

Using Generative AI to Develop Multimedia Video Teaching Materials for Nuclear Energy Science Education

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Abstract

This study investigated the feasibility of applying generative artificial intelligence to the development of multimedia video teaching materials for nuclear energy science education and established a systematic and reusable production workflow. The official website of the Nuclear Safety Commission and its official Facebook page were used as the primary information sources [1][2] to collect science communication materials related to nuclear energy and radiation. After organizing the collected materials, the researchers drafted preliminary narration scripts and then used ChatGPT to refine the wording and optimize the structure so as to improve clarity, readability, and audience comprehension. After the scripts were completed, Pictory AI was used to generate draft videos [3], and TTSMaker was employed to produce voice narration [4]. The final stage involved audiovisual integration, visual adjustment, and output production.

Keywords: generative artificial intelligence, nuclear energy science education, multimedia video materials, ChatGPT, Pictory AI, TTSMaker

1. Introduction

In recent years, issues related to atomic energy, radiation, and nuclear accidents have received considerable public attention. However, public understanding of these topics is often distorted by fragmented information, high technical barriers, and persistent misconceptions. For example, nuclear energy is frequently confused with nuclear weapons, and microwave heating is often mistakenly treated as equivalent to radioactive hazards. Likewise, inadequate basic scientific knowledge can lead to unnecessary panic when people

interpret information related to nuclear incidents. At the same time, radiation technologies are widely applied in agriculture, medicine, industry, and space exploration. Accordingly, science communication delivered in an accurate and accessible manner can enhance rational understanding and scientific literacy regarding nuclear energy issues.

With the rapid development of digital content, multimedia video materials have become an important medium for science communication. Compared with text-only materials, videos that combine narration, visuals, and pacing are more effective in transforming abstract or highly specialized scientific concepts into forms that are easier for the general public to understand. However, traditional production of video teaching materials typically requires substantial time and labor, including information collection, script writing, voice recording, visual asset selection, and editing. Therefore, improving the efficiency of science education material production through generative artificial intelligence has become an issue worth exploring.

The materials used in this study were obtained primarily from the official website of the Nuclear Safety Commission and its official Facebook page [1][2], which served as the knowledge foundation for the nuclear science communication videos. The official website provides relatively complete and traceable content through science communication sections, frequently asked questions, news releases, and outreach materials. In contrast, the official Facebook page presents information mainly through graphics, short texts, and infographic-style posts, which are more suitable for public communication and social media dissemination. By drawing on both sources, this study sought to ensure information credibility and traceability while maintaining accessibility and readability.

Against this background, the purpose of this study was to establish a generative AI-centered workflow for producing nuclear energy science communication videos and to evaluate its value for educational material development. Specifically, this study integrated official information collection, script writing and optimization, AI-based video generation, voiceover production, and audiovisual integration to develop a reusable model for multimedia teaching material production. Through the practical production of three thematic videos, the study also demonstrates the potential of this workflow for nuclear energy science education and provides a reference for future development of digital science communication materials.

2. Methodology

2.1 Data Sources and Topic Planning

The content of the multimedia teaching materials developed in this study was drawn mainly from the official website of the Nuclear Safety Commission and its official Facebook page [1][2]. The researchers first identified topics related to nuclear energy and radiation, then conducted keyword-based searches and content organization using official materials. Definitions, background information, common misconceptions, application examples, and risk communication messages were collected and integrated from multiple pages and posts to form the basis for video development.

Two principles guided topic selection in this study. The first was thematic relevance, namely whether different pieces of information could collectively support a coherent science communication topic. The second was content complementarity, namely whether different sources could compensate for each other's limitations in terms of professional depth and expressive style. Based on these principles, three main topics were ultimately developed: "Effects and Applications of Radiation on Plants," "From Röntgen to Curie: How Radiation Science Changed Medicine," and "Does Irradiated Food Become Radioactive? Understanding Irradiation vs. Microwave Heating." These topics served as the principal outcomes presented in this study.

