

AI in the Classroom

*Adaptive technology delivering tailored
instructions by integrating real-time insights
into personalized learning pathways*

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Mayte Cubino

Emily McKeon



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Dedicated to

My rapidly growing and always inspiring family.

– Ross Smith

My family, my anchor, and my everyday motivation.

– Mayte Cubino

Colin and Riley, with love

– Emily McKeon

Foreword

For the past thirty-six years, I have devoted my life to public education, leading innovative STEM programs and seeking new ways to ignite creativity and innovation in students. My journey has taken me from running one of the world's premier STEM labs to working internationally with schools and government bodies to integrate artificial intelligence responsibly. In 2016, I was honored to be named one of the Top 10 Teachers in the World. The opportunities that came from that honor affirmed a lifelong mission: preparing students with the skills, resilience, and vision they will need to thrive in an uncertain future. Today, I continue this pursuit as I complete research for my doctorate, focusing on the synthetic relationships that develop between children and intelligent tutoring systems and social robots, which is an area that highlights both the promise and complexity of AI in education.

This book arrives at a pivotal moment. Education is increasingly shaped by technology, from digital learning platforms to remote instruction. Artificial intelligence now offers personalized learning, streamlined tasks, and deeper student engagement. Yet, alongside this potential, we must consider risks. For example, young children may form unhealthy attachments to social robots or intelligent systems, confusing programmed interactions with genuine relationships. As AI becomes more common in classrooms, these developmental and ethical concerns must stand alongside issues of security, privacy, and equity. This book addresses these challenges directly, offering both practical insights and a responsible framework for implementation.

Across its eleven chapters, the book explores the history of technology in the classroom, the rise of personalized learning, and the growing role of AI in assessment, feedback, and professional development. It presents case studies of successful AI use, strategies for supporting diverse learning needs, and thoughtful discussions on parental concerns and ethical considerations. The later chapters look ahead, examining how students can prepare for an AI-driven workforce and how educators can build their own AI fluency. Together, these themes provide a comprehensive roadmap for schools seeking to embrace AI while safeguarding trust and human connection.

Reading this book, I was struck by its balance of inspiration and practicality. It speaks to educators, technologists, and parents alike, offering vision while grounding its insights in real-world examples. Most importantly, it reinforces what I have witnessed throughout my career: when thoughtfully applied, technology has the power to unleash creativity, resilience, and potential within every student. For those seeking to understand how AI can responsibly shape the future of education, this book is both timely and essential.

Joseph Fatheree | Innovation specialist

Top 10 Finalist 2016 Global Teacher Prize

NEA National Award for Teaching Excellence 2009

Illinois State Teacher of the Year 2007

About the Authors

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- **Emily McKeon :** To my family and especially my husband Kevin, and our boys, Colin and Riley, who sparked the passion to embark on this transformative journey of research and learning into AI in the Classroom!

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We want to express our deepest gratitude to our family and friends for their unwavering support and encouragement throughout this book's writing. This is our second authoring adventure in the past few years, and this passion has taken away many weekends and evenings from our social activities, toiling in the research and development of what we hope is a useful text for many.

We are also grateful to BPB Publications for their guidance and expertise in bringing this book to fruition. Their patience, coordination and belief in our vision, along with the collaboration of reviewers, technical experts, and editors, is what makes this book come to life.

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For all the people who have shaped our thinking about life and specifically around AI in the Classroom! Including: Joe Fatheree, Holly Kelly, Xin Deng, Iro Stefopoulou, Wendy Norman, Koen Timmers, Ivy Zhang, Paul Watkins, Dyane Smokorowski, Phaedra Boinodiris, Yu Kai Chou, Daniel Englebretson, Ishita Pai Raikar, Heidi Spiess, Lizbeth Goodman, Anthony Ventresque, Julian Birkenshaw, Gary Hamel, Christine Delos Reyes and Melanie Jackson. Ross's late close friends who shaped his thinking - Mihaly Csikszentmihaly and Warren Miller.

Finally, we would like to thank all the readers who have taken an interest in our book and for their support in making it a reality. Your encouragement has been invaluable!

Preface

Education is increasingly shaped by technology, from digital learning platforms to remote education systems. As **artificial intelligence (AI)** becomes more embedded in our daily lives, its role in education continues to grow. AI tools offer personalized instruction, streamlined administrative tasks, and enhanced student engagement, creating a learning environment tailored to individual needs. As AI becomes more integrated into the classroom, it is crucial to implement these tools with responsible AI practices, ensuring that security, privacy, and ethical considerations are prioritized. This book explores how AI can become an integral part of the classroom, helping students and instructors succeed in an AI-driven future, while safeguarding trust and compliance every step of the way.

Chapter 1: AI and Personalized Learning – Explores how different learning methods have evolved over time and the role AI plays in today’s more personalized learning approach to education.

Chapter 2: History of Technology in the Classroom – Covers the history of technology in the classroom from clay tablets to the use of television and explores how advances in technology as teaching tools have led to improvements in how we educate and acquire knowledge.

Chapter 3: AI-driven Assessment and Feedback Tools – Shares the impact AI has on both student and teacher assessment practices, along with the challenges faced with implementation.

Chapter 4: Successful AI Implementations – Looks at multiple case studies and best practices in how to successfully implement AI in the classroom.

Chapter 5: Addressing Parental Concerns – Discusses what teachers should consider when supporting their students through their AI journey, including: privacy, security, screen time, AI tools access and the need for ongoing collaboration with parents and guardians.

