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How AI Makes its Mark on Instructional Design

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Abstract: Artificial Intelligence (AI) has revolutionized various aspects of human activities, profoundly impacting the landscape of higher education, particularly in the domain of teaching and learning. This paper aims to discuss the topic of instructional design from both a human and technological perspective. A comparison between current learning methods and AI-enabled learning approach will be presented. Additionally, the potential shifts of the current ID practices, especially the role of AI in the instructional process, including its impact on analysis, design, development, and evaluation will also be discussed. By leveraging AI functionality, humans can be released from performing fundamental activities and focus on tasks or activities which are more complex. Hence, this paper will also provide some insights on some new emerging roles (i.e., AI content strategist and AI technology specialist) that are prospering and certain specific roles (i.e., content accessor and learning experience designer) that are gaining more significance in the instructional design process. It is also crucial to understand how human and machine interact and the ways it allows an improvement of the learning experience of the individuals in the AI-enabled learning ecosystem. Hence, the potential benefits and challenges will be discussed and recommendations for future practice will also be offered.

Keywords: AI-enabled learning, instructional design, human-machine interaction, higher education, teaching and learning.

Highlights

What is already known about this topic:

- It is important for instructional designers to improve learning experience for students especially by leveraging the use of technology.
- AI frees individuals from basic tasks, allowing us to concentrate on more advanced activities that require higher-level thinking.

What this paper contributes:

- This paper provides insights on how ADDIE model and instructional design practice can be transformed with AI.
- This paper suggests a new approach for integrating assisted and autonomous intelligence into the instructional design process.

Implications for theory, practice and/or policy:

- The availability of AI will revolutionize instructional design processes, raising concerns about how designers handle AI-generated content (AIGC) in the future.
- The relationship between humans and AI will continue to grow in importance especially in AI-enabled learning environment.
- AI is about to bring about significant changes to various roles within the instructional design industry.



Introduction

The ever-evolving technological revolution continues to reshape and redefine our lives, propelling us forward into an era of constant transformation. If there is continued breakthroughs of this technology, society will experience drastic changes in our everyday life. Today, artificial intelligence is gaining more importance in the modern world. AI enables a simpler human life, the same will happen to education learning processes. By leveraging AI functionality, individuals can be released from performing those fundamental activities and we can focus on more complex activity which involves higher order level thinking.

The role of AI in instructional design process

Instructional design is a system of procedures in creating the instructions in a reliable and consistent manner (Gustafson, 2002). There are models that emerged in 1980 that are still being used today by modern instructional designers, ranging from ADDIE models (Gustafson & Branch, 2002), Dick & Carey models (Dick, 1997), Gagne's 9 events of instruction (Gagne, 1985), Gerald & Ely (Gerlach & Ely, 1980) and Rapid instructional models (Piskurich, 2015). The transformation of these models has been observed across the century and along the times of the technology revolution.

ADDIE, a cornerstone of instructional design, has long been ingrained in the fabric of this field. Many researchers have proposed different models throughout the years and the changes of it are inseparable from the ADDIE model, where the needs, contents, goals, teaching methods and instructional media are identified at the initial stage (Isman, 2011), followed by design, develop and implementation. The instructional design process ended up with evaluation, also known as feedback, and revision to be made so that the entire cycle of the ID process is continuous and sustainable. This is also called a "content supply chain" which functions to create, plan, produce and deliver the educational materials.

ADDIE is commonly used as a reference model in the instructional design process by most people. How AI is being called into the process of instructional design? The following discussion for each phase in ADDIE will be discussed.

Analysis

AI offers a swift and cost-effective means of analyzing data, particularly when it needs to be presented in a simplified yet informative format for instructional designers to comprehend the requirements of the target learners and formulate effective instructional strategies. In the past, this stage demanded considerable time and effort, involving manual data collection, surveys, interviews, and contextual understanding. However, the infusion of AI can revolutionize this phase by automating data gathering and analysis, expediting the process, improving accuracy, and diminishing resource demands.

Design & Development

Educational technology materials are used to expand knowledge (Iman, 2011), these multimedia materials consist of a wide range of resources ranging from text, images, videos, and audio. AI does not simply create; rather, it generates assets throughout the entire journey from ideation to the product phase. According to Betz (2023), there are two main types of Artificial Intelligence – Capability-based and Functionality-based. The Capability-based type of AI is designed to excel human capability and intelligence, on the other hand, functionality-based type of AI is to apply learning capability to respond and interact with the stimuli in its surrounding environment. Table 1 exemplifies the profound impact of AI on the instructional design process.