2.2 Script Writing and Generative AI-Based Editing

At the script development stage, this study adopted a workflow that combined manual drafting with generative AI-assisted revision. The researchers first organized key points from official materials and prepared preliminary scripts and narration drafts. ChatGPT was then used to refine the language, reorganize paragraphs, and optimize expression. Its main functions included converting formal or technically dense statements into clearer and more accessible language, improving transitions between paragraphs to strengthen narrative coherence, and removing repetitive or overly long expressions in order to improve the rhythm and clarity of video narration.

To ensure that the content did not deviate from official information, ChatGPT was restricted to rewriting and polishing rather than generating new knowledge. In other words, all input content was based on key points organized from official Nuclear Safety Commission materials, and the model was instructed not to add unverified information, definitions, or numerical data. After revision, the researchers cross-checked the scripts

against the original sources to confirm the accuracy of key terms, basic concepts, and core statements before proceeding to the next stage.

2.3 Video Generation and Voiceover Production

For video generation, this study used Pictory AI as the principal platform for video creation and editing [3]. Completed narration scripts were imported into the system, which automatically segmented scenes based on the text and matched them with corresponding visual materials to produce an initial video draft. This approach substantially reduced the time required for conventional scene-by-scene editing and improved production efficiency.

For voice narration, TTSMaker was employed [4]. The narration scripts were entered into the system, and parameters such as language, voice style, speaking rate, and output format were adjusted according to the target audience and content needs in order to generate audio suitable for science communication videos. Compared with manual recording, this method made it possible to regenerate narration rapidly whenever the script was revised, thereby improving both convenience and consistency in material updates.

2.4 Audiovisual Integration and Visual Adjustment

During the audiovisual integration stage, voice files generated by TTSMaker were named according to topic and segment, then imported into Pictory AI [3][4] and matched sequentially to the corresponding scenes to ensure consistency between narration and visual storytelling. If automatically selected visuals did not adequately reflect the content of a segment, the researchers manually replaced and adjusted them. The adjustment procedure involved extracting the key concept of the segment, searching for suitable materials using English keywords, and selecting visuals that more accurately represented the intended meaning.

Overall, the workflow established in this study can be summarized as follows: official information collection → script writing and optimization → AI-based video generation → voiceover integration → final adjustment and output. This workflow combines content credibility, production efficiency, and repeatability, and thus constitutes the core methodological framework of the study.

3. Results and Discussion

3.1 Effects and Applications of Radiation on Plants

The first video produced in this study addressed the topic “Effects and Applications of Radiation on Plants.” The video explains how different types of radiation may lead to DNA damage, reduced photosynthetic efficiency, and increased oxidative stress in plants, and further introduces plant repair and protective mechanisms as well as the applications and limitations of radiation in contexts such as agricultural improvement, contaminated environments, and space agriculture. Through this topic, the video not only presents the potential effects of radiation but also helps viewers understand that the relationship between radiation and biological response is not a simple matter of harm; rather, it depends on radiation type, dose, exposure pathway, and application context. A representative frame from the completed video is shown in Figure 1.



Figure 1. Effects and Applications of Radiation on Plants

The educational significance of this topic lies in challenging the common one-sided perception that radiation is solely harmful and in helping viewers recognize its practical applications in agriculture and environmental research. Presenting this content in video form also helps transform relatively abstract concepts—such as plant physiological responses, dose concepts, and risk thinking—into narratives that are easier for general audiences to understand.

3.2 From Röntgen to Curie: How Radiation Science Changed Medicine

The second video focused on “From Röntgen to Curie: How Radiation Science Changed Medicine.” Through the scientific work of key figures such as Wilhelm Röntgen, Marie Curie, and Irène Joliot-Curie, the video outlines the historical development of X-ray discovery, radioactivity research, and artificial isotope production, and further connects these milestones to applications of radiation science in medical imaging, battlefield medicine, scientific research, and treatment. A representative frame from the completed video is shown in Figure 2.



Figure 2. From Röntgen to Curie: How Radiation Science Changed Medicine

Compared with simple factual explanation, this video places greater emphasis on the spirit of scientific inquiry, experimental verification, and the social value of scientific applications. By presenting the topic through scientists' life stories, viewers can better understand major milestones in radiation science while also developing a broader appreciation of scientific methodology and medical technological progress. For nuclear energy science education, this kind of historically contextualized video can help enhance audience engagement and learning motivation.