Chapter 6: AI for Diverse Learning Needs – shares the benefits and challenges of AI inclusion for students with diverse learning needs, exploring early AI intervention techniques and curriculum personalization.

Chapter 7: Preparing for an AI-driven Workforce – Shows students how to prepare for their future in an AI-driven workforce, from understanding the basics of AI to applying this knowledge for success, bringing the classroom and real world together.

Chapter 8: AI-enhanced Professional Development for Educators – Dives into how educators can enhance their AI skills, learn best practices and become instructors of the future.

Chapter 9: AI in Supporting Social-emotional Learning – Discusses how AI can support students’ social-emotional learning in new and interesting ways through classroom strategies and implementation techniques.

Chapter 10: Data Security and Ethical Considerations in AI – Explores the core themes of security, fairness, transparency, accountability, inclusiveness, and privacy.

Chapter 11: Future of AI in the Classroom – Discusses what the future holds for AI in the classroom and how human and AI solutions come together to offer students a comprehensive roadmap to academic and social-emotional growth.

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CHAPTER 1

AI and Personalized Learning

I am always ready to learn although I do not always like being taught.

-Winston Churchill

Introduction

For centuries, educators have faced the challenge of crafting truly personalized lesson plans. Understanding each student's strengths, growth areas, and unique interests requires not just teaching expertise but a deep commitment to individualized learning. Given the diversity of student needs, creating tailored learning experiences has long seemed like an unattainable dream. Too many students and too few educators. Instead, most lesson plans today focus on aligning with standardized curricula, often overlooking the opportunity to meet students exactly where they are and spark genuine curiosity.

Enter **artificial intelligence (AI)**, the game-changer in today's education. AI does not just make personalized learning possible; it makes it practical, scalable, and achievable. With AI-powered insights and assistance, educators can now adapt lessons in real-time, responding to each student's learning style, pace, and engagement. Imagine a system that identifies when a student struggles with a certain concept and instantly suggests alternative explanations, interactive exercises, or even real-world applications tailored to their interests. AI-driven tutoring and self-help do not just provide answers; they cultivate curiosity, guiding students toward mastery in a way that feels natural and exciting.

With AI in the classroom, education is shifting from a one-size-fits-all model to a dynamic, student-centered experience. Every learner moves at their ideal pace, building confidence, deep understanding, and learning progress like never before. The impact extends far beyond the classroom, instilling a lifelong love of learning and equipping students with the skills they need to thrive in an ever-evolving world. The future of education is not just digital; it is intelligent, adaptive, and inspiring.

Structure

This chapter covers the following topics:

- Evolution of education and learning methods
- Personalized learning and AI
- Plato's vision of education
- Balance of individuality and collective good
- Developing a complete child through AI

Objectives

By the end of this chapter, you will have a thorough understanding of how different learning methods have evolved over time and the role AI plays in today's more personalized learning approach to education. You will learn how adaptive learning systems and technologies influence personalized learning and understand how these systems benefit teachers and students, along with introducing some challenges. We will wrap up with sharing a unique view of ancient philosophies on education and how they are juxtaposed with AI and personalized learning practices. For the ideal reader, whether a forward-thinking teacher, an engaged parent or guardian, or a passionate advocate for educational innovation, this chapter provides both inspiration and practical guidance. By embracing adaptive technologies responsibly, we can create classrooms where every student has a unique opportunity to reach their full potential.

Evolution of education and learning methods

For centuries, education has largely followed a more traditional, one-size-fits-all approach. This model goes back to early humans learning from elders. There was no specialization; everything was about survival. In *Ancient Greece* and *Rome*, the wealthy were all educated similarly. It was very different for women and slaves, who were only educated in the basics. Today's modern education was shaped by the industrial revolution, designed to produce a standardized workforce, with students progressing through rigid curricula based on age and grade levels rather than individual ability or interest. However, as societies evolved and technology advanced over the last few decades, the limitations of this method have become increasingly evident, paving the way for a shift toward personalized learning. The concept is

built on the idea that education should adapt to the learner, rather than expecting the learner to adapt to a predefined curriculum.

For generations, the conventional education system has operated like a well-oiled machine; it has been structured, standardized, and uniform. Students' progress through the curriculum at the same pace, absorbing identical lessons, regardless of their unique strengths, interests, or learning styles. Teachers, so often constrained by rigid schedules and standardized tests, deliver their best lessons in a lecture-based format, while assessments prioritize memorization over understanding.

While this model has provided foundational education for millions over the years, it comes with undeniable flaws. Some students struggle to keep up, feeling overwhelmed and discouraged. Other students find the material too easy and quickly lose interest. The result? Frustration, disengagement, and, in many cases, an increased risk of dropping out. Meanwhile, educators are stretched thin, trying to support diverse learning needs without the flexibility or resources to do so effectively.

However, in 2025, education is evolving. We are seeing the entrance of AI-based personalized learning, a transformative approach that recognizes students do not all learn the same way or at the same speed. Instead of forcing everyone into a one-size-fits-all system, personalized learning adapts the curriculum to individual needs, abilities, and interests. Imagine a classroom where each student receives instruction tailored to their strengths, where learning feels more like an adventure than a chore.

