



LEVERAGING ARTIFICIAL INTELLIGENCE FOR PLAYFUL AND INCLUSIVE EDUCATION: DEVELOPING SEMI-AUTOMATIC AND ADAPTIVE EDUCATIONAL PATHS

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Abstract: *This review article investigates the revolutionary potential of utilizing artificial intelligence (AI) to nurture playful and inclusive education through the construction of semi-automatic and adaptive educational paths. It investigates the advantages of playful learning and individualized education, emphasizing their role in increasing engagement and accommodating varied learning styles. The incorporation of AI in education is poised to transform curriculum design, content generation, and evaluation, relieving educators of administrative duties. Furthermore, adaptive learning enabled by AI algorithms promises tailored educational journeys that modify dynamically to individual progress and preferences. However, ethical concerns about algorithmic prejudice and data privacy necessitate monitoring. The future promises intriguing potential, such as the integration of immersive technology and interdisciplinary collaboration to develop a responsible AI-powered educational landscape that responds to the different needs of students.*

Keywords: Artificial Intelligence (AI) in Education, Playful Learning, Inclusive Education, Semi-Automatic Educational Paths, Adaptive Learning

INTRODUCTION

Artificial Intelligence (AI) has emerged as a revolutionary force in the ever-changing world of education, challenging established paradigms and creating novel learning environments. AI has achieved significant advances in a variety of fields, from healthcare to economics, and education is no exception.

The limitations of traditional one-size-fits-all approaches have become increasingly apparent as educational institutions attempt to fulfil the different requirements and preferences of a global student body. AI enables educators in detecting student strengths and shortcomings, allowing for early intervention to help difficult students. The incorporation of artificial intelligence (AI) in education has brought benefits

and problems, altering instructional approaches, individualized learning, and making decisions based on data (Luengo-Oroz et al., 2021). Artificial intelligence (AI) is the science and engineering of building smart machines that can solve a variety of problems by utilizing machine learning, neural networks, and natural language processing (Mondal, 2020). Using intelligent agent systems, Chatbot, and recommendation systems, AI in education can assist teachers in predicting learner status and achievement, providing resources for learning, and automating tests to improve students' learning experiences (Mousavinasab et al., 2021; Su et al., 2022; Zheng et al., 2021).

This study is significant because it investigates the ground-breaking possibilities of using Artificial Intelligence (AI) for playful and inclusive education via semi-automatic and adaptive educational paths. This article intends to illustrate how AI-driven techniques can adapt to varied learning needs, boost engagement, and create adapted educational experiences by analysing the convergence of AI, playful learning, and inclusive education. The goal of this article is to provide insights into the benefits, problems, and empirical evidence around AI's role in creating the future of education, with the goal of promoting additional research, innovation, and informed practices in this expanding subject.

The study examines the following Research Questions:

1. How does the integration of artificial intelligence (AI) technologies impact the effectiveness of playful learning strategies in educational settings?
2. To what extent can AI-driven adaptive educational paths address the diverse learning needs of students in inclusive education environments?
3. What are the ethical considerations and challenges associated with implementing AI in education, particularly when aiming to achieve inclusivity and playfulness?
4. What are the key success factors and best practices derived from real-world implementations of AI in playful and inclusive education, and how can these be leveraged for future developments?

1. METHODOLOGY

The methodology for this review paper will be a comprehensive and systematic literature review. It will entail searching academic databases for peer-reviewed articles, books, reports, and relevant conference proceedings, such as PubMed, Google Scholar, and education-specific archives. Inclusion criteria will be developed to ensure that studies directly connected to AI in playful and inclusive education are chosen. To discover major themes, patterns, and empirical evidence, data will be extracted and analysed. A qualitative content analysis technique will also be utilized to evaluate the ethical concerns and issues related with AI in education. The methodology will strive to provide a comprehensive review of the subject.

