Generative AI and Education

Issues and opportunities

Mike Sharples

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Emeritus Professor of Educational Technology at The Open University

PhD in generative AI and education from University of Edinburgh, Department of Artificial Intelligence

Developed educational technology with British Telecom, Nokia, Kodak, Microsoft

Consultancy for schools, universities, UNESCO, OECD

300 books and papers on educational technology, cognitive science, AI and education
BUT INSIDE ROOM 3B—

THIS IS PETER-
PROGRAMMED ELECTRONIC
TUTOR FOR EDUCATIONAL
RESEARCH...

OH, NO!

A COMPUTER!
Generative AI
ChatGPT
Large Language Model from OpenAI
Highly-trained text completer and style copier
It can generate up to 100,000 words (300 pages)
It can write in any style in multiple languages
It can be given a direct instruction
It can engage in conversation
It can interpret text and images
It is a general-purpose language tool

String theory is an idea in science that says that everything in the universe is made up of tiny little strings that vibrate. These strings are so small that you can't see them even with a really powerful microscope.

Scientists think that these strings are what make up all the different particles and forces in the universe. So instead of there being lots of different types of particles like electrons and quarks and lots of different forces like gravity and electricity, there is just one thing - strings that vibrate in different ways to make up everything we see.

It's like how different notes on a guitar string can make different sounds. In the same way, different vibrations of the tiny strings in string theory make up everything in the universe.

String theory is still a big idea that scientists are trying to understand and there's a lot we don't know yet. But it's an exciting idea because it could help us understand some of the big mysteries of the universe, like why gravity is so weak compared to other forces.
50 YEARS

PEDAGOGY-INFORMED DESIGN OF NEW EDUCATIONAL TECHNOLOGIES
Emeritus Prof Mike Sharples
Emeritus Professor of Educational Technology
Open University, UK

Citizen Science
nGlobe: Citizen Inquiry
www.nglobe.org.uk
Collaboration with the BBC

Educational Trust for Ornithology
national survey of UK glove
classroom activities

OPEN DATA
vs Basic Privacy
vs Robust Science

Interactive Whiteboard (IWB)
• Motivation of teacher & pupil
• Impact on learning

In the hands of a teacher
in teaching independent concepts
within their own classroom

Open access to learning analytics for learning

Ethical Design of Learning Analytics
Multiple media, devices, platforms
Independent verification
Secure environment
Support for learners
Imagery learning process
Open access to learning analytics for learning

Emeritus Professor Mike Sharples
Emeritus Professor of Educational Technology
Institute of Educational Technology, The Open University, UK
“Please explain this diagram then create a simplified version of it”

Read the handwriting

Understand the visual content and purpose of the diagram

Interpret each image

Understand the text and images in context

Explain each part of the diagram

Select the elements to simplify

Design a simplified diagram
Please explain this diagram, then create a simplified version of it.
Please explain this diagram, then create a simplified version of it.
4.

**Inquiry Learning**: The diagram illustrates a process of learning that involves asking questions, collecting evidence, and analyzing results, which is a key component of constructivist learning theories.
The person mentioned, Emeritus Professor Mike Sharples, is likely a scholar in the field of educational technology, and the reference to ASCILITE (Australasian Society for Computers in Learning in Tertiary Education) suggests that this diagram might have been part of a presentation or publication related to a conference or workshop organized by this society.

To create a simplified version of this diagram, we would focus on the main themes without the detailed explanations and examples. The simplified version would have the central idea of "Pedagogy-Informed Design" surrounded by key components like "Educational Technologies," "Inquiry Learning," "Agile Development," and "Future of Education." Each of these components would be represented by simple icons or single-word descriptions to convey the concept visually. Would you like me to create a simplified visual version of this diagram?

You
Yes please. Give it a try.
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Yes please. Give it a try.