Beyond customization, AI can revolutionize the way students receive feedback. No longer do students need to wait for test results or progress reports as AI offers immediate, data-driven insights, highlighting areas for improvement and celebrating successes in the moment. It can recommend supplementary resources, track progress and tendencies over time, and help teachers refine their strategies to support every learner effectively.

What is driving this shift is technology. With AI-powered tutoring, adaptive learning software, and real-time data analytics, educators can now track student progress with unprecedented accuracy. Gamified lessons make learning more interactive and engaging, while digital platforms adjust content dynamically, ensuring students grasp concepts before moving forward.

With the wide availability of new generative AI and language models, such as ChatGPT, Claude, and Gemini, new possibilities in learning are now available to society at large. These **large language models (LLMs)** open up a world of generative technologies that have the ability to create new and valuable outputs with little to no input. These outputs include text, video, art, and music. While these LLM developments assist in the creation of a large range of natural language tasks such as translation, question answering, and summarization, there are challenges that we will explore throughout this book related to security, privacy, and bias.

Personalized learning is not just an educational trend; it is an AI revolution. By meeting students where they are and empowering them to take ownership of their education, AI is

redefining what is possible in the classroom. The question is: Are we ready to embrace the future of learning?

Real-time insights for tailored instruction

Personalized learning has long been a cornerstone of effective education and an aspirational goal for educators. The historical dream of tailoring learning to the unique needs, preferences, and pace of each student has often been out of reach due to logistical challenges. However, with the integration of AI into education, this vision is finally becoming a reality. AI opens the door to a new era of individualized learning, overcoming longstanding barriers and reshaping how we think about education, as celebrated in the following figure:

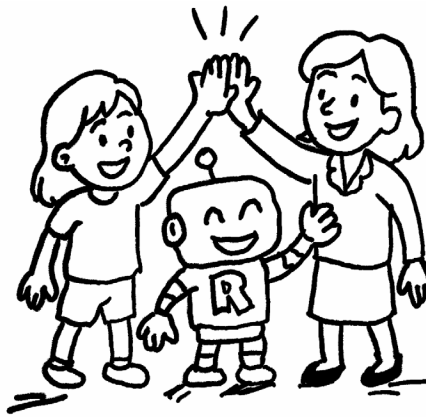


Figure 1.1: Personalized learning: Teacher, student, and AI working together

Historically, education systems have struggled to balance individuality with the scalability and standardized goals of curricula. During the *Industrial Revolution*, education mirrored the factory system, focusing on efficiency and uniformity to prepare students the same way the system prepared workers for a growing industrial economy. Classrooms were structured to manage large groups of students, with standardized instruction designed to ensure consistent delivery and predictable outputs. While this model expanded access to education, it came at a significant cost. The rigidity of the system often stifled creativity and failed to address diverse learning styles, paces, and the interests of individual students.

Teachers have always recognized the value of personalized learning, but have always been constrained by time, resources, and the sheer size of their classrooms. Addressing the unique needs of each student required more time and attention than most teachers had the capacity to realistically provide. Additionally, traditional tools for assessing progress, such as standardized tests, offered limited insight into a student's understanding, leaving educators with an incomplete picture of individual needs.

During the global COVID-19 pandemic, students and educators were challenged to shift their status quo. Many educational institutions quickly pivoted from in-person instruction to online

only. Students were given, or required to purchase, computer devices, and leverage meeting software such as Zoom or Microsoft Teams in order to connect with instructors and other students in a virtual classroom setting. Teachers were challenged to adapt to new instruction styles and pay attention to students in virtual settings, and students were challenged to sit through hours of virtual instruction without much personal interaction with others. These challenges were a catalyst for the creation of additional AI-powered solutions, allowing both educators and students to learn and thrive in new ways. While most teachers and students are back in an in-person classroom setting, the learning, adaptation, and adoption of AI solutions continue to excel. Even if the use of technology for in-class instruction is less than during the pandemic, teachers are now more apt to include the use of educational technologies in their curriculum.¹

Today, AI is revolutionizing this dynamic by introducing adaptive technologies that can easily customize learning experiences in real time. AI-powered platforms analyze vast amounts of data that provide insights into how students engage with material, providing detailed insights into their strengths, weaknesses, and preferences. These systems use this information to adjust content delivery, student pacing, and teaching methods that suit the individual, helping to ensure that learning is truly tailored to the individual at each stage in their development. For example, AI-based adaptive learning systems can help refine lesson plans on the fly, allowing students who excel in a subject to advance quickly while ensuring those who struggle receive targeted support.

Real-time insights generated by AI systems can further enhance the learning experience. Intelligent tutors, for instance, monitor a student's progress and offer immediate feedback or supplemental resources, much like a dedicated personal tutor. This ensures that students remain engaged and supported, fostering an environment where curiosity and mastery can flourish. Ironically, AI can also support the human experience that students are familiar with. These AI tools also help teachers identify patterns that might otherwise go unnoticed, such as a student consistently struggling with a specific concept, enabling timely intervention.

AI also addresses significant historical challenges in education, particularly in terms of accessibility and inclusivity. Traditional classrooms often struggle to accommodate students with disabilities or language barriers, leaving these learners at a disadvantage. AI-powered tools like speech-to-text systems, language translation applications, computer vision, and customizable content delivery ensure that all students can participate fully in the learning process. Additionally, remote learning platforms powered by AI can help to extend educational opportunities to underserved and geographically isolated communities, breaking down barriers that once seemed insurmountable.