2. THE ROLE OF ARTIFICIAL INTELLIGENCE IN EDUCATION

In an educational environment, AI refers to the use of advanced computer techniques that enable machines to replicate human-like intellect, such as problem solving, thinking, and learning. It entails the creation of algorithms and systems capable of analyzing data, adapting to user interactions, and making educated judgments in order to improve learning and teaching experiences (Pedro et al., 2019).

AI has been widely used in education since the development of computing and information processing tools. AI in education creates new opportunities, challenges, and challenges for instructional strategies (Ouyang & Jiao, 2021). The goal of AI in education is to significantly improve teaching techniques through real-world trials and the development of modular standard prototypes in statistical reasoning, data visualization, and learning analytics (Alam, 2021).

Numerous algorithmic applications in education are already powered by AI. Intelligent tutoring systems that provide intelligent help; individualized learning systems that promote student learning; and automated systems that aid teachers in measuring what pupils know are just a few examples. They also have an impact on the learning ecosystem through a variety of social networks, blogs, gaming platforms, and mobile applications that integrate smoothly into the learning processes (Holmes & Porayska-Pomsta, 2022). In recent years, scholars have developed the concept of „AI literacy” to underline the significance of include AI in 21st-century digital literacy skills for everyone, including children (Ng et al., 2021). In order for everyone (including young children) to understand and apply AI as a tool to live, learn, and work in our digital environment, it has become vital that AI literacy be taught in grades K–12 (Ng et al., 2021; Steinbauer et al., 2021).

The meta-analysis investigates the influence of AI on learning outcomes and perception. The findings indicate a link between AI use and learning achievement. Moreover, AI integration improves learners’ perceptions of the learning experience overall (Zheng et al., 2021). In order to enable further integration of intelligent technology into education and more teacher professional development initiatives linked to AI and AIED, the Chinese government developed an education modernization strategy in 2019 (Chiu, 2021; Xia et al., 2022).

2.1. Transformation of Traditional Education through AI Integration

AI has transformed traditional educational practices by offering revolutionary solutions that improve engagement, personalisation, and efficiency.

1.1.1. Personalized Learning Paths

Personalized Learning Paths make use of AI to customize each learner’s educational experiences. AI-driven systems tailor material and activities to each user’s preferences and performance, maximizing engagement and comprehension. Research from Vygotsky (1978), which emphasizes the advantages of personalised learning, supports this strategy. Personalized learning strives to adapt students’ learning experiences to their own needs, skills, talents, and interests (Shemshack & Spector,

2020). Increased motivation, engagement, and comprehension can result from using personalized learning as a successful strategy (Falcão et al., 2018). The study by Ingkavara et al. (2022) reveals how personalized learning promotes self-regulated online learning, increasing learner autonomy and engagement and aligning with AI's capacity to tailor education to individual needs. The Dogan et al. (2023) cite the top research areas for using artificial intelligence to enhance online learning and distance learning processes as educational information mining, learning analytics, personalized, adaptive learning, algorithmic online educational spaces, ethics, and human intervention, as well as online learning through detection, identification, recognition, and prediction. Students might receive individualized career guidance from AI based on their interests, abilities, and ambitions. This might help students in making better job decisions in the future (Bozkurt & Sharma, 2023).

These studies show that using AI to create personalized educational routes has shown amazing promise in terms of increasing student engagement and comprehension. However, as we move toward an inclusive and effective AI-driven educational future, ethical issues and the need for continued research remain critical.

2.1.2. Semi-Automatic Educational Paths

Semi-automatic educational pathways improve learning experiences by fusing conventional teaching strategies with technology-driven resources. These pathways can be customized to meet unique needs by utilizing AI and adaptive learning platforms, thus promoting individualized education. The Khan Academy, for instance, uses semi-automation by providing interactive video courses and activities that adjust difficulty based on user performance (Bendou, 2021).

