Design of AI-Based Personalized Interdisciplinary Animated Micro-Courses

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Abstract. In the era of information, the development and application of artificial intelligence (AI) technology in the fields of data and graphics have provided decision-making support for various educational entities. In the field of education, animated micro-courses—known for their brevity, clarity, visual appeal, and high interactivity—facilitate the integration of multiple disciplines. These courses not only reduce students' cognitive load during interdisciplinary learning but also enhance their motivation and engagement[1]. AI-powered animated micro-courses can automatically generate content, customize learning pathways, and improve learning outcomes and personalized experiences through real-time feedback. AI technology not only increases the efficiency and quality of animation production but also enhances interdisciplinary teaching effectiveness through knowledge integration and personalized support. The study concludes that AI-driven personalized animated micro-courses hold significant potential for modern education, promoting the development of personalized learning and multimodal learning theories, while also providing essential practical support and theoretical foundations for future educational innovations.

Keywords: Artificial Intelligence; Animated Micro-Courses; Interdisciplinary; Personalized Learning

1 Introduction

With the rapid development of information technology, artificial intelligence (AI) is revolutionizing various industries at an unprecedented pace. This transformation is particularly significant in the field of education, where the integration of AI has greatly advanced the progress of personalized learning[1]. Interdisciplinary research that transcends traditional academic boundaries is widely regarded as key to the next generation of breakthroughs[2]. However, the integration of diverse knowledge systems and methodologies to enhance student learning continues to face numerous challenges. Conventional teaching frameworks often struggle to meet the demands of interdisciplinary courses, leaving students feeling confused when confronted with the merging of knowledge from different disciplines and making it difficult to build effective cognitive

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connections.From the perspective of constructivism, learning is a process of connecting new knowledge with prior knowledge through interaction with the environment. Cognitive load theory emphasizes reducing extraneous cognitive load to enhance learning outcomes. According to multimedia learning theory, the combination of visual and auditory channels during the learning process enhances students' ability to process information, effectively reducing cognitive load. Personalized teaching approaches, tailored to the unique needs, interests, and abilities of each learner, allow for the creation of customized learning paths and materials. By leveraging the vivid and engaging characteristics of animation, complex theories can be transformed into intuitive visual information, helping students reduce cognitive load while strengthening their understanding of abstract concepts, thereby improving the quality and effectiveness of learning.AI-powered data analysis enables real-time tracking of students' learning activities, cognitive states, and personal preferences, allowing for the automatic generation of learning materials tailored to each individual[3]. This intelligent learning support system is increasingly becoming a key pillar in the modernization of education.

The innovation of this study lies in the combination of AI technology with animated micro-courses. By focusing on personalized design, interdisciplinary integration, and student learning outcomes, the study aims to create animated micro-courses that meet the educational needs of various disciplines.

2 Applied Research

Early research indicates that human attention tends to be sustained for approximately 10 to 15 minutes, after which it begins to decline. In response to this, animated micro-courses, as an emerging teaching method, offer a visually engaging and comprehensible way to present abstract and complex theoretical concepts from various disciplines. These courses help students more easily grasp learning content through vivid visuals, thus increasing their motivation to learn. Animated micro-courses not only deepen students' understanding of abstract concepts but also facilitate the integration and consolidation of interdisciplinary knowledge through multisensory learning experiences. In the past, the complexity of animation production limited its widespread use across disciplines, as even professionals required substantial time to create animations. However, with advancements in AI, particularly in graphic computation, computer vision, and natural language processing, rapid design and production of animations have become feasible[4]. Below is a discussion of the application of AI and animated micro-courses in interdisciplinary education.

2.1 The Role of Animated Micro-Courses in Interdisciplinary Education

2.1.1. Promoting Interdisciplinary Knowledge Integration.

In interdisciplinary education, students frequently face challenges in acquiring and integrating knowledge from multiple disciplines, as they need to synthesize information from various fields and apply it in practice. Animated micro-courses offer unique educational value in this context. By visualizing core theories from different disciplines,

they effectively promote students' understanding of the intrinsic connections between fields, enhancing their ability to integrate knowledge.

2.1.2.Reducing Cognitive Load in Interdisciplinary Learning.

Given that interdisciplinary education involves multiple disciplines and advanced theories, students often experience cognitive overload, which can hinder learning outcomes. By presenting difficult and abstract theoretical knowledge through engaging and comprehensible animations, animated micro-courses effectively reduce cognitive load, allowing students to process and understand complex information more easily and fluently.

2.1.3.Enhancing Student Motivation and Engagement.