Another area where AI is making notable progress is in enhancing the role of teachers. While technology provides tailored instruction, it can also free educators from repetitive tasks, such as grading and basic content delivery. This allows teachers to focus their time on higher-order

1 Pozo, J., Cabellos, B., & Del Puy Pérez Echeverría, M. (2024). Has the educational use of digital technologies changed after the pandemic? A longitudinal study. *PLoS ONE*, 19(12), e0311695. <https://doi.org/10.1371/journal.pone.0311695>

tasks like mentoring, fostering critical thinking, and nurturing creativity. Far from replacing teachers, AI will serve as a powerful ally in the future, amplifying their ability to connect with and support students.

The integration of AI into education also helps align personalized learning with broader curriculum goals. By helping to harmonize individual learning paths with established milestones, AI can ensure that students meet critical objectives while still pursuing their unique interests and strengths. A study conducted by the *International Journal of Innovative Science and Research Technology* explores how multimodal AI, the integration of different forms of AI such as audio, video, and language, influences learning. By using different AI modalities during instruction, the AI systems have the ability to personalize and provide more accurate feedback to students.² This is crucial for preparing students to thrive in a complex and interconnected world.

Despite all of its promises, the use of AI in education is not without challenges. Ethical considerations, such as model transparency, data privacy and algorithmic bias, must be carefully managed to ensure equitable outcomes. Moreover, the human element of education, empathy, understanding, and the cultivation of social skills, must remain central in a world of AI. It cannot replace the role of a teacher in inspiring, motivating, and guiding students, but it can augment these efforts in meaningful ways.

Squirrel AI, a case study on personalized learning

*Squirrel AI*³, an AI-powered education company based in China, offers an exemplary case study of how AI can enhance personalized learning. Squirrel AI's platform uses AI to assess students' current knowledge level, identify learning gaps, and continuously adjust content to address those gaps. The system applies machine learning algorithms to analyze student behavior and provides individualized recommendations and lessons, ensuring that each student is always challenged at the appropriate level.

In the study, *Performance comparison of an AI-based Adaptive Learning System in China*⁴, the authors evaluate the effectiveness of Squirrel AI compared to traditional classroom instruction and another adaptive learning platform, BOXFiSH⁵. The results show that students using the

Squirrel AI system performed better in both English and math learning than those receiving traditional instruction from expert human teachers or those using BOXFiSH. This suggests that AI-powered adaptive learning systems can enhance student performance by providing personalized, real-time feedback and adapting to individual learning needs.

2 Arjunan, G. (2024). AI Beyond Text: Integrating vision, audio, and language for multimodal learning. In *International Journal of Innovative Science and Research Technology* (Vol. 9, Issue 11, pp. 1911–1912) [Journal-article]. <https://ijisrt.com/assets/upload/files/IJISRT24NOV1542.pdf>

3 Home - Squirrel AI. (2025, February 11). Squirrel AI. <https://squirrelai.com/>

4 Cui, W., Xue, Z., & Thai, K. (2019, January 29). Performance comparison of an AI-based Adaptive Learning System in China. *arXiv.org*. https://arxiv.org/abs/1901.10268?utm_source=chatgpt.com

5 Teaching Method - BOXFiSH. (n.d.). <https://www.boxfish.cn/en/guide.html>

In 2020, *Squirrel AI Learning* by Yixue Group received the prestigious *UNESCO AI Innovation Award* for its groundbreaking work in adaptive learning technology. This award, under the theme *Artificial Intelligence and Inclusion*, affirmed Squirrel AI Learning's role as a leader in promoting personalized high-quality learning with AI recognition of learning patterns and its contribution towards the direction of more inclusion and equity in education.

Squirrel AI continues to make strides in adaptive learning by using vast amounts of learning behavior data to fine-tune their first all-subject **Large Adaptive Model (LAM)**, resulting in their ability to correctly represent students' learning profiles and provide customized learning solutions.⁶ They have since expanded beyond *China* to the global market, with the founder, *Derek Li*, seen as one of the world's premier AI education thought leaders.⁷ While benefits abound in AI platforms that are able to deliver personalized learning, challenges are also apparent. Chief among the challenges is maintaining personal data privacy and security. With the vast amounts of data needed to train the model, it has become apparent that keeping the private data of students safe and secure is paramount to the success of the platform.

In the age of AI, personalized learning is no longer a distant ideal but a real-life, evolving practice that redefines what is possible in education. It transforms classrooms into dynamic, student-centered environments where every learner can unlock their potential in new and unique ways. By addressing historical challenges and leveraging cutting-edge technologies, AI can help foster and usher in a generation better equipped to navigate the complexities of the modern world. The future of education is here, and it is as individualized as the students it serves.