To further deliver top-notch information to a global audience, Massive Open Online Courses (MOOCs) like Coursera use semi-automation. According to user preferences and prior knowledge, AI systems can suggest courses (Saadatdoost et al., 2023). Platforms like Udemy use semi-automation to offer a variety of courses in vocational training, enabling students to pick and choose the courses they want to take and learn at their own pace (Udemy, 2021).

AI support is used in semi-automatic educational pathways for curriculum design, content development, and assessment. They simplify administrative tasks so that teachers can concentrate on teaching. This strategy tries to increase educational effectiveness while keeping a personal touch in the teaching and learning process.

The study by (Vesin et al., 2022) emphasizes how semi-adaptive evaluation tools, such as Elo-rating, can improve student learning in programming classes. Continually altering the questions' level of difficulty and suggesting pertinent topics based on student performance.

Semi-automatic learning pathways democratize information and increase learning flexibility and inclusivity. Technology supports human educators' efforts, making education more flexible and learner-centered while maintaining the importance of human educators.

2.1.3. Adaptive Assessment

Adaptive teaching, a data-driven approach utilizing computer algorithms, offers personalized instruction to engage individual students and improve their learning (Fontaine et al., 2019). Learning effectiveness may be improved by adaptive learning (Kellman & Krasne, 2018). Recent systematic reviews and meta-analyses have shown that adaptive learning environment seem to be successful at enhancing students' and professionals' skill sets. It has been demonstrated that AI-powered adaptive learning systems can tailor language instruction to the needs of individual students, enabling personalized learning experiences (Rusmiyanto et al., 2023).

The study by Chen et al. (2023) shows how adaptive learning system improves individualized learning experiences by directing learners through material that is in line with their areas of strength and weakness. The study by Wang et al. (2023) discovered that the adaptive learning system produced favourable results in terms of learning efficacy. When compared to students receiving teacher-led instruction, those using the adaptive learning system demonstrated greater comprehension and memory of the subject matter. The study by Xie et al. (2019) highlights the beneficial effects of these methodologies on students' learning outcomes and engagement while identifying various technical tools and methodology utilized to conduct adaptive learning. The study by Peng et al. (2019) emphasizes how adaptive learning can improve motivation, engagement, and overall learning results. The strategy attempts to promote a more productive and inclusive educational environment by giving learners content and experiences that are in line with their individual qualities.

Finally, adaptive educational pathways provide effective and tailored learning opportunities. They increase engagement and skill learning by customizing the pace and content to each learner's needs. By encouraging lifelong learning and guaranteeing that students flourish in dynamic, knowledge-driven environments, adopting these innovative approaches can revolutionize education.

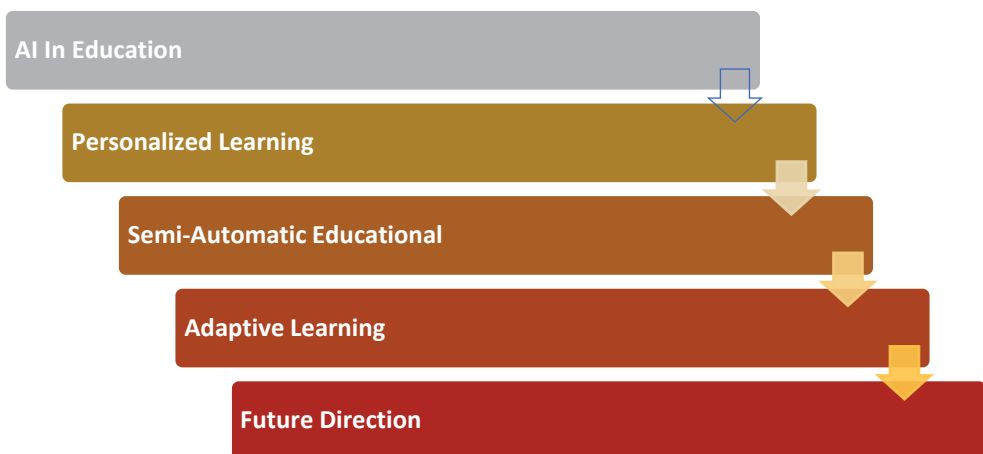


Figure 1. Workflows related to AI in Education

Sources: Own work.