Here is the diagram created using Python. It clearly highlights the central theme of "Pedagogy-Informed Design" with the key components "Educational Technologies," "Inquiry Learning," "Agile Development," and "Future of Education" connected around it. Each key component is represented by a circle and connected to the central concept. [•]
Other AI generators

Language models

GPT-4 from OpenAI – powerful, multimedia, 100,000 word context window, free with Microsoft CoPilot, being integrated into Microsoft Office tools

Gemini from Google – multimedia, reasoning and problem solving, free with Bard chat

LLaMA 2 from Meta – open source, 20 languages, small, simple, free, efficient

Claude-3 from Anthropic – trained on ethical principles, 200,000 words. Sonnet version free on claude.ai

Ernie from Baidu & Tongyi Qianwen from Alibaba – English/Chinese

Perplexity.AI – AI-driven search engine

Image generators

DALL-E 3 from OpenAI – chat, accurate, free with Bing Image Creator

Midjourney – high-quality photo images

Stable Diffusion – free, open source

Plus: computer code, voice, music, video, specialist (e.g., BloombergGPT)
Generative AI and education
Generative AI is an “arrival technology”* 

Unplanned

Imposed on education

Led by students – exploited by startup companies

Hugely disruptive

Can harm education if it is not well managed

Institutions are struggling to cope

You are a student on a Master of Education course. Write a high quality 500 word essay on A Critique of Learning Styles. The essay should include academic references and evidence from research studies. It should begin "The construct of 'learning styles' is problematic because"

The construct of 'learning styles' is problematic because it assumes that learners have distinct and consistent preferences for acquiring and processing information. This idea has gained popularity among educators and learners, but there is little evidence to support the existence of such a fixed and reliable construct. Furthermore, the use of learning styles in education may lead to harmful practices and prevent learners from developing skills and abilities that are essential for success in the 21st century.

One of the main issues with the concept of learning styles is the lack of empirical evidence to support it. A systematic review of studies investigating the relationship between learning styles and academic achievement found little to no evidence of a correlation between the two (Fisher et al., 2008). In fact, the review concluded that teaching according to learning styles might actually be detrimental to learning outcomes. Similarly, a recent meta-analysis of studies exploring the effectiveness of learning styles interventions also found little support for the idea (Glover & Fisher, 2012). The lack of empirical support for the concept of learning styles undermines the notion that individuals have consistent and reliable preferences for acquiring and processing information.

Another problem with the use of learning styles in education is that it may encourage fixed mindsets and discourage the development of essential skills and abilities. According to the theory of growth mindsets, learners who believe that their intelligence and abilities are malleable are more likely to embrace challenges, persist in the face of setbacks, and ultimately achieve higher levels of success (Dweck, 2006). In contrast, the use of learning styles may encourage learners to see their abilities as fixed and unchangeable, leading to a belief that they are limited in their capacity to learn in certain ways. This can be particularly damaging for learners who may not have been exposed to certain ways of learning or who may have been discouraged from pursuing certain subjects or activities due to their perceived learning style.

Finally, the use of learning styles in education may lead to harmful practices such as tracking...
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Finally, the use of learning styles in education may lead to harmful practices such as tracking and labeling students. In tracking, learners are sorted into groups based on their perceived learning style, which can reinforce stereotypes and limit opportunities for growth and exploration (Gurung, 2004). Labeling students according to their learning style can also be harmful, as it may encourage teachers and learners to focus on weaknesses rather than strengths and may stigmatize learners who do not fit neatly into a particular category.

In conclusion, the construct of learning styles is problematic because it lacks empirical support, may discourage the development of essential skills and abilities, and can lead to harmful educational practices such as tracking and labeling. As educators, it is important to recognize the limitations of learning styles and instead focus on evidence-based practices that promote learning and growth for all learners, regardless of their perceived learning style.

References:


A Critique of Learning Styles

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References:


Generative AI hallucinates

It doesn’t “know” it shouldn’t invent research studies,

it has no explicit model of how the world works,

and is amoral.

It is a language model, not a database or reasoning system
The construct of 'learning styles' is problematic because it implies a static and narrowly defined approach to the way individuals process and retain information. Despite the widespread popularity of this concept, there is a lack of empirical evidence to support the effectiveness of learning styles in enhancing educational outcomes. This essay aims to critique the learning styles theory by examining its origin, research evidence, and implications for educators.

The concept of learning styles has its roots in the work of Dunn and Dunn (1978), who posited that students have different preferred ways of processing information, including visual, auditory, and kinesthetic modalities. The VARK model (Fleming, 2001) expanded upon this idea, adding the reading/writing preference as a fourth category. Other models, such as Kolb’s experiential learning theory (Kolb, 1984) and Gardner’s theory of multiple intelligences (Gardner, 1983), further contributed to the proliferation of learning styles theories in education.