Personalized learning and AI

Today, instructors are often stretched thin, trying to address individual needs while managing large groups of students. This is a prime situation where adaptive technologies, powered by AI, have emerged as transformative tools for supporting personalized learning. The diverse needs of each student necessitate a unique learning plan that draws on their strengths and bolsters opportunities for excelling in any setting. With the power of AI, teachers now have the ability to better meet the needs of each individual student while ensuring larger classroom sizes can easily move forward with skill development together. The following figure showcases AI instruction:

6 Squirrel Ai Learning. (2024, March 12). Squirrel Ai Speaks at Harvard + MIT Joint Symposium on the Future of AI-based Adaptive Learning. PR Newswire. <https://www.prnewswire.com/news-releases/squirrel-ai-speaks-at-harvard-mit-joint-symposium-on-the-future-of-ai-based-adaptive-learning-302086461.html>

7 Flannery, R. (2025, February 18). Derek Li and Squirrel Ai aim to lead the future of AI-Driven education. Forbes. <https://www.forbes.com/sites/forbeschina/2025/02/18/derek-li-and-squirrel-ai-aim-to-lead-the-future-of-ai-driven-education/>

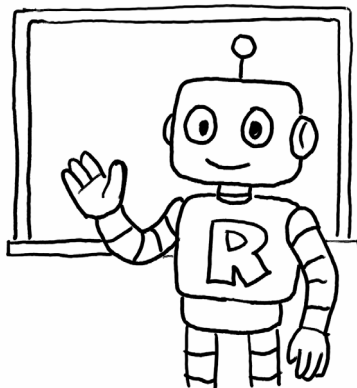


Figure 1.2: AI can help teach every student

Adaptive learning systems and AI-driven platforms

Adaptive learning systems leverage AI to create a personalized learning environment that adjusts in real time to a student's performance. These platforms are designed to deliver content that matches the learner's current ability level, continually challenging them without overwhelming them. As a student works through exercises, the AI platform analyzes responses and tailors subsequent questions to better align with their skill level. DreamBox Math⁸ (K-8), for example, is an AI-powered platform that adapts math lessons for students based on their individual responses, providing real-time adjustments in difficulty and learning pace. Think of adaptive technologies as AI tools that help students accomplish their learning goals in the way that is best for them as an individual.

Examples of adaptive technologies include:

- **Tailored content delivery:** As a student learns, the content platform adapts to the learner's progress by delivering customized lessons, quizzes and activities. It helps the student keep pace with the educational objectives while challenging them and assisting with areas where they may need additional assistance.
- **Real-time feedback:** As students learn, real-time feedback provides immediate insights. For example, when a student answers a question incorrectly, they are notified immediately and provided with additional context and similar problems to help reinforce the learning and concepts being taught.
- **Dynamic learning paths:** Customized and personalized learning designed to guide students on a path toward subject mastery. This AI-driven system helps to identify gaps in a student's knowledge and provides the flexibility to learn with a non-rigid educational plan.

⁸ DreamBox by Discovery Education. (2025, January 8). Online math & reading programs for students | DreamBox by Discovery Education. <https://www.dreambox.com/>

Recent advances in adaptive learning are made possible by the ability of AI to enhance personalization through the integration of LLMs into the learning platforms, making interactive tutors, multimodal capabilities, real-time adaptation, and collaborative learning a reality. The natural interaction these LLMs, such as with ChatGPT, can enable through conversational dialogue with students allows for greater engagement and effective learning experiences.

Elementary and secondary education

Adaptive learning platforms such as *Khan Academy*⁹, *DreamBox*¹⁰ and *Smart Sparrow*¹¹ provide differentiated instruction at the elementary and secondary level, revolutionizing how students interact with core subjects like math, reading, and science. They provide the right level of instruction and challenge based on where the student is in their knowledge journey. By meeting students where they are, the tools help prevent both frustration and boredom and ensure progress through a fun and engaging experience.

Higher education

Personalized learning platforms like **Assessment and Learning in Knowledge Spaces (ALEKS)**¹² are increasingly being used in higher education settings. The individualized problems, constructive feedback, and practice allow students to learn at their own pace while instructors can track both individual and group progress through detailed dashboards. This ensures that the educator can best monitor the progress of the full class and ensure the overall pace progresses, giving students specialized instruction to deepen their understanding.

Additional tools such as ChatGPT¹³ and Claude AI¹⁴ are being adopted and integrated into higher education classrooms to assist with:

- Personalized tutoring (interactive learning, adaptive feedback and 24/7 availability on demand).
- Research assistance (summary generation and providing insights).
- Writing assistance (content generation, error detection, grammar and style support, and plagiarism detection).

The integration of adaptive learning systems in higher education is not without challenges. Ethical concerns, including data privacy, accessibility, bias in AI models and the autonomy of

9 Khan Academy. (n.d.). <https://www.khanacademy.org/>

10 DreamBox by Discovery Education. (2025b, February 12). Online math & reading programs for students | DreamBox by Discovery Education. <https://www.dreambox.com/>

11 Smart Sparrow. (n.d.). Smart Sparrow. <https://www.smartsparrow.com/>

12 ALEKS | Learning Solutions | McGraw Hill Higher Education. (n.d.). <https://www.mheducation.com/highered/aleks.html>

13 Naznin, K., Mahmud, A. A., Nguyen, M., & Chua, C. (2025). ChatGPT Integration in Higher Education for Personalized Learning, academic writing, and coding Tasks: A Systematic review. *Computers*, 14(2), 53. <https://doi.org/10.3390/computers14020053>

14 Praxis AI pioneers AI-driven education with Claude in Amazon Bedrock. (n.d.). Anthropic. Retrieved March 30, 2025, from <https://www.anthropic.com/customers/praxis>

teachers and students, is discussed in detail in *Chapter 10, Data Security and Ethical Considerations in AI*. Academic integrity, another concern with the adoption of AI in education, is core to maintaining quality learning free from bias, trust and a strong reputation. Educational institutions are learning and adapting established practices and policies to best protect their academic integrity with the inclusion of AI tools. Updated standards around plagiarism are a prime example of how academic institutions are working to protect their reputation and integrity.¹⁵