Table 1. Current Practice of Instructional Design Process versus AI-collaborative Practice in Multimedia Creation.

Current Practice	New Practice
Content	
<p><i>Higher originality with the gist of human, time consuming</i> Content is written by the Subject Matter Expert. They research, source for the internet, books and other possibility means and produce the piece of work with their knowledge and experience.</p>	<p><i>Machine-generated piece of work, time saving</i> Content can be generated using ChatGPT. ChatGPT is also consisted part of the source that a SME might have. The only difference is that we can obtain the information from one single point – mega site of library instead of multiple points of source. Furthermore, this AI tool also features word editing and proofreading features that eliminate glaring grammar mistakes.</p> <p>By utilizing this tool, content can be created swiftly for your eLearning course, including introductions, objectives, main content topics, quizzes, assignments, and instructions. A thought or spark of an idea, the creator can simply collaborate with AI to create the content.</p> <p>Content Generated AI: ChatGPT, Hypotenuse, Jasper, Writesonic, Cowriter.</p> <p>Content Assisted AI: Grammarly, Quillbot, ProWritingAid, WhiteSmoke, and Ginger.</p>
Image	
<p>Search for images that match the context and purpose, either by using relevant images or by creating highly customized copyrighted illustrations. From the outset, we have embraced the integration of visuals into our instructional design. A key aspect of designing educational materials revolves around the careful selection of images, considering the distinction between copyrighted and non-copyrighted ones. Acquiring suitable artwork can be financially burdensome, particularly when customization is required.</p>	<p>The issue of copyright for images created by AI is a complex and evolving area of law. The U.S. Copyright Office has taken the stance that AI generated images themselves are not eligible to copyright protection because they are not the work of human authorship (Abramovitch, MacColl & Abramczyk, 2023).</p> <p>AI-generated images can be created based on human imagination (Bozkurt, et. al, 2023). AI-generated drawings are flawless and saving cost and time. Custom drawings that fit the content and context perfectly could be easily generated.</p> <p>Tools: Midjourney, Adobe Firefly, Stable Diffusion, Craiyon.</p>
Video	
<p>Videos are the common teaching tool used in eLearning (Gilardi, et. al, 2015; Mayer, 2017; Nazarov, 2023). Creating videos for eLearning used to be a time-consuming process involving a studio, recording equipment, editing and consuming lots of post-production time.</p>	<p>AI has the remarkable capability to expedite video creation to under 15 minutes, streamlining the process once the content is prepared. Simply prepare the content and the tool will do the rest.</p> <p>Animation AI: Synthesia, Adobe Firefly, D-ID, Fliki, Peech, Animated Drawings.</p> <p>Editing AI: Pollinations, Munch, Runaway</p>
Audio	
<p>a. Text to speech technology has become increasingly prevalent in instructional design process although it is not new to the field. Nonetheless, the monotonous tone of the machine can potentially demotivate learners, as research by Mayer (2017) suggests that individuals tend to engage in deeper learning when the lesson incorporates a human voice as opposed to a machine-generated one.</p> <p>From appointing voice talent, booking of the studio and post editing might take up days or weeks. If modifications are made to the script, the entire production cycle would need to repeat.</p>	<p>AI now offer voice-over services that can make your script sound more engaging. AI simulation technology can resemble human voices very accurately. Thus, no voice talent has to be appointed for the task, any individual with a recording device can make use of this feature. As AI produces voice that are free of echo or background noise, post editing work are not needed too. A voice clip can be produced in a matter of seconds and corrections made on the video script can be made without implying hefty changes.</p> <p>Text to speech AI: Murf AI, Play.ht, Resemble AI, Papercup</p> <p>Audio editing AI: LALAL AI</p> <p>Music producer AI: Mubert, Boomy, Riffusion, Soundraw</p>