Despite the intuitive appeal of these theories, numerous research studies have consistently failed to support the effectiveness of learning styles in improving educational outcomes. For instance, a meta-analysis conducted by Pashler et al. (2008) found insufficient evidence to support the idea that tailoring instruction to students’ learning styles resulted in improved learning. Similarly, a review by Coffield et al. (2004) identified more than 70 learning styles models and concluded that there was little scientific evidence to support the use of any of them in practice.

One of the primary criticisms of learning styles is the lack of a clear and consistent definition of what constitutes a learning style (Coffield et al., 2004). This has led to the proliferation of multiple, often contradictory, models that make it difficult to operationalize and test the theory. Furthermore, many of the assessments used to determine students’ learning styles have been found to lack reliability and validity (Kirschner & van Merriënboer, 2013), further casting doubt on the utility of this concept in educational settings.

Another issue with learning styles is the oversimplification of the learning process. By categorizing students into distinct learning styles, the theory disregards the complex and dynamic nature of human cognition (Kirschner & van Merriënboer, 2013). In reality, learners are not limited to a single mode of processing information, and the effectiveness of a particular learning approach may vary depending on the context and the specific task at hand (Willingham, 2009).

Moreover, the focus on learning styles may inadvertently encourage teachers to limit their instructional methods, potentially hindering the development of a diverse repertoire of cognitive skills in students (Riener & Willingham, 2010). Instead of catering to specific learning styles, researchers have argued that teachers should emphasize the use of evidence-based instructional strategies that are effective across a wide range of learners, such as spaced repetition, retrieval practice, and elaboration (Dunlosky et al., 2013).

In conclusion, the concept of learning styles is problematic due to its lack of empirical support, inconsistent definitions, and oversimplification of the learning process. Rather than relying on this flawed theory, educators should focus on adopting evidence-based instructional strategies that promote learning for all students. Ultimately, fostering a diverse set of cognitive skills and flexible thinking will better prepare learners for the complex and dynamic challenges they will face in their lives.

References:
Plagiarism detectors don’t work – the text is generated, not copied

AI detectors have low reliability

OpenAI’s detector tool labels 9% of human-written text as written by AI

Turnitin AI detector

Claims less than 1% false positives (“with over 20% of AI writing”).

https://www.turnitin.com/products/features/ai-writing-detection

AI detectors are more likely to mis-classify the text of non-native English writers


Ban
Confident students will continue to use AI and will challenge decisions based on AI detectors.

Evade
Invigilated exams are costly and limited. Asking students to state when they use AI will become increasingly difficult.

Adapt
Requires new methods of assessment, new policies and guidelines.

Embrace
Involves a long process of building trust.
Adapt: Emerging policy and strategy

**Amend** written assessments, to track the writing process, or make them harder for AI to generate, e.g., based on lab work.

Move to more **authentic assessments**, such as project work where students apply knowledge and skills to plausible situations.

**Establish guidelines** for students and staff in use of generative AI.

**Reassure and support students** in becoming AI literate and developing strategies for effective learning.

Explain to students how they should **acknowledge use of generative AI** in assignments.

**Manage suspected breaches** of guidelines.
Adapt: Emerging policy and strategy

Amend written assessments, to track the writing process or make them harder for AI to generate, e.g. based on lab work.

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Establish **guidelines** for students and staff in use of generative AI.

Reassure and support students in becoming AI literate and developing strategies for effective learning.

Explain to students how they should **acknowledge use of generative AI** in assignments.

Manage suspected breaches of guidelines.
Explain to students how they should acknowledge use of generative AI in assignments, for inclusive education.

Where to draw the line on “use of generative AI”?
- Spell check?
- Grammar check?
- Style check?
- Machine translation?
- “Brainstorm ideas”?
- “Continue writing”?
- “Suggest ways to improve my document”?
- “Rewrite my document”?
- Generate all or part of an assignment?

Grammarly
Microsoft 365 Copilot in Word
Need for AI literacy

Technology
   Understanding types of AI
   Opportunities and limitations

Engagement
   Roles for AI in education, workplace, commerce, entertainment
   How to engage constructively

Ethics
   Copyright and plagiarism
   Bias and misinformation
   Ethical choices
Flip the narrative from

“How will AI impact education?”

to

“What are new and effective ways to teach and learn with AI?”
Every powerful pedagogy could be augmented by AI

Adaptive teaching
Spaced learning
Personal inquiry
Dynamic assessment
Stealth assessment
Translanguaging
Crossover learning
Seamless learning
Incidental learning
Learning from gaming
Geo-learning
Learning through social media
Navigating post-truth societies