Special education

Adaptive technologies such as text-to-speech and speech-to-text features, visual aids, **augmented reality (AR)**, **virtual reality (VR)** and gamified learning lessons assist students with learning disabilities, ensuring they can more easily keep pace with their traditional learner peers. Through the use of adaptive technologies, a student with dyslexia, for example, can use AI tools to improve reading fluency by receiving audio prompts and instant corrections, giving them more confidence in their learning abilities. Students with **attention deficit hyperactivity disorder (ADHD)** or autism can benefit from AR through behavioral interventions where real-time prompts and feedback are given, helping the student stay on task and better manage their behavior. Similarly, students on the autism spectrum could benefit from VR environments that generate real-life scenarios that create a safe space for these kids to practice their social interactions and develop their communication skills.¹⁶ This topic is covered in detail in *Chapter 6, AI for Diverse Learning Needs*.

Empowering educators

While modern adaptive technologies primarily focus on enhancing the student's personal experience, they also empower educators to make data-driven decisions on what and how the student experiences content. Here is how:

- **Insights into student performance:** AI platforms help generate detailed analytics, highlight trends, strengths, and areas of improvement for individual students, as well as entire classes, schools, districts, and states. Educators can use this data to design targeted interventions, such as forming small groups for peer collaboration or adjusting lesson plans to address widespread trends and challenges.
- **Time savings:** By automating routine tasks like grading and progress tracking, AI-based adaptive technologies can help free up educators to focus on fostering meaningful human connections with students and exploring creative teaching methods.

15 Ahmad, H., & Fauzi, M. A. (2024). Plagiarism in academic writing in Higher Education Institutions: A Bibliometric analysis. *International Journal on Social and Education Sciences*, 6(1), 64–84. <https://doi.org/10.46328/ijonses.623>

16 Manu, & Author_Name. (2025, March 18). Top 5 immersive technology trends for the upcoming 2025. YORD | XR & AI Creative Studio. <https://yordstudio.com/top-5-immersive-technology-trends-for-the-upcoming-2025-year/>

- **Professional development:** AI-based adaptive systems can also support teachers' growth by identifying areas where they might benefit from additional training or **professional development (PD)** resources, offering personalized PD pathways similar to those provided for students.

Overall, teachers have reported that the use of generative AI in the classroom is beneficial, especially for reducing time spent on administrative tasks, adaptive learning support, improving student engagement and helping to enhance a student's learning.¹⁷ In a study published in the *IAFOR Journal of Education: Technology in Education*, it was noted that instructors who perceive AI to be useful are more likely to use AI for educational purposes. This study also indicates that a supportive educational institution is key to the adoption of AI in the educational setting, helping to better train and support instructors.¹⁸

Fostering student autonomy

One of the most significant advantages of adaptive learning is its potential to cultivate self-directed learners. By providing students with immediate personal feedback and control over their learning paths, these tools encourage and empower students to take ownership of their education. This aligns closely with Montessori principles¹⁹ of fostering independence and respect for individual development.

For example, a high school student preparing for standardized tests might use an AI-driven platform to identify weak areas, set personal goals, and monitor their own progress. The system not only adapts to their pace but also builds their confidence by showing tangible improvement over time.

Challenges and considerations

While these AI-based adaptive technologies hold immense promise, they are not without challenges. Some of these challenges include:

- **Equity and access:** The digital divide remains a significant barrier to widespread adoption. Even in today's climate, students in under-resourced schools may lack access to the necessary devices or internet connectivity to benefit from these tools. Policymakers and educators must work to address these disparities to ensure all learners can access personalized resources.

17 Slagg, A. (2024, September 30). AI in Education in 2024: Educators Express Mixed Feelings on the Technology's Future. *Technology Solutions That Drive Education*. <https://edtechmagazine.com/k12/article/2024/09/ai-education-2024-educators-express-mixed-feelings-technologys-future-perfcon>

18 Bakhadirov, M., Alasgarova, R., & Rzayev, J. (2024). Factors influencing teachers' use of artificial intelligence for instructional purposes. In *IAFOR Journal of Education*, *IAFOR Journal of Education: Technology in Education* (Vol. 12, Issue 2). <https://files.eric.ed.gov/fulltext/EJ1440077.pdf>

19 Natalie. (2021, September 24). What is Montessori? 7 Principles of the Montessori Method. *Montessori Up!* <https://www.montessoriu.com/what-is-montessori/>

- **Algorithmic bias:** AI systems are only as good as the data they are trained on. If training data reflects biases, whether cultural, gender-based, socioeconomic, or otherwise, if deliberate efforts are not made, these adaptive technologies risk perpetuating those biases. Developers and educators must prioritize fairness, safety, security, and inclusivity in AI design.
- **Over-reliance on technology:** While AI can enhance learning, it should not replace the human touch that educators bring to the classroom. Teachers can play a crucial role in guiding students, fostering critical thinking, and addressing emotional and social needs, areas where technology cannot yet replicate human interaction.
- **Privacy concerns:** Adaptive technologies collect vast amounts of data on students, raising questions about how and where this information is stored, used, and protected. As a result, educational institutions need to be more diligent than ever. In March 2025, a widely used *Student Information System*, *PowerSchool*, experienced a global privacy breach that exposed millions of sensitive student and teacher records.²⁰ This breach remained undetected for nine days, giving the perpetrators the benefit of time to dig into children's sensitive information. Data breaches continue to raise questions about what needs to be done to secure our students' information. It likely is a multipronged approach where advocacy groups, government and schools must define and implement robust data security measures and communicate transparently with parents or guardians about privacy policies.