<p>b. Speech to text technology enables learners from various language backgrounds to understand the content of the delivered speech. In the current practice, transcribers have to transcribe the audio word-by-word to create subtitles for instructional videos. If the video is intended to serve learners from diverse language backgrounds, the workload would be significantly increase and become burdensome.</p>	<p>With the integration of AI, speech to text technology is commonly seen in the form of auto-generated captions for any live meetings. This is available in most of the meeting's software such as Zoom, Microsoft Teams, Skype and Google Meet.</p> <p>To work on text transcript, simply upload the video or audio clips to the application tool and text would be auto-generated. While the accuracy may not reach 100%, hence, some minor tweaks have to be made, but overall, it saves up time for the transcribe or text editor.</p> <p>Speech to text AI: Otter AI, Microsoft Group Transcribe, Descript</p>
<p>Other emerging AI teaching-assisted tools</p>	
<p>Presentation tools When it comes to consolidating all the content into a PowerPoint presentation, educators may encounter challenges, particularly if they lack the requisite expertise or experience in content design and organization.</p>	<p>The PowerPoint presentation can be created quickly and in a short amount of time with the aid of AI tools as long as the content is ready.</p> <p>Example: Beautiful AI, Mind Show, Tome, Gamma AI.</p>
<p>AI-based assessment tools There has been a movement towards AI-based evaluation and the inclusion of algorithmic solutions in the learning process (Sánchez-Prieto, et. al, 2020; Bozkurt, et. al, 2023).</p>	<p>AI can be used for assessment of behaviors, feelings and academic performance.</p> <p>Example: Auto-assessment machines and graded system to monitor and evaluate student performance</p>
<p>AI generated Question bank Traditionally, assessment questions are created by the number of educators. They usually have to create a pool of questions in the learning management system according to the level of difficulty and question types based on various topics. This involves time and cost.</p>	<p>By utilising AI, educators can take advantage of a vast repository of assessment questions that not only cover various topics, levels of difficulty, and question types, it could also present unique sets of questions to different students, fostering a self-paced learning.</p>

In the modern landscape, the advent of AI has fostered the creative realm, empowering individuals without specialized skills to delve into design, animation, and even writing. This accessibility enables a level playing field, granting broader opportunities for creative expression and the latent talents of diverse individuals who may have previously been excluded from these domains. AI's transformative influence paves the way for a new era of inclusivity and self-actualization, where aspiring designers, animators, and writers can embark on fulfilling journeys of artistic exploration and innovation. Furthermore, the rise of internet celebrities in recent years is indicating a new trend of how internet has changed the landscape of media, design and publicity. In the past, it appeared difficult to enter some sectors or professions without a specialized background, credentials or qualifications. Now, anyone can start their journey in these fields by merely displaying a strong desire and developing their talents through self-directed learning. Educators in higher education as subject matter experts lack formal training in the instruction design even though they produce the teaching and learning materials (Khalil & Elkhider, 2016). Self-directed learning has gained greater importance, be it learners or educators (Mukhtar, et. al, 2020; Borah, 2021). The advent of AI has sped up the transformation of the conventional practice in various industries. Obviously, this has also transformed the traditional instructional design practice to AI collaborative mode where the AI applications that are shown in Table 1. The paradigm shift has opened up new opportunities and possibilities across various sectors in education, where the education system is not confined to just a discipline-based approach. Instead, it should embrace a multidisciplinary approach to applied learning, emphasizing skill-based education with the application of AI tools. In addition, AI adoption and AI-related skills such as Technical and Vocational Education and Training (TVET) is becoming increasingly significant and is receiving increasing attention across the globe.

While human interaction is irreplaceable, with the existing of the AI can reduce the administrative tasks or loads from the teachers in which teacher can be more focus on the teaching and learning activity that is concerning the personal development of the students. Train the teachers to be skills-oriented in terms of technology and capability-building in the area of technology-enabled environment (Tlili, et. al, 2023).

Implementation

During the convening of the International Conference on Artificial Intelligence (AI) and Education in Beijing, China, the participants emphatically called upon UNESCO stakeholders to proactively embrace the potential presented by AI. They fervently advocated for the integration and development of AI technologies and tools within education management information systems, recognizing the immense opportunities that lie within. This collective appeal seeks to inspire actionable implementation strategies, aiming to harness the transformative capabilities of AI to elevate and enhance the educational landscape on a global scale. This system would enhance data collection and processing, making education management and provision more open, equitable, inclusive, and personalized (UNESCO 2019).