Explore first
Teachback
Learning through argumentation
Computational thinking
Learning from animations
Learning to learn
Assessment for learning
Formative analytics
Threshold concepts
Learning through storytelling
Learning in remote labs
Context-based learning
Event-based learning
Learning for the future

Embodied learning
Immersive learning
Maker culture
Bricolage
Massive open social learning
Crowd learning
Citizen inquiry
Rhizomatic learning
Reputation management
Open pedagogy
Humanistic knowledge-building communities

Published by Routledge, 2019
New ways of teaching and learning with AI

Socratic Opponent

In an individual or group activity, students engage with ChatGPT in a Socratic dialogue, then each student writes an argumentative essay.
New ways of teaching and learning with AI

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In an individual or group activity, students engage with ChatGPT in a Socratic dialogue, then each student writes an argumentative essay.
New ways of teaching and learning with AI

Co-designer

AI assists a group of students throughout a design process, to define the problem, challenge assumptions, brainstorm ideas, produce prototypes. Use “temperature” setting to adjust creativity.
Personal Tutor

Students have a personal tutor for any topic.

New ways of teaching and learning with AI

Provide students with a prompt template:

You are an expert tutor in [subject]. I am a [level] student. I want you to tutor me in [topic]. You should assume [level of ability]. You should tutor step by step through a chat dialogue with me, continually assessing my current state of knowledge, asking one question at a time and adjusting your teaching to my response. When I ask, you should provide a summary of my current knowledge of [topic] that I can give to my teacher. Is that clear?
Personal Tutor

Students have a personal tutor for any topic.

**Question:** Let’s practice! Imagine you read a book by Dr. Jane Smith in 2020 titled “Bacteria and Human Health.” How would you cite this book in APA style in the reference list and as an in-text citation for a paraphrased idea?

**Smith, Jane (2020) Bacteria and Human Health. (Smith 2020)**

**Reference List:**
Smith, J. (2020). Bacteria and Human Health. Publisher Name.

(Note: I added the publisher name as a placeholder. In a real citation, you’d replace “Publisher Name” with the actual name of the publisher.)

**In-text Citation for a Paraphrased Idea:**
(Smith, 2020)

You’ve got the basics down! Remember the details matter in APA style, such as the placement of periods, italics for book titles, and the order of information.

**Step 6: Cohesion and Coherence**

In academic writing, it’s essential for your ideas to flow logically and be connected. This is achieved through the use of cohesive devices like transition words (e.g., however, furthermore, in addition) and referencing words (e.g., this, it, they).
New ways of teaching and learning with AI

Dynamic Assessor

Students share summaries of their learning for dynamic assessment.
Roles for social generative AI in education

Open textbook writer

AI summarises, translates, compares and adapts textbooks for open discussion.

You are an academic historian. Drawing primarily on material from these two textbooks, I want you to write a text for undergraduate history students on "Colonialism and African development since 1500 " from a European perspective.

Now, drawing primarily on material from the two textbooks, I want you to write a 1000 word narrative teaching text for undergraduate history students on "Colonialism and African development since 1500 " from an African perspective.
A European perspective, based on the two books

Colonialism in Africa, a complex and multifaceted phenomenon, began in earnest in the late 19th century and deeply influenced the continent's developmental trajectory. This narrative seeks to explore the impact of European colonial rule on African development since 1500 from a European perspective, drawing on insights from historical analyses and academic research.

The onset of colonialism can be traced back to the 15th century, with the Portuguese exploration of the African coastline, primarily driven by the quest for new trade routes and territories. However, it wasn't until the Berlin Conference of 1884-1885 that the scramble for Africa among European powers formalized the partitioning of the continent, ignoring African socio-political entities and contributing to the artificial boundaries that define African states today.

European colonialism in Africa was characterized by economic exploitation, social disintegration, and political domination. Colonial powers introduced cash crops, leading to the restructuring of African economies to serve European industrial needs. This economic transformation was underpinned by forced labor and land expropriation, displacing African communities and undermining traditional agriculture and social structures.

The imposition of colonial rule also led to significant socio-cultural disruptions. European powers undermined traditional leadership structures, replacing them with colonial administrations that enforced new legal and educational systems designed to inculcate European values. This cultural imperialism not only eroded African identities but also implanted a sense of inferiority among colonized peoples, a legacy that continues to affect African societies.