Many organizations and governments around the world are working to better regulate and provide guidance to help mitigate many of these challenges. One such framework, developed by UNESCO, called **Rights, Openness, Access and Multi-stakeholder Governance (ROAM)**, works to ensure AI in education addresses concerns such as ethical issues and human rights.²¹

Best practices for implementation

To maximize the benefits of AI-based adaptive technologies while addressing potential pitfalls, educators and administrators can consider the following strategies:

- **Blend AI-based learning with traditional methods:** Rather than relying solely on AI tools, combine them with teacher-led instruction to create a balanced and holistic learning environment.
- **Invest in professional development:** Provide teachers with AI training to effectively integrate adaptive technologies into their classrooms and interpret the data these tools generate.

20 Fioccola, D. (2025, March 27). The PowerSchool Breach: A Privacy Lesson on Third-Party Risk Exposure | Proskauer on Privacy. Proskauer on Privacy. <https://privacylaw.proskauer.com/2025/03/articles/data-breaches/the-powerschool-breach-a-privacy-lesson-on-third-party-risk-exposure/>

21 PDF.js viewer. (n.d.). https://unesdoc.unesco.org/in/documentViewer.xhtml?v=2.1.196&id=p::usmarc-def_0000376709&file=/in/rest/annotationSVC/DownloadWatermarkedAttachment/attach_import_761b-cdad-d1e3-40c9-819d-03c4ac725f26%3F_%3D376709eng.pdf&locale=en&multi=true&ark=/ark:/48223/pf0000376709/PDF/376709eng.pdf#AI%20in%20education_pages.indd%3A.14137%3A1018

- **Engage stakeholders:** Involve parents, students, business, and community members in discussions about AI adoption to build trust and ensure alignment with educational goals.
- **Monitor and evaluate:** Continuously assess the effectiveness of adaptive technologies, gather feedback from teachers and students to refine implementation strategies. Reinforcement learning is a key strategy here.

UNESCO produced guidelines for AI in education which included a human-centered approach to responsible AI implementation.²² These guidelines detail steps for not only governments to consider for the regulation of AI in educational settings, but also for the roles teachers play in helping students learn and understand the appropriate use of AI technologies in the classroom.

Future of AI-based adaptive technologies

As AI continues to evolve, personalized learning using AI will continue to evolve. Emerging trends include:

- **Emotion-sensing AI:** AI Tools that can adjust lessons based on students' emotional states, helping to promote engagement and reducing frustration.
- **Collaborative AI platforms:** Systems that help to facilitate peer learning by intelligently grouping students for collaborative projects.
- **Lifelong learning support:** AI-based adaptive technologies designed to support learners at all stages of life, from preschool to professional development.

These advancements promise to make education more inclusive, engaging, impactful, and effective, empowering students and educators to thrive in an AI-driven world. According to a Forbes article, AI will take the lead in developing personalized learning paths for students from identification of need to analysis to the deployment of content. This **decision intelligence**, whereby AI has the ability to analyze vast amounts of data and make informed recommendations, has the potential to assist both the instructors and students through an adaptable personalized learning plan.²³

AI-based adaptive technologies represent a paradigm shift in education, offering personalized learning experiences that empower students and support educators. By tailoring content, pacing, and feedback to individual needs, AI-driven tools make learning more accessible and engaging for a broad set of diverse learners. Their successful implementation requires careful consideration of equity, ethics, and teacher engagement.

22 Guidance for generative AI in education and research. (2024, June 19). UNESCO. Retrieved March 31, 2025, from <https://www.unesco.org/en/articles/guidance-generative-ai-education-and-research>

23 Ravaglia, R. (2024, December 28). AI in education innovators identify directions expected in 2025. Forbes. <https://www.forbes.com/sites/ravaglia/2024/12/28/innovators-see-ai-in-education-unlocking-digital-promise-in-2025/>

Plato's vision of education

The legendary Plato envisioned education as the foundation of a just and virtuous society. In Plato's Republic, he proposed a model where education nurtures the soul, cultivating wisdom, courage, and temperance to achieve harmony within individuals and the state²⁴. For Plato, true education goes beyond mere knowledge acquisition; it helps shape character and fosters critical thinking, guiding individuals toward the ideals of the good and the just. He emphasized the role of philosophers as educators, entrusted with enlightening the guardians of society. Plato's vision endures as a call to view education not as a tool for utility, but as a path to virtue and justice for future generations.

Plato's vision of education can be seen as the foundation of today's ethical debates involving AI integration in education. New courses are being developed and taught in some of the most prestigious universities, where the debate ensues regarding whether computer programs or technologies, specifically AI, can distinguish right from wrong. One example is MIT's ethics of computing course, where philosophy meets technology through an interdisciplinary approach to ethical questions.²⁵

Role of education in a just society

Education plays a fundamental role in shaping a just society by cultivating virtue, rational thought, and a sense of shared responsibility among its members. Rooted in the ideals of philosophers like Plato, education is not merely a mechanism for acquiring knowledge but can help to contribute to a transformative process that will nurture the moral and intellectual capacities necessary for justice. A well-educated populace understands and values principles of fairness, equity, and collaboration, laying the foundation for a harmonious and balanced society. And to be frank, an uneducated populace will not.