Synchronous learning and AI Chatbot can be a significant learning aid and interact with the students at any time. Instructional designers can further enhance the self-directed learning implementation in the AI-enabled learning environment by effectively making use of synchronous and asynchronous learning. Learner engagement often remains one-sided when synchronous learning activities with peers or tutors are not readily available. However, the presence of AI chatbots offers the potential to establish and cultivate Human-Chatbot Relationships (HCRs), thereby fostering user engagement through meaningful bonds with real-time and immediate feedback and communication (Mo, Fang, & Chang, 2023; Tiili, et. al, 2023).

Evaluation

The pervasive influence of technology in shaping our lives is undeniable, compelling us to embrace its presence at our doorstep without hesitation. It is like we cannot change the technology that is evolving. The same goes to the accessibility to AI. A significant number of leading universities around the world such as The University of Hong Kong, the University of Cambridge, Sciences Po, RV University banned the use of ChatGPT in response to the release in late 2022. Why? The answer can easily be obtained by asking a machine. Who produces the machine? Human. What's in it? Data fed by human.

We are testing the intelligence of the students to perform tasks that the machine does. No way. But we are not blocking Grammarly, Quillbot, etc those AI that are considered "lower-level" intelligence, why? The answer is simply "we are not ready yet". Restricting it to spare some time to react for the future. Our education system is assessing the students for their ability to memorize facts and it's time for the educators to place a higher value on creativity and originality (Chow, 2023). The use of AI tools will become a routine and it is more sensible to adapt and teach students how to use these tools ethically (Chan & Chin, 2023).

Hence, the shift of our education paradigm is obvious – students shouldn't be just assessed based on cognitive domain assessment, instead evidence-based practices. Transform from knowing to doing. This is similar to the constructivist view of instructional design in which learners should be active and use cognitive activity to construct new knowledge (Iman, 2011). In addition, as suggested by Bozkurt et al. (2023), it is important to consider authentic assessment and evaluation strategies that can effectively incorporate the appropriate use of AI.

In this juncture, educational practitioners stand at a crucial turning point, where they must introspect and overhaul pedagogical approaches to effectively address the unique requirements and aspirations of adult learners. It is imperative to embrace this opportunity for transformative change, reimagining instructional methodologies to create a learning environment that is tailored to the diverse and evolving needs of adult learners. The concept of pedagogy has evolved over time, with its roots coming from the Greek word "Peda", meaning "child." Pedagogy refers to the way of teaching students. It has been used widely in the educational setting for decades, even in adult education settings. However, in 1960, Malcom Knowles lamented that the concept of pedagogy is child-centered and he has made known of Andragogy which recognizes the distinct characteristics and motivations of adult learners, emphasizing

self-directed learning and relevance to their experiences (Knowles, 1980). While pedagogical concept is still relevant in various teaching and learning contexts, it is crucial to acknowledge that Higher Education should move away from solely relying on pedagogy and shift towards a more adult-learner-centered approach. This shift requires reassessing instructional strategies, incorporating andragogy and making sure the teaching and training methods is in line with the unique needs and goals of the adult learners.

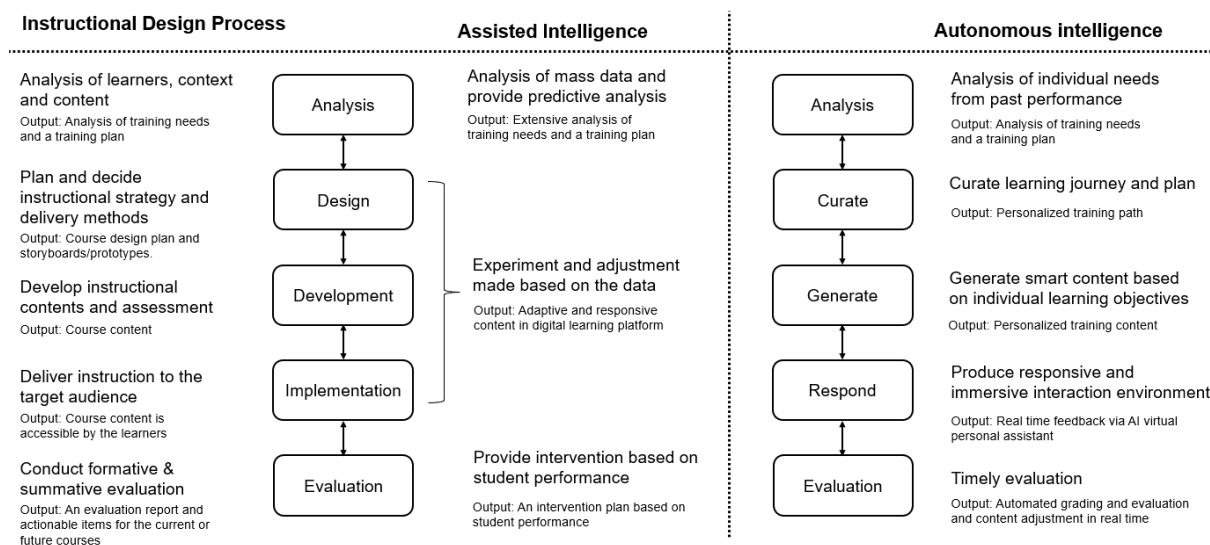
Transformation of instructional design process

