What are teachers' initial experiences with AI in education?**

Action Research rationale

As a teacher I have witnessed first-hand the challenges that educators face in addressing the diverse learning needs of their students. In my 21 years of teaching, I have seen the struggle to balance the demands of the curriculum with the need to provide individualised support for students with varying learning styles and disabilities. The potential of Generative AI (GenAI) to provide personalised learning experiences is immense, and I believe it can bridge the gap between the ideal of tailored education and the practical constraints of the classroom. By focusing on this area, I aim to develop and share practical strategies that can help educators effectively use AI to enhance their teaching and support all students.

All students have different approaches and perspectives to learning. The diversity of student learning styles presents a challenge to the current teaching methods, where one-size-fits-all approaches often fail to meet the unique needs. Learning styles can be such as visual, auditory, reading, kinaesthetic and more, all of which exist in every classroom. Teachers I have encountered throughout my career have always been open to the opportunity to cater to different styles by having curated lesson planning. However, they struggle to implement personalised instruction due to time constraints or lack of resources. The introduction of Generative AI presents the opportunity to tackle these shortcomings in an efficient manner.

My research will focus on integrating Generative AI with existing lesson plans with the aim of creating more adaptive learning environments that accommodate diverse learning styles and needs. These lesson plans will then be implemented into the classroom with the aim of enhancing learning outcomes. This will be done through an iterative process that involves continuous assessment and refinement in an aim to meet desired outcomes. Research like this is timely and essential for promoting equity and inclusivity in education, and using new technologies to help ensure that every student has the opportunity to succeed is imperative.

Data collection

Q1: Why do I think it is important to develop diverse/individualised lesson plans for VARK learners?

1a. Teacher shadowing: Participants: five teachers

I will observe their lesson preparation and process only to better understand diverse learning. I will be able to find the educators' approach to lesson planning, use of different tools, their thinking, struggles and their solutions to problems, to cater to diverse lesson plannings. This will serve as useful qualitative data for future comparison when AI is introduced.

1b. My own reflections via an interview: Participant: myself + colleague

I will reflect on my own teaching methods and challenges through an interview/brainstorming session, studying my content and instructional techniques. Understanding the importance of identifying individual student characteristics will help highlight the value of diverse lesson plans.

Q2: How do students and teachers perceive the role of AI in enhancing their learning experiences?

2a. Creating a questionnaire for students: Participants: 29 (Grade 9–12)

For quantitative data, students will be given a questionnaire with closed and open-ended questions on the current methodology of teaching and their expectation for the introduction of AI in lesson planning.

2b. Creating a questionnaire for teachers: Participants: 14 (13 teachers)

Closed and open-ended questions to assess current methods and expectations for Generative AI for students. Quantitative and qualitative data on teachers' perceptions of AI's role in education.

Q3: What are teachers' initial experiences with AI in education?

3a. Reflections with colleagues using a focus group: Participants: (eight teachers)

A discussion will be held with the educators to analyse their observations and experiences, and an understanding of the advantages and challenges of each approach. This qualitative data collection is a good comparison for research.

Data analysis for the exploration stage

Key findings from exploration

Initially teacher shadowing revealed a significant gap in understanding of varied learning styles among educators. Surprisingly, 75 per cent of teachers lack formal training in this area, often confusing it with general differentiation strategies. While 40 per cent feel somewhat confident in adapting lessons, large class sizes and time constraints make personalisation a daunting task.

Teachers often resort to improvisation, with 60 per cent relying on on-the-spot adjustments instead of well-planned differentiation. Outdated resources are another hurdle, with 70 per cent of current materials falling short of modern needs. Unsurprisingly, 75 per cent of educators find balancing time and resources an ongoing challenge.

AI is emerging as a potential game-changer. All surveyed teachers recognised its value in addressing diverse learning needs, and 85 per cent are eager to use it for streamlining lesson planning. However, half of them feel that current AI tools lack subject-specific depth and are not always user-friendly.

Students are optimistic about AI's ability to enhance learning experiences, with 65 per cent excited about interactive lessons. Yet, concerns linger – 40 per cent worry about AI's fairness in grading and reduced teacher involvement.

Both teachers and students stress that AI should complement, not replace, human connection in the classroom. Leveraging technology for professional training, updated resources and ethical safeguards are vital to make this integration meaningful and impactful.



Action Research

Action plan

A comprehensive four-week professional development programme with a customised cohort for educators in collaboration with LUMSx: **AI in the classroom: strategies and tools for educators.**

Participants: 25 teachers from K-12 various subjects.

Duration: 10 Jan–6 Feb – four weeks (three live sessions, three or four hours per session, four to five videos, three to five articles per module).