2.2. Playful Learning and its Pedagogical Benefits

Playful learning is a learning strategy that includes elements of play and exploration into the learning process to improve engagement, motivation, and knowledge acquisition. Play has traditionally been regarded as essential to human development and development (Whitton, 2018). Play-based learning is learning that occurs during play, also known as learning by play or fun learning (Danniels & Pyle, 2022; Parker et al., 2022). Exclusionary pedagogy” is a term used to describe teaching methods or practices that intentionally or unintentionally exclude specific groups or persons from the educational process (Raji et al., 2021).

Despite a huge body of research emphasizing the benefits and relevance of play in the field of care and education for young children, our understanding of playful learning among adults, particularly in teacher education programs, has been severely limited (McArdle et al., 2019). It is not enough to understand the theoretical underpinnings of play to successfully implement play pedagogy in early childhood settings. Pre-service teachers should have sufficient opportunities in beginning teacher education programs to learn about play, investigate the play-based curriculum, experience playful learning, and practice play pedagogy in order to encourage play among young learners (Canaslan-Akyar & Sevimli-Celik, 2022).

A powerful educational strategy that multiplies its pedagogical advantages is provided by playful learning when integrated with the capabilities of artificial intelligence (AI). Aslan et al. (2022) investigate collaborative and immersive play-based learning experiences for children. The researchers are looking into the usefulness of a system called “Kid Space,” which is intended to assist learning through playful and interactive activities in a multi-modal and immersive environment. Ng et al. (2022) investigate the use of digital narrative writing as an instructional strategy for developing AI literacy in primary school children. Ng et al. (2022) explore the use of digital narrative writing as an instructional strategy for developing AI literacy in primary school children. Gibert and Schneider (2022) concentrate on the creation and application of a platform targeted at enticing young people into STEM fields (Science, Technology, Engineering, and Mathematics). The platform uses robots and artificial intelligence (AI) in a creative way to encourage interest in and education about these fields.

AI integration with playful learning has the potential to completely reshape education as we know it, making it more learner-centered, efficient, and pleasurable.

2.3. Inclusive Education and the Role of AI

Regardless of a learner’s talents, background, or differences, inclusive education refers to a pedagogical method that tries to meet their different needs (Jungjohann & Gebhardt, 2023). A “procedure that helps beat barriers” to students’ enrolment, engagement, and academic performance is “inclusive education” for all young people, especially those who have historically been overlooked and those who have disabilities (UNESCO, 2017) .

AI has huge potential to improve inclusive education by tailoring learning opportunities for different student populations. The study by Krasniqi et al. (2022) looks at

how assistive technology affects the independent living and inclusive education of people with Down syndrome. In the context of inclusive higher education for students with specific learning impairments, the study by Yenduri et al. (2023) examines the shift from assistive to metaverse technology. The study conducted by Han and Lee (2022) discovered that integrating a FAQ chatbot improved the learning experience for a wide spectrum of learners by offering immediate and individualized responses to their questions.

Finally, the symbiotic integration of AI into inclusive education has the potential to be transformative. AI's individualized adaptations, assistive technology, and cross-cultural bridges help different pupils learn better. The importance of ethical vigilance cannot be overstated. As artificial intelligence advances, appropriate implementation offers a more equitable and accessible educational landscape.