In the past, instructional designers manually employ the ADDIE approach to carry out instructional design tasks. The traditional approach relies on group learning or targeting a specific audience due to the limitations of individual analysis, which is time-consuming and costly. Tiili et al. (2023) argued that AI can lead to a paradigm shift in instruction delivery and potentially the future learning. With the advent of AI, there are two distinct approaches that can revolutionize these processes. They are assisted intelligence and autonomous intelligence. As stated in the PwC report (2023), assisted Intelligence helps human to perform tasks faster and better, on the other hand, autonomous intelligence comes with automating decision-making processes without human intervention.

At the assisted intelligence process, the analysis phase can focus not only on one group of targeted learners, but many user groups. Enabling designers to gain a practical understanding of what AI can achieve, this allowed designers to easily experiment with AI during the design ideation phase and facilitated their evaluation and adjustment based on the data input received from learners (Yang, Steinfeld & Zimmerman, 2020) in order to create an adaptive and responsive design.

When comparing assisted intelligence with the Rapid Instructional Design Model – A model that claimed to be increasing the efficiency of eLearning solution development (Piskurich, 2015), it shares similarities in the iterative processes of analysis, design, and review. However, with the inclusion of assisted AI, the entire process becomes even more rapid as time is reduced in all phases. Overall, the introduction of AI into human manual processes has the potential to streamline operations, improve efficiency, and enhance decision-making capabilities. Figure 1 presents a summary of how the instructional design process can be transformed through assisted intelligence for shorter-term gains and autonomous intelligence for long-term advancements.

Figure 1. AI integration in each phase of analysis, design, development, implementation, and evaluation (ADDIE) model.



Collaboration between human and AI

The concept of “human-robot collaboration” (HRC) examines how humans and robots interact cognitively and physically as they work together to accomplish a common goal (Semeraro, Griffiths & Cangelosi, 2023). Instructional designers, Subject Matter Experts and AI play a key role in the content supply chain. As described in the chapter earlier, content supply chain involves the process of planning, producing and delivering the content from its creation to the final stage. With the rapid advancement of AI, we can foresee that the collaboration between human and machine is increasingly evident in content supply chain. Humans and machines can work together to maximise each other's individual strengths and increase the return on investment in the workforce through certain automation with increasing the efficiency and accuracy in the content supply chain. While AI systems excel at processing massive quantities of data, carrying out sophisticated computations, and delivering real-time analysis, humans add creativity, critical thinking, emotional intelligence, and contextual awareness. When plan is predictable, it makes our plan and process reliable. Yang, Steinfeld and Zimmerman (2020) have pointed out HCI and designers require a certain level of technical literacy in AI, with designer-focused AI education materials being made accessible. The researcher also suggested the creation of AI-specific design processes that can foster the collaboration of human and AI. However, further research data is needed to provide support for understanding the roles of humans in AI-specific contexts.