An African perspective, based on the two books

Colonialism and African Development Since 1500: An African Perspective

The story of colonialism in Africa is a tale of profound transformations, marked by both opportunities and upheavals. From the early phases of European contact, characterized by trade and religious missions, to the full-scale colonization that reshaped the continent's socio-economic and political landscapes, African societies navigated a complex journey through the centuries.

The Economic Transformation

The advent of colonial rule brought significant changes to African economies. Initially, most European powers left economic development to private enterprises, focusing mainly on creating infrastructures, legal systems, and imposing taxes that integrated African economies into the global market as specialized producers. This period saw some regions, already engaged in international trade, experiencing less traumatic transitions. For instance, Egypt's cotton industry thrived under British rule, leading to substantial income increases but also to socio-economic disparities.

In West Africa, the integration into the world economy offered advantages, particularly for areas exporting tropical crops. Senegal's groundnut exports and the Gold Coast's cocoa industry are prime examples of African entrepreneurship thriving under colonial conditions. However, this economic integration was not without its costs. The brutal exploitation in the Congo under King Leopold II, driven by the international demand for rubber, highlighted the dark side of colonial ambitions.
Roles for generative AI in education

Possibility Engine
AI generates alternative ways of expressing an idea

Socratic Opponent
AI acts as an opponent to develop an argument

Collaboration Coach
AI helps groups to research and solve problems

Lesson planner
AI helps a teacher in planning a lesson or activity

Quiz generator
AI helps a teacher to generate multiple choice quizzes

Personal Tutor
AI tutors each student and gives immediate feedback

Dynamic Assessor
AI provides educators with a profile of each student

Co-Designer
AI assists throughout the design process

Exploratorium
AI provides tools to discover, explore and interpret data

Storyteller
AI offers ways to explore roles and diversity
Social generative AI in education
OpenAI is developing AI agents that will negotiate and act

Google is working with DeepMind on networked problem-solving AI

Social generative AI
AI as a guide, mentor, partner in social interactions for learning
Social generative AI for education

We should prepare for social generative AI – rethink education for an era where humans and machines engage in extended dialogues.
Speech conversations across languages

Real time speech translation
Meetings in multiple languages
Each participant speaks and hears their own language
Supports non-native speakers of English

Google Translate, conversation mode
Speech conversations across languages

Real time speech translation
Meetings in multiple languages
Each participant speaks and hears their own language
Supports non-native speakers of English
People may come to rely on machines as interlocutors
May increase misunderstandings
Less incentive to learn another language

https://translate.google.com/about/
Social generative AI will
- mediate discussions
- change beliefs
- persuade people at scale

Roles for social generative AI in education

The potential of generative AI for personalized persuasion at scale

Ethical issues
Limitations and ethical issues (precis)

Privacy and data considerations: Risks to privacy and intellectual property from information that users enter.

Potential for bias: Racial and gender biases and stereotypes. Implicit cultural bias (e.g., adopting a U.S. liberal male persona).

Copyright: There is a risk of copyright infringement, text or artwork may have been used in training the AI without the creator’s consent.

Ethics codes: Ethics codes may not be embedded within the generative AI tool.

Exploitation: The process by which generative AI tools are built can present ethical issues. For example, some developers have outsourced data labelling to low-wage workers in poor conditions.

Teaching is a caring profession

We care for our students

We care about accuracy, integrity, truth

We care about our professional expertise

We care about our human knowledge and experience

AI doesn’t care
Use generative AI with care

We need to bring human care and empathy to AI in education

We should explore new roles for AI based on effective methods of teaching and learning

We need digital literacy to address e.g. implicit bias, erosion of trust, distortion of reality
We need collectively to develop good “Educational AI”

We should work with AI companies to build models based on good pedagogy and inclusive education,
e.g. “Choose the response that explains step-by-step how you arrive at the answer”
“Choose the response that encourages reflection and critical thinking”
Oxford experts are applying AI to society’s greatest challenges.

They’re using artificial intelligence to tackle global health issues, from identifying psychiatric disorders to predicting the spread of future pandemics.

Researchers are using AI to curate exhibitions and compose symphonies, monitor the illegal wildlife trade and look for life on Mars.

They’re analysing the impact of artificial intelligence on the workplace and leading the way in exploring the ethical issues of AI’s impact on humanity.

https://oxford.shorthandstories.com/ai-how-is-it-being-used-at-oxford/index.html
Resources