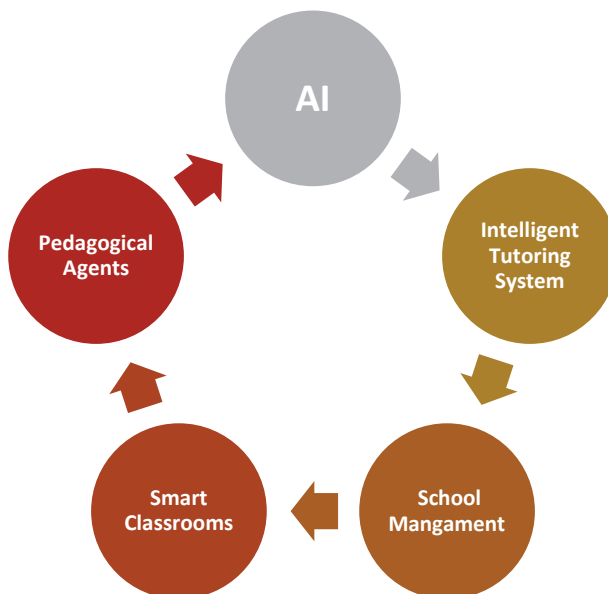


Figure 2. Application of AI in Education

Sources: Own work.

2.4. Technological Implementation and Challenges

Through virtual platforms, technology in education improves engagement and flexibility. However, there are challenges related to universal access, data privacy, and bias mitigation. Tools for artificial intelligence (AI) are continually being made available to the general population. Even if technology has the potential to transform education, there are still a lot of difficulties for academics and practitioners who work with related systems or activities (Kay & Kummerfeld, 2019). This presents a variety of potential and problems for education, primarily for teachers and students, as with all new technical developments (Foltynek et al., 2023). AIED is an “extremely technology-dependent and multidisciplinary field” by definition (Hwang et al., 2020).

The technologies built on artificial intelligence can be quite useful when utilized by experts, and they can also help students when used appropriately. However, if students choose this possibility, it may be able to substantially reduce effort by using artificial intelligence to provide better job results (Cotton et al., 2023).

In AI-driven education, address issues regarding data gathering and storage. The study Kamalov et al. (2023) talk about the difficulties with data security and privacy in healthcare settings and offer solutions to these problems. Using generative AI in education raises important questions about data privacy and security. The application of AI in education creates a lot of information about students, including their academic success, preferred methods of learning, and personal details. Making sure the data is kept and handled ethically and properly is vital (Su & Yang, 2023).

Across fields, including medicine, human resources management, and sports performance analysis, there are on-going discussions in the literature about the ethics of data exploitation in decision-making and interventions. (Araújo et al., 2021; Farris et al., 2021; Jalal et al., 2021; Reddy et al., 2020; Tambe et al., 2019). More emphasis has been called for on enforcing ethical standards for AI systems in order to better match them with social values, according to educators, students, parents, AI developers, and lawmakers (Berendt et al., 2020; Hagendorff, 2020; Nigam et al., 2021).

Ensuring equity and justice in AI-generated educational content is a complex task that necessitates a diverse strategy inspired by the dual goals of utilizing the benefits of AI while preventing the spread of bias and inequity (Kenwright, 2023).

Another issue is that, as students become increasingly dependent on automated tools to complete their work, the usage of generative AI may result in deterioration in their writing and critical thinking abilities (Warschauer et al., 2023). According to some researchers, this might have a detrimental effect on educational quality and eventually affect students' learning outcomes (Chan, 2023; Chan & Lee, 2023; Zhai, 2022). In the light of above literature adoption of new technologies is a complex and revolutionary process. It necessitates thorough planning, flexible tactics, and a strong understanding of potential difficulties. Assuring that innovation leads the path for increased efficiency and advancement requires proactive problem-solving and a collaborative approach.

Table 1. AI in Education – Impacts and Challenges

Aspect	Impact	Challenge
Personalization	Improved engagement and comprehension	Data privacy and ethical considerations
Semi-Automation	Efficient teaching, adaptive learning paths	Over-reliance on AI, potential decline in critical thinking abilities
Adaptive Assessment	Individualized learning experiences	Equity in AI-generated content, balancing automation with human interaction

Source: own work.