Interdisciplinary education, which involves knowledge from various fields, can be highly challenging and demanding, leading to a decline in students' motivation and engagement. By integrating animation into micro-courses, educators can reignite students' interest and enthusiasm through lively and engaging presentations, thus fostering greater participation.

2.1.4.Interactive Learning Experience.

Compared to traditional teaching models, animated micro-courses offer a more dynamic and interactive learning environment. By combining animation technology with interactive design, students can not only observe dynamic presentations of knowledge but also actively participate in interactive components within the animation, such as problem-solving and virtual experiments. This interactive approach significantly enhances the immersive learning experience and encourages students to actively engage in discovering and applying interdisciplinary knowledge[5].

2.1.5.Integration of Multimodal Information.

According to multimedia learning theory, students process information more effectively when stimulated by multiple sensory channels, such as visual and auditory cues[6]. Animated micro-courses, by incorporating multiple modes of information, condense complex disciplinary knowledge into a more accessible format. For example, in interdisciplinary courses that combine physics and mathematics, animated micro-courses use dynamic graphical models alongside voice-over explanations to help students intuitively grasp the application of physical laws and mathematical formulas. This approach significantly reduces cognitive load when students are dealing with interdisciplinary information.

2.1.6.Progressive Content Presentation.

Through the use of AI technology, animated micro-courses can progressively present course content in phases, gradually increasing the complexity of the learning material. This staged approach allows students to first master foundational knowledge in one discipline before gradually transitioning to more advanced content in other fields.

For instance, in an interdisciplinary exploration of climate change, animated micro-courses could begin with basic meteorological concepts and then progressively introduce related theories from economics and policy studies, enabling students to absorb and integrate knowledge from different fields more seamlessly.

2.1.7. Providing Personalized Learning Support.

Given the broad scope of knowledge involved in interdisciplinary fields, individual differences among students can significantly affect learning outcomes. By combining animated micro-courses with AI technology, personalized learning support can be tailored to each student's learning abilities, disciplinary background, and cognitive style. This approach provides customized assistance, helping students more effectively navigate the challenges of interdisciplinary learning.

In interdisciplinary education, animated micro-courses offer a unique approach to promoting the integration of knowledge from multiple disciplines. Through their interactive features and personalized support, these courses enhance student motivation and reduce cognitive load. As AI technology continues to advance, the use of animated micro-courses in interdisciplinary education is expected to become more widespread and profound, offering new opportunities for innovation in educational models.

2.2 The Role of AI in the Production of Animated Micro-Courses

In recent years, artificial intelligence (AI) technology has become widely adopted across various fields, prompting fundamental changes in teaching models and course content, particularly in education. The integration of AI into animated micro-courses has not only reshaped the creation process but also enhanced personalized teaching, interactive experiences, and educational effectiveness. The following section further analyzes the impact of AI technology on the production of animated micro-courses.

2.2.1. Automated Animation Content Generation.

Traditional animated micro-course production is a labor-intensive process, requiring animators to create each frame manually, design scenes, set up characters, and implement dynamic effects. This process is not only time-consuming but also heavily dependent on various software tools and creative input. The integration of AI technology has significantly streamlined this complex workflow. For instance, through the application of Generative Adversarial Networks (GANs), AI systems can learn from vast databases of animation styles and generate matching animation clips based on predefined instructional content frameworks. This advantage becomes particularly evident when handling repetitive tasks or producing large-scale content. Additionally, natural language processing (NLP) and computer vision technologies have the ability to convert text-based materials into visual images or animations. Educators only need to provide instructional texts, and AI can automatically generate corresponding animation scenes and characters. This automated production model not only increases the effi-

ciency of animation creation but also significantly reduces the technical barriers to content development, opening up opportunities for a broader range of educators to participate in the creation of animated micro-courses.

2.2.2. Personalized Animation Design.

AI's contributions to animation production extend beyond workflow automation. AI can also tailor animated micro-course content to the unique needs and preferences of each learner. Given the differences in students' learning habits and information-processing methods, AI can flexibly adjust the presentation format of the animation by analyzing learning behavior data. For example, the system can generate content rich in graphical information for visual learners, while for kinesthetic learners, it can design more interactive course elements to enhance the learning experience[3]. Additionally, personalization extends to content depth and complexity. Leveraging AI technology, animated micro-courses can dynamically adjust the difficulty level of instructional materials based on a student's grasp of the content. When the system detects that a student is struggling with a specific concept, it can intelligently supplement the lesson with additional explanations or related animated examples, ensuring the student fully comprehends and retains the material. This real-time, adaptive adjustment guarantees that each student progresses at their own pace, receiving the most appropriate guidance.