Central to this vision is the cultivation of virtue, qualities like honesty, empathy, and courage, through education. By encouraging critical thinking, perspective, and rational discourse, education can help empower individuals to engage with diverse perspectives and make informed decisions. This fosters not only personal growth but also the ability to contribute meaningfully to the collective good.

Personalized learning can help amplify the role of education in a just society by addressing the unique needs and potential of each individual. Tailored approaches ensure that every learner, regardless of background or ability, has equitable access to opportunities for intellectual growth. By embracing diversity and inclusiveness, personalized education can help to promote fairness and strengthen societal cohesion.

24 What does Plato say about education in The Republic? - WisdomShort.com. (2024, February 7). WisdomShort.com. <https://wisdomshort.com/philosophers/plato/on-education-in-the-republic>

25 Bridging philosophy and AI to explore computing ethics. (2025, February 11). MIT News | Massachusetts Institute of Technology. <https://news.mit.edu/2025/bridging-philosophy-and-ai-to-explore-computing-ethics-0211>

In essence, education serves as both a mirror and a compass for a just, functioning society, reflecting its values while guiding its progress.

AI's potential to foster virtue and wisdom

AI has the potential to transform education by serving as a powerful guide in fostering both moral and intellectual virtues in students. Traditionally, nurturing virtues such as empathy, integrity, and critical thinking has relied on an individual educator's ability to tailor lessons to the diverse needs of their students. However, with AI's adaptive capabilities, educators now have tools to assist them in deepening and personalizing this process, unlocking pathways for student character development and intellectual growth that were previously unattainable.

AI excels in identifying individual strengths and weaknesses, enabling it to craft personalized learning experiences that encourage self-awareness and mastery. For instance, intelligent systems can employ AI tools to assess a student's progress in real time, offering challenges that stretch their abilities while reinforcing areas of need. This tailored approach cultivates perseverance, self-discipline, and a sense of accomplishment, qualities foundational to wisdom and virtue.

Beyond academics, AI can facilitate the exploration of moral reasoning through simulations and ethical dilemmas, providing students with curated opportunities to reflect on their values and decision-making processes. It can also help bridge cultural and social divides, offering tailored insights into diverse perspectives and fostering empathy.

By aligning learning paths with each student's personal background and potential, AI can leverage their background to nurture both their intellect and character. Far from being a mere tool for knowledge acquisition, AI emerges as a wise mentor for holistic growth, guiding students toward a deeper understanding of themselves, others, and the world. In this new era, AI enables education to inform minds and help virtuous, wise individuals ready to contribute to a better society.

Tests of wisdom and virtue

In exploring this concept, the idea of these four classic thought experiments was intriguing, with the potential application of AI:

- **The prisoner's dilemma:** A classic exercise. Two individuals are arrested and interrogated separately. Each can either betray the other (known as defecting) or remain silent (cooperating). If both remain silent, they receive a light sentence. If one defects and the other cooperates, the defector goes free while the cooperator receives a harsh sentence. If both defect, they receive moderate sentences. The dilemma highlights the tension between individual rationality (defection) and collective benefit (cooperation), often used to explore trust, collaboration, and competition in social and strategic contexts.

- **The tragedy of the commons:** This thought experiment illustrates the conflict between individual and collective interests over shared resources. Imagine a group of farmers using a common pasture. Each benefits from adding more livestock, but if everyone overuses the pasture to serve their own personal needs, it becomes depleted, harming all. The tragedy explores how unregulated self-interest can lead to the overexploitation of communal goods, raising questions about sustainability, governance, and cooperation.
- **The ultimatum game:** One participant (the proposer) decides how to divide a sum of money between themselves and another participant (the responder). The responder can accept or reject any offer. If rejected, neither participant gets anything. Rationally, the responder should accept any non-zero offer, but emotions and perceptions of fairness often drive rejections of unequal splits. This game probes the interplay between self-interest, fairness, and social behavior.
- **Newcomb's paradox:** A player faces two boxes: one transparent, containing \$1,000, and one opaque, which may contain \$1,000,000 or nothing. A predictor, who has a near-perfect record, places the \$1,000,000 in the opaque box only if it predicts the player will take only the opaque box. If the player takes both boxes, the opaque box is empty. This paradox explores trust, rationality, free will, and decision-making in the face of predictive certainty and uncertainty. The following figure indicates the question of uncertainty in this thought experiment:

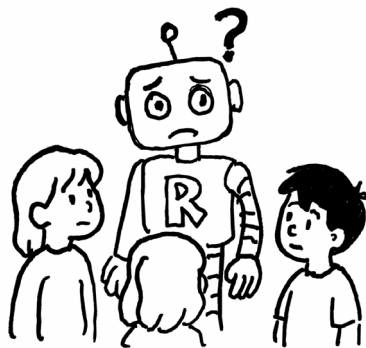


Figure 1.3: AI is not always right and can hallucinate

These thought experiments are meant to invite educators to think about their relationship with AI and AI-based tools. Human-AI-based partnerships will be a part of our human future and we can learn and develop our own perspectives from these thought experiments.

Balance of individuality and collective good

The tension between personal growth and the collective good has been a persistent theme in philosophy, education, and governance throughout history. On one hand, fostering individual potential unlocks creativity, innovation, and fulfillment; on the other, societal progress depends on cooperation, cohesion, shared goals, and collective community effort. This duality presents