2.5. Future Directions and Possibilities

Artificial intelligence (AI) integration in education offers opportunities for the future and ensures inclusive and engaging learning environments. One approach is to use immersive technology, such as augmented reality (AR) and virtual reality (VR). These technological advancements can offer dynamic and engaging experiences that let students participate more fully with the educational material (Mystakidis, 2019). Advanced adaptive algorithms could also take AI-powered customisation to new heights. These algorithms would combine real-time data from wearables and sensors in addition to taking into account different learning preferences and styles. According to Tapalova and Zhiyenbayeva (2022), this might result in highly individualized learning paths that adjust in real-time to a student's cognitive and emotional states. Deploying ethical AI will continue to be important in these advances. It will be crucial to strike a balance between automation and human contact while also guaranteeing justice and openness in algorithmic decision-making (Shulner-Tal et al., 2023). As AI develops, interdisciplinary cooperation among AI scientists, educators, psychologists, and designers will be essential to developing cutting-edge, interesting, and inclusive AI-powered learning environments. The potential for AI in education to transform both teaching and learning makes this field of study intriguing to explore.

2.6. Conclusion

Finally, the convergence of artificial intelligence (AI) with education offers a transformative opportunity for building entertaining and inclusive learning environments. AI technologies are making personalized educational pathways that adapt to individual learning styles and needs increasingly achievable. The combination of playful learning and individualized instruction has enormous potential to improve engagement, comprehension, and retention across a wide range of learners. However, as we embark on this exciting journey, ethical issues must be prioritized to ensure fairness, openness, and the protection of students' data and privacy. Collaboration among educators, engineers, and policymakers is critical for effectively harnessing AI's capabilities and creating a healthy balance between automation and human engagement. Cultivating a responsible AI integration ecosystem can pave the way for an inclusive and intellectually exciting educational landscape that empowers learners for future generations of learners.

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PREFACE. ENHANCING STUDENT FLEXIBILITY AND ENGAGEMENT IN ONLINE HIGHER EDUCATION: THE IMPACT OF INSTRUCTOR-CREATED VIDEO MATERIAL

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Over the past few years, there has been a significant growth in online higher education, resulting in an unprecedented degree of flexibility and accessibility for a diverse range of students.

However, the challenge lies in creating an interactive and personalized educational experience that caters to the needs of modern students, particularly those belonging to younger age groups.

This article examines the benefits of educators creating their own video content to enhance the degree of personalization and interaction they have with their students inside the online higher education setting.

Educators possess the capability to provide timely learning experiences that cultivate stronger relationships and effectively resonate with learners who have been raised in a digital milieu through the utilization of video technology.

This article examines the potential advantages associated with the creation of video material by educators. The advantages encompass enhanced engagement between students and teachers, heightened understanding and memory retention, as well as the development of critical thinking skills.

Furthermore, the article examines the potential challenges associated with personalized, video-based education and proposes feasible strategies to address these issues. This ensures that instructors may effectively harness the complete benefits of this educational approach.

The fast advancement of technology and the internet has transformed both the methods of delivering education and the platforms via which it may be accessed.

Many individuals seeking a more adaptable and convenient educational experience often opt for online higher education as a viable alternative.

However, the lack of personalization in traditional online courses sometimes fails to match the expectations of contemporary students, who are accustomed to highly interactive and customized digital and physical experiences.

The utilization of instructional videos created by educators presents a feasible solution to address this disparity and establish an educational setting that is characterized by personalized and captivating learning experiences for students.

In traditional educational settings, instructors possess the capacity to adapt their teaching methodologies based on the real-time feedback provided by students through their comments and inquiries.