2.2.3. Improving the Efficiency and Quality of Animation Production.

In the process of producing animated micro-courses, AI technology significantly improves both efficiency and quality. For example, ChatGPT can be used to quickly generate or optimize course content and storyboards, while DeepBrain AI (for live-action styles) and DeepMotion (for 3D styles) enable rapid character generation, utilizing motion databases to animate characters. Tools like DALL-E 3 and MidJourney can generate personalized scenes tailored to the needs of the micro-course, while Lumen5 and DeepBrain AI produce smooth, natural video sequences that meet course requirements. Additionally, Kaedim and Masterpiece Studio can create 3D models necessary for course demonstrations. Finally, CapCut's AI features can assist teachers in quickly generating voiceovers, subtitles, and other time-consuming tasks.AI technology has further enhanced the efficiency of animation production, ensuring highly engaging and visually appealing content. This, in turn, helps students better grasp complex academic concepts through more intuitive and dynamic presentations.

2.2.4. Real-Time Feedback and Interactive Features.

AI-driven animated micro-courses incorporate interactive features that respond to students' progress in real-time. Through the analysis of student data and learning outcomes, AI systems can promptly address student questions and offer guidance on specific learning paths[4]. The course content is dynamically adjusted to meet the personalized learning needs of individual students.

2.2.5. Supporting Interdisciplinary Knowledge Integration in Animation Production.

In the implementation of interdisciplinary education, students are required to acquire knowledge from multiple academic domains[5]. AI provides powerful support in this regard. Through knowledge graphs and AI recommendation algorithms, systems can collect and structure related interdisciplinary content based on educational requirements and generate corresponding animation contexts. This significantly enhances the effectiveness of interdisciplinary education by allowing students to use animated micro-courses to comprehend the relationships between different fields of knowledge.

AI technology demonstrates multidimensional influence in the production of animated micro-courses, involving automated content generation, personalized interface design, streamlined and optimized creation processes, and enhanced interactive and feedback systems. It fosters the integration of interdisciplinary knowledge and is fundamentally reshaping the creation and outcome of animated micro-courses. AI has dramatically lowered the barriers to entry for producing animations, opening new possibilities for course innovation. As AI technology continues to advance, the future of animated micro-courses is expected to evolve toward greater intelligence, personalization, and efficiency, injecting new momentum into the transformation and progress of educational models.

3 Potential and Challenges

Personalized animated micro-courses are well-suited for widespread adoption and promotion across various educational platforms. By integrating personalized animated micro-courses into online learning environments, such as Massive Open Online Courses (MOOCs), a tailored learning experience can be created for each student. Through in-depth analysis of student behavior, platforms can dynamically match appropriate learning modules to individuals and provide personalized feedback[6].

Despite significant breakthroughs in the design and implementation of personalized animated micro-courses, several issues remain underexplored. First, future research should adopt longitudinal study designs to track the long-term effects of personalized micro-courses, especially concerning knowledge retention and sustained learning motivation. Second, the applicability and effectiveness of personalized designs in different cultural contexts need to be verified. Based on these findings, decisions regarding the broader application of personalized learning can be made. Finally, future research should explore how AI technology can be integrated with other cutting-edge educational tools, such as virtual reality (VR) and augmented reality (AR), to further enhance the interactivity and immersion of personalized learning experiences.

Future research should focus on optimizing the knowledge delivery model for interdisciplinary micro-courses, particularly in enhancing the structure and flow of the content. This can be achieved by involving more experts and scholars from various academic fields in the course design process. Additionally, given the diversity in cognitive characteristics among students from different disciplinary backgrounds, research should further explore how various combinations of disciplines affect the effectiveness

of personalized design strategies. This will allow for the creation of optimized design solutions for a wide range of interdisciplinary teaching contexts[7].

4 Conclusions

This study explores the application of AI-driven personalized animated micro-courses in enhancing learning outcomes, promoting interdisciplinary knowledge integration, and stimulating student motivation. From an academic perspective, this research advances the boundaries of personalized learning theory and multimedia learning theory[8], confirming the practical value of personalized animated micro-courses in interdisciplinary educational settings. From a practical standpoint, the research demonstrates how the integration of AI technology with multimodal learning resources expands the implementation of personalized teaching strategies, laying a solid foundation for future theoretical developments and practical innovations in the field of educational technology.

In summary, this research offers novel theoretical insights and practical support for the fields of personalized learning and interdisciplinary education. The future of educational technology will continue to revolve around AI, providing increasingly efficient, flexible, and targeted learning experiences for students[9].

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