Programme

Week 1: Varied learners training and demystifying Generative AI

- Understanding various learning styles and their relevance to lesson personalisation
- Introduction to Generative AI and its potential in education
- Hands-on activity: Exploring AI tools for generating learning materials

Week 2: Using Generative AI and prompt engineering to empower educators

- Practical applications of AI in lesson planning for varied learners
- Developing skills in prompt engineering for personalised content creation
- Collaborative activity: Creating sample AI-generated lesson plans

Week 3: Ethics in AI

- Addressing concerns about AI's impact on teacher–student relationships
- Data privacy, ethical considerations and responsible AI usage
- Developing guidelines to ensure AI complements human teaching
- Case studies: Ethical dilemmas in AI usage and teacher discussions

Week 4: The future of Generative AI in education

- Innovations in AI and their potential applications in education
- Integrating AI seamlessly with traditional teaching methods
- Final project: Designing an AI-supported lesson plan for diverse learners

This programme balances foundational knowledge, practical skills and ethical considerations, equipping teachers to confidently use Generative AI to support varied learners. Along with this, collaborative reflection sessions enhance peer learning and engagement. Weekly discussions can focus on sharing insights, challenges and applications, while a midpoint feedback loop allows participants to review progress and refine their work. Mentorship panels with experts can provide additional guidance, and a post-course online community can sustain collaboration by sharing lesson plans and updates.

Action plan evaluation tools

The impact of the action plan will be evaluated by assessing teachers' understanding of diverse learning styles and Generative AI, their ability to create customised lesson plans using AI tools, and their confidence and ethical awareness in applying AI in classrooms. It will also track the integration of AI-supported strategies in lesson generation and determine changes in student engagement and learning outcomes.

1. How do I perceive the impact of AI-supported lesson plans on fostering inclusivity and adaptability in diverse classrooms?

- **Reflective journal**

Purpose: Capture personal insights and challenges while designing and implementing AI-supported lesson plans.

Before implementation:

2a. What are the expectations and concerns of teachers regarding generative AI as a tool for adaptive lesson planning?

- **Teacher questionnaire (25 teachers)**

Purpose: Assess teachers' baseline understanding of AI tools and their expectations. Gather insights into teachers' initial expectations and concerns about using AI for lesson planning.

Format: Combination of Likert scale and open-ended questions.

During implementation:

2b. How do teachers evaluate the effectiveness of AI-supported lesson plans in addressing diverse learning preferences?

- **Session feedback forms (25 teachers)**

Purpose: Evaluate teachers' experiences during each session of the professional development programme.

Format: Gather immediate feedback after each workshop session using Google Forms, incorporating short forms with rating scales and open-ended questions.

3. How did teachers apply the training to designing adaptive lessons, and what challenges or successes emerged during implementation?

- **Lesson plan analysis (pre- and post-implementation) (25 teachers)**

Purpose: Analyse existing lesson plans (pre-AI) across subjects for varied learners to establish a baseline and compare with AI-enhanced plans later made during training. Assess how teachers applied training to their classroom practices and the effectiveness of AI-enhanced lesson plans.

Metrics: Alignment with learner needs, effective AI usage and curriculum integration.

Evaluation tool after the cohort workshop

- **Focus group discussions (eight to ten teachers)**

Purpose: Collect qualitative insights into teachers' application of AI-supported lesson plans. Facilitate discussions to explore participants' experiences, successes and challenges post-programme, as well as gather feedback on AI applications and learning needs.

Metrics: Practical AI application, understanding of concepts and personal reflections.

Format: Semi-structured discussions led by a facilitator.



Data analysis and conclusions

Action plan implementation

The implementation of my action plan began with a collaboration with LUMSx, a prestigious university in our country. They designed a four-week training cohort to equip teachers across multiple subjects and grade levels (K-12) with AI-integrated teaching strategies. This programme included educators from both our institution and underprivileged schools.

Coordinating teachers from five different schools, each with their ongoing commitments, posed a challenge. However, the effort proved worthwhile as 100 per cent of the participants successfully completed the course, which incorporated videos, articles, live sessions and quizzes.

A surprising revelation was that many educators initially believed they had a solid grasp of AI tools. However, as the course progressed, they discovered new techniques, particularly in prompt engineering, and learned how to leverage AI tools tailored to their subjects and grade levels, many of which were free. This realisation assured them that budget constraints would not hinder the development of individualised lesson plans.

The biggest challenge was ensuring educators could effectively practise prompt engineering to generate the desired outcomes for different learning needs. The LUMSx trainers played a crucial role in guiding teachers through this process while considering cultural and ethical factors relevant to classrooms at Aitchison College.