The challenge associated with delivering online education lies in the necessity to mimic the level of responsiveness typically found in traditional educational settings. Educators are empowered by video lessons created by themselves, since they enable them to customize their training to cater to the specific needs of their students, while simultaneously providing up-to-date and relevant material.

Educators can enhance the linkage between theoretical ideas and practical applications by incorporating illustrative examples, stories, and real-world experiences into their instructional approach.

This instructional approach facilitates students' comprehension of the subject matter and sustains their engagement.

The utilization of video content facilitates teachers in showcasing their personality, passion, and expertise, thereby fostering the cultivation of a more robust teacher-student rapport.

Students find it more convenient to establish connections with teachers who exhibit authenticity and enthusiasm for their respective academic disciplines. The establishment of a personal connection fosters the development of a feeling of affiliation and communal identity inside the online educational setting, ultimately resulting in increased motivation and a more pleasurable learning encounter.

It refers to the practice of acquiring knowledge and skills precisely when they are needed, rather than through traditional, preemptive methods.

Students are able to conveniently access the educational materials at their own convenience due to the availability of video content created by their instructors.

This medium caters to a diverse range of learning preferences and schedules. The adaptability of online education aligns with the requirements of contemporary lifestyles and accommodates the many preferences of students opting for remote learning.

Learners possess the capability to actively interact with the educational material at their preferred time and location, hence yielding advantages to them, regardless of whether they are revisiting challenging subjects or exploring supplementary resources.

The younger cohorts have been raised in a digital environment characterized by uninterrupted connectivity and the ubiquity of many media platforms.

It is conceivable that conventional text-based resources may not effectively engage these learners to the same extent as dynamic and visually captivating video information. Educators can effectively capture and sustain the interest of individuals who are proficient in using digital technology by utilizing the potential of video content. This approach leads to improved retention of information and a more immersive learning encounter.

The cognitive benefits and advantages of analytical and critical thinking are significant.

The utilization of many sensory modalities during the consumption of video content enhances the cognitive processing and understanding of complex concepts. Enhancing the acquisition and retention of knowledge can be facilitated by the utilization of visual, hence catering to diverse learning preferences.

Educational videos curated by educators, incorporating animated visuals, graphical representations, and real-life illustrations, have the potential to facilitate a more profound comprehension of the subject matter among students.

The facilitation of critical thinking can be effectively achieved through the utilization of instructional video materials, wherein educators can present students with various scenarios that necessitate analytical thinking and decision-making processes.

Learners are motivated to employ their acquired knowledge in practical contexts by utilizing interactive elements such as quizzes, polls, and conversations, so enhancing their problem-solving aptitude.

This sort of dynamic engagement facilitates the enhancement of a learning process that is characterized by greater significance and profound change.

The process of generating video content may provide a formidable challenge for educators who lack familiarity with the field of video production. Nevertheless, the provision of suitable tools and resources, together with chances for professional growth, can enable educators to cultivate the necessary skills and produce engaging films with confidence.

The creation of high-quality videos necessitates a significant investment of time and work. Educators have the potential to mitigate the effects of this challenge by the use of more efficient protocols for content development, utilizing existing resources and own skills, and engaging in collaborative efforts with instructional designers or multimedia specialists.

It is imperative for educators to consider accessibility components such as closed captions, transcripts, and audio descriptions to ensure equitable access to knowledge for all students.

These enhancements not only provide assistance to students facing challenges, but they also contribute to the overall improvement of subject understanding and clarity. In the dynamic landscape of online higher education, the utilization of instructor-generated video content holds significant potential in enhancing personalization and fostering student engagement.

Educators possess the capability to create a learning experience that is timely and relevant for younger generations, fostering the development of critical thinking skills, by leveraging the unique attributes of video.

While it is true that difficulties may arise, they can be overcome via the implementation of strategic planning and ongoing professional growth.

Instructors who actively engage in the production of video content can foster a dynamic and engaged online learning environment. This educational setting provides students with the necessary resources to thrive in the era of digital technology.