



## ATOMIC ANIMATION: UNCOVERING THE PROCESS OF CREATING ANIMATION WITH ARTIFICIAL INTELLIGENCE

## ANIMAÇÃO ATÔMICA: DESCOBRINDO O PROCESSO DE CRIAÇÃO DE ANIMAÇÃO COM INTELIGÊNCIA ARTIFICIAL

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Michele Batista dos Santos<sup>1</sup>   
State University of Campinas

Estéfano Vizconde Verasztó<sup>2</sup>   
Federal University of São Carlos

**Abstract:** This article describes the process of developing an educational animated film using two artificial intelligences (AI): Eleven Labs and Adobe Express. The film was based on the children's book entitled "The Others Are Us", which was prepared as part of a master's thesis by the author with the aim of promoting the understanding of chemical concepts, especially about radiation, in educational teaching. The book "The Others Are Us" was designed following the three axes proposed by Káplun for the creation of teaching materials: the content axis (which aims to transmit information), the subject axis (which takes into account the characteristics and needs of students) and the axis of organization (which defines the structure and sequence of the material). The work seeks to make learning complex chemistry concepts more accessible and engaging for students, using a narrative and playful approach. In the process of adapting to the animation format, AI Eleven Labs and Adobe Express played crucial roles. Eleven Labs was used to assist in script creation and dialogue generation, while Adobe Express contributed to the production of visual elements and animations. The combination of these technologies allowed the creation of a high-quality animated film, with solid and visually attractive educational content. The end result is an innovative educational resource that uses the advantages of AI to make chemistry learning more dynamic and engaging. The animated film based on the book "The Others Are Us" represents a new approach to teaching science, effectively integrating technology and storytelling to stimulate student interest and understanding.

**Keyword:** Animation; Chemistry Teaching, Artificial Intelligence.

**Resumo:** Este artigo descreve o processo de desenvolvimento de um filme de animação educacional utilizando duas inteligências artificiais (IA): Eleven Labs e Adobe Express. O filme foi baseado no livro infantil intitulado "Os Outros Somos Nós", elaborado como parte de uma dissertação de mestrado do autor com o objetivo de promover a compreensão de conceitos químicos, especialmente sobre radiação, no ensino educacional. "Os Outros Somos Nós" foi desenhado seguindo os três eixos propostos por Káplun para a criação de materiais didáticos: o eixo conteúdo (que visa transmitir informações), o eixo disciplina (que leva em consideração as características e necessidades dos alunos) e o eixo de organização (que define a estrutura e sequência do material). O trabalho busca tornar o aprendizado de conceitos complexos de química mais acessível e envolvente para os alunos, utilizando uma abordagem narrativa e lúdica. No processo de adaptação ao formato de animação, a IA Eleven Labs e o Adobe Express desempenharam papéis cruciais. O Eleven Labs foi utilizado para auxiliar na criação de roteiros e geração de diálogos, enquanto o Adobe Express contribuiu na produção de elementos visuais e animações. A combinação dessas tecnologias permitiu a criação de um filme de animação de alta qualidade, com conteúdo educacional sólido

<sup>1</sup> PhD student in the Graduate Program in Education at the State University of Campinas. Email: [contatomichelebatista@gmail.com](mailto:contatomichelebatista@gmail.com)

<sup>2</sup> Physicist and PhD in Education, Science, and Technology from the State University of Campinas, with a research stay at the Complutense University of Madrid. Adjunct Professor at the Federal University of São Carlos in the Department of Natural Sciences and Mathematics. Permanent faculty member of the Graduate Program in Science and Mathematics Education. Lecturer in the Graduate Program in Education and collaborator at the School of Education of the State University of Campinas. Email: [estefanovv@ufscar.br](mailto:estefanovv@ufscar.br)

e visualmente atrativo. O resultado final é um recurso educacional inovador que utiliza as vantagens da IA para tornar o aprendizado de química mais dinâmico e envolvente. O filme de animação baseado no livro “Os Outros Somos Nós” representa uma nova abordagem ao ensino de ciências, integrando eficazmente a tecnologia e a narração de histórias para estimular o interesse e a compreensão dos alunos.