Another challenge was bringing all teachers together to compare their pre-cohort lesson plans with those developed post-training. Educators shared insights, showcased AI-integrated lessons, and presented their experiences in using various tools to personalise instruction.

While all teachers gained valuable insights, implementing AI-generated lessons came with challenges. Despite this, it was encouraging to hear success stories. For instance, a biology teacher analysed students' previous test results and used AI tools to customise instruction. After applying these strategies, students – particularly lower achievers – demonstrated significant improvement in their test scores.

Key findings

AI significantly enhances lesson planning for personalised teaching by offering structure, creativity and time-saving benefits. However, its implementation comes with challenges, such as the overwhelming number of AI-generated options and concerns over confidentiality. While AI improves differentiation and multimodal engagement, teachers remain the primary decision makers in determining the best strategies for their students. The structured professional training at LUMSx has been instrumental in equipping educators with AI knowledge. Moving forward, AI should serve as a complementary tool, promoting student-centred learning and critical thinking rather than replacing traditional pedagogical methods. Over-reliance could limit creativity and individualised instruction.

The data reflects strong teacher interest in AI integration, with 88 per cent expecting improved lesson planning and 85 per cent recognising AI's potential for diverse learning needs. However, 63 per cent report only moderate AI proficiency, indicating a training gap.

Challenges include 29 per cent citing time constraints as a major barrier to adapting lessons. Despite 75 per cent seeing AI as valuable for differentiation, inconsistent technology use (71 per cent) suggests room for improvement. To ensure effective AI adoption, teachers request hands-on training, AI lesson examples and mentoring.

Teachers responded positively to AI-driven lesson planning, valuing its clarity with 91 per cent and relevance with 82 per cent. AI resources were seen as useful with 87 per cent, supporting differentiation and engagement. While practical application remains an area for growth, these findings highlight AI's potential to enhance teaching, reinforcing the need for structured training and integration.

The findings highlight AI's potential to enhance lesson adaptability and engagement, particularly in catering to diverse learning styles. However, practical implementation challenges remain, with teachers citing over-reliance on AI (67 per cent) and unrealistic time allocations (43 per cent). While 85 per cent found AI useful for differentiated activities, 50 per cent felt tools needed refinement for subject-specific content. Ethical concerns, including AI hallucinations (40 per cent), underscore the need for human oversight. Despite 92 per cent acknowledging AI's benefits, only 63 per cent felt confident using it independently, emphasising the need for structured training in prompt engineering and lesson customisation to maximise AI's effectiveness in classrooms.

Conclusions

AI has proven to be a game-changer in lesson planning, helping teachers save time, enhance differentiation and engage students in more dynamic, multimodal learning experiences. The research highlights AI's transformative role in being adaptive and student-centred. Teachers leveraged AI to design lessons that not only impart concepts but also encourage critical thinking and enquiry. Activities were structured to prompt student reflection, fostering deeper understanding rather than passive learning.

Additionally, AI supports assessment for learning (AfL) by enabling teachers to track student progress, identify learning gaps and provide immediate feedback, ensuring lessons are continuously refined to meet student needs.

AI also plays a key role in ongoing assessment, helping teachers track student progress, identify learning gaps and adjust instruction accordingly. By providing timely feedback, AI enables a more responsive and personalised learning experience, aligning with the principles of AfL.

While 92 per cent of teachers recognise AI's benefits, targeted, subject-specific training is essential to boost confidence and ensure the effective integration of AI. By using AI as a collaborative tool, educators can cultivate curiosity, creativity and personalised learning, ensuring that lessons inspire students to think, question and engage meaningfully with content.



Future actions

This action research will shape a more inclusive, AI-driven approach to lesson planning at Aitchison, ensuring diverse learning preferences are met. AI-powered adaptive strategies will enable teachers to personalise instruction while maintaining pedagogical integrity. Insights are being shared through mentorship programmes, resource hubs and professional networks, fostering collaboration to facilitate continuous resource-sharing and peer support.

Cultural diversity is another key consideration while teaching at Aitchison College, with lessons tailored to reflect students' backgrounds for better engagement. Teachers are refining their AI skills through prompt engineering, integrating AI tools into diverse classrooms. These strategies will inform the school's development cycle, embedding AI-enhanced methodologies into curriculum planning, teacher training and policymaking.

Ultimately, this scalable model will contribute to global education systems, offering innovative, student-centred learning solutions that support sustainable and inclusive teaching practices worldwide.

'Educators are often overworked and many school systems are severely under-resourced.'

You Jeen Ha, Sue Hendrickson, Adam Nagy, Elisabeth Sylvan, Tom Zick – Exploring the impacts of generative AI on the future of teaching and learning

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