New roles emerged in AI-enabled learning instructional design process

With the growing popularity of AI, some new emerging roles are expected to emerge in the AI-enabled learning ecosystem. These roles include AI content strategists, content accessors, and AI technology specialists. Nevertheless, one of the most crucial roles in this evolving landscape is that of the learning experience designers. Each of the roles is discussed as follows:

- a) AI Content Strategist – Content will be generated, strategized or even further enhanced with AI. Content is the source of learning for students. Before producing any learning material, we need to have content. The content typically originates from the subject matter expert, while AI is designed with the capability to excel in its intelligence, it could play an important part in content creation. AI content strategist will then create personalized learning content assessments with the AI input.
- b) Content Accessor – SMEs possess unique knowledge, skills, and experience in their area of expertise. Thus, content validation and verification will still be coming from a person (instead of a machine) who can ensure the content is accurate, relevant and meets the needs of the intended audience. Hence, SMEs' focus is not on content creator but content accessor. They play a crucial role in ensuring that the content developed is of high quality so that the output is not a case of 'garbage in, garbage out'.
- c) Learning Experience Designer – Learning can happen anywhere and anytime, but sometimes it just doesn't happen at all. Creating engaging and effective learning experiences for diverse groups of learners are crucial, hence learning experience must be of the top concern when it comes to instructional design. Kim, Lee, and Cho (2022) claim that there will be an increasing collaboration between students and AI. Hence, by integrating AI Chatbots which is functionality-based can enhance the personalized learning experience of individual learners.
- d) AI Technology Specialist – This would be brand new role in which the individual would be able to use various AI tools in creating learning objects or assets for the educator and students in the teaching and learning activity. The acquisition of the skills is quite diverse and demanding as the specialist should possess a high level of adaptability and be quick to learn new technologies. This also includes assist educators and students in using technology systems in complex environments, as well as help them integrate AI tools throughout their teaching and learning process such as improving the teaching and learning experience through the use of augmented intelligence applications (Crowe, LaPierre and Kebritchi, 2017).

In addition to its well-known roles in chatbots, virtual assistants, and language translation, AI also holds the capability to generate text content (Bozkurt & Sharma, 2023). AIGC refers to the content generated by using artificial intelligence. It becomes a crucial focal point for the future teaching and learning. Based on AIGC, various AI professions have emerged such as digital influencers, social robots, illustrators, copywriters, and even programmers (Sharples, 2023). The same goes to industrial robots, which have replaced manual labor, the substitution effect of AIGC on repetitive tasks is inevitable (Li, 2023). Thence, AIGC has also given rise to a new professional occupation called Prompt Engineers. A prompt engineer in education might be someone who create prompts or instructions for AI-based instructional applications or systems. They would work on designing prompts that effectively guide students' learning experiences and elicit desired responses or actions from AI systems. Prompt engineers may also focus on optimizing the interaction between students and AI tools, ensuring that the prompts provided align with educational objectives and foster meaningful interaction and engagement. Their role would be to bridge the gap between instructional needs and the capabilities of AI systems, enhancing the overall learning process.

Conclusion and Suggestions

While discrete skills can be automated, complex skills remain firmly within the domain of human expertise. The primary purpose of AI is to liberate individuals by reducing the time-consuming aspects of their tasks. AI serves as a supportive force in the creative process, streamlining fundamental tasks and facilitating a more efficient workflow. By alleviating mundane responsibilities, AI empowers us to prioritize and concentrate on the essential aspects of our work that demand our focus and ingenuity.

The emergence of AI technology has lightened the burden of human work and allowed us to spend more time on thinking, creating, and innovating, rather than pushing ourselves to challenge our own limits against machines. Hence, we should not view the emergence of AI as a threat. On the contrary, communicating and collaborating effectively with machines is a new skill to be learned for humans to achieve greater precision and efficiency.

On the other hand, the emergence of AIGC can also be seen as a completely new approach to creation as it goes beyond simple AI-assisted production or sharing workload with human (Semeraro, Griffiths, & Cangelosi, 2023). It has the potential of showing another breakthrough in the AI field when large-scale model technologies and AI can learn and train independently (Zhan, Li & Sun, 2023).

AI has the ability to address some of today's most pressing educational concerns, improve teaching and learning techniques, and accelerate progress toward SDG 4 – Quality Education (UNESCO, 2023). It has become clear in the field of education that “you can't optimise when you can't measure.” Here is when integrating AI approach into the workflow of instructional design process is useful. Innovative teaching and learning techniques are being created by utilising AI, enabling personalised and adaptive approaches. AI gives educators the ability to collect useful data, examine learning trends, and customise educational experiences to meet the requirements of specific students. The use of AI in instructional design has the potential to significantly improve outcomes, efficacy, and student engagement, opening the door to a learning environment that is revolutionary.

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