3.3 Does Irradiated Food Become Radioactive? Understanding Irradiation vs. Microwave Heating

The third video addressed the topic “Does Irradiated Food Become Radioactive? Understanding Irradiation vs. Microwave Heating.” This video focuses on a common social misconception in which food irradiation and microwave heating are treated as the same concept. The video explains the differences between the two in terms of mechanism, function, and safety implications: food irradiation uses high-energy treatment to suppress bacteria, mold, and pests in order to improve food safety and preservation, whereas microwave heating uses electromagnetic waves to make water molecules vibrate and generate heat. Thus, the two differ substantially in both purpose and mechanism. The video also extends the discussion to spice treatment and agricultural applications, thereby helping audiences connect food safety, radiation technology, and everyday experience. A representative frame from the completed video is shown in Figure 3.



Figure 3. Does Irradiated Food Become Radioactive? Understanding Irradiation vs. Microwave Heating

The value of this topic lies in addressing one of the public’s most common everyday questions, allowing science communication to move beyond abstract theory and inform practical understanding. By breaking down misconceptions into clearly comparable

concepts, the video can more effectively reduce fear-based misunderstanding and improve audiences' ability to distinguish scientific information.

3.4 General Discussion

Taken together, the production experiences of the three videos indicate that generative artificial intelligence has clear practical benefits for the development of multimedia video materials for nuclear energy science education. First, during script preparation, ChatGPT helped transform original official materials into narration that was more conversational and coherent, thereby reducing the workload associated with textual revision. Second, during video generation and voice production, Pictory AI and TTSMaker enabled rapid creation of draft visuals and narration output [3][4], which made the overall production process more efficient. Third, subsequent manual verification and visual adjustment by the researchers helped preserve both credibility and presentation quality while still benefiting from improved efficiency.

However, this study also shows that generative artificial intelligence cannot completely replace human involvement in educational material production. In particular, for specialized and sensitive topics such as nuclear energy and radiation, AI-generated content must still be grounded in credible sources and verified through manual checking and fact comparison to ensure accuracy. In addition, automatically matched visual materials may not fully align with the script content and therefore require post-production correction. In this sense, generative artificial intelligence is better understood as an efficiency-enhancing support tool rather than as a fully autonomous producer of educational content.

Overall, the workflow established in this study shows that when official information, generative AI tools, and manual verification mechanisms are properly combined, multimedia video materials for nuclear energy science education can be produced within a relatively short period while maintaining knowledge value, audience appeal, and communication effectiveness. This model is not limited to nuclear energy topics and also has potential for extension to science education and communication in other scientific domains.

4. Conclusion

This study successfully applied generative artificial intelligence to the development of multimedia video teaching materials for nuclear energy science education and established a

workflow centered on official information collection, script writing and revision, video generation, voice narration production, and audiovisual integration. The results show that the integrated use of ChatGPT, Pictory AI, and TTSMaker [3][4] can effectively improve the efficiency of developing nuclear energy science education materials, reduce teachers' workload in information organization, textual editing, voice recording, and video editing, and enhance the diversity, attractiveness, and comprehensibility of the resulting teaching materials.

In addition, the workflow developed in this study demonstrates a certain degree of repeatability and practical flexibility. Researchers can continue to develop nuclear energy science communication videos on different topics by following the same model, making video material production less dependent on highly labor-intensive traditional procedures. Instead, generative artificial intelligence can be used to produce a rapid first draft, which can then be professionally checked and refined by human editors. This approach not only improves the efficiency of promoting nuclear energy science education but also increases the speed of updating materials and their potential for dissemination through social media.

In conclusion, this study confirms that generative artificial intelligence can serve as an effective support tool for developing multimedia video teaching materials for nuclear energy science education. Future work could further strengthen this approach by incorporating systematic topic series planning, clearer source attribution, audience feedback collection, and visual asset management mechanisms, thereby improving the completeness, credibility, and instructional value of the materials. Moreover, the workflow developed in this study can be extended to multimedia science communication materials in other scientific fields, thereby broadening the application of generative artificial intelligence in educational communication and public science outreach.

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