**Palavras-chave:** Animação; Ensino de Química; Inteligência Artificial.

## INTRODUÇÃO

This article aims to introduce an animated film created for educational purposes utilizing artificial intelligence. The foundation of this film rests upon a paradidactic book developed as part of the author's master's thesis. Serving as the inspiration for the film's script, this children's book, crafted during the pursuit of the author's master's degree, provided the narrative backbone. Educational films hold significant importance in the realm of education, offering immersive visual experiences that complement traditional teaching methodologies. They possess the capacity to ignite curiosity and captivate students, rendering intricate concepts more accessible and comprehensible. Furthermore, films can vividly depict historical, scientific, and cultural occurrences, furnishing context and enriching students' comprehension. By fostering imagination and creativity, educational films serve as catalysts for students to delve into new subjects and viewpoints (CAMPOS, 2020).

Educational science films serve as invaluable tools for teaching science as they facilitate the transformation of abstract concepts into tangible, visual representations. By presenting natural phenomena, biological processes, significant discoveries, and scientific theories in an engaging and accessible manner, these films enrich the learning experience. Moreover, they augment students' understanding by showcasing experiments and demonstrations that may be challenging to replicate within a classroom setting. Through the seamless integration of entertainment and education, educational science films kindle students' curiosity in science, motivating them to delve deeper into scientific principles (CAMPOS, 2020; SANTOS, 2021).

The focal point of the film is radiation, encompassing a plethora of crucial topics ranging from fundamental radiation principles to its diverse applications in medicine, industry, and research. Various forms of radiation, including ionizing and non-ionizing radiation, are elucidated, alongside discussions on their impacts on both humans and the environment. Additionally, the film delves into the ethical and societal ramifications associated with radiation usage, addressing concerns such as the risks of overexposure and the requisite safety protocols to safeguard the public. By offering a comprehensive and well-balanced perspective, the film facilitates a nuanced understanding of the subject matter, empowering viewers to comprehend the inherent benefits and challenges therein (SANTOS, 2019; 2021).

Paulo Freire (1984) explains the importance of media as an educational and awareness tool. He argued that media can be used not only to transmit information but also to stimulate critical reflection and dialogue among individuals. Freire emphasized the need for an educational approach that goes beyond the simple reproduction of media content and promotes the ability to analyze, question, and interpret the messages conveyed by the media.

The authors discuss how media education can contribute to the formation of more critical, participatory citizens capable of understanding and acting consciously in society. It emphasizes the importance of addressing significant social issues and encourages democratic debate, prompting students to actively participate in knowledge creation. Freire also emphasized the need for a pedagogical approach that recognizes the cultural and social diversity of students while also taking into account the different forms of language and expression found in the media. It provides teaching practices that are sensitive to students' experiences, encouraging them to actively participate in the learning process (FREIRE, 1984).

Simply put, media education offers in-depth reflection on the role of media in education and personal learning and advocates a critical and emancipatory approach that values dialogue, reflection, and transformative action. In this way, an educational and audiovisual tool can assist students in learning (FREIRE, 1984).

Russell (2011; 2021) argues that AI can serve as a positive force in addressing a variety of global issues, ranging from environmental challenges to social inequality. He explores the diverse ways in which AI can enhance people's quality of life and foster social progress.

Simultaneously, Russell (2021) warns about the associated risks of AI development, including ethical, security, and governance concerns. This underscores the significance of responsibly developing and utilizing artificial intelligence, while considering the social and ethical implications of its applications.

Furthermore, the author delves into the concept of AI alignment, which entails ensuring that the objectives and values of AI systems align with human interests (RUSSELL, 2021). This proposes an approach to guaranteeing that AI systems are engineered to respect human interests and mitigate undesirable outcomes. Consequently, the film utilized the following Artificial Intelligence tools: Eleven Labs and Adobe Express. Eleven Labs is a free AI platform that facilitates audio recording with a humanized voice, while Adobe Express is an animation tool provided by Adobe for creating animations at no cost. Both platforms offer free access for non-commercial use.

The foundation for the film's script originated from the author's master's thesis, which focused on developing a paradigmatic book. To achieve this, the research integrated three core pillars proposed by Gabriel Kaplun: Conceptual axes, pedagogy, and communication, with a particular emphasis on addressing the needs of students with visual impairments.

The overarching goal was to understand the landscape of research in chemical education tailored for visually impaired students, leading to the creation of a novel and meaningful narrative within the field. Given the limited existing literature on radiation exposure for novices, the research aimed to fill this gap by developing educational materials that not only facilitated exploration of the subject matter but also enhanced overall learning potential.

The development process of the book aimed to achieve several specific objectives. Firstly, it sought to provide comprehensive and accessible learning tools that catered to diverse needs. Additionally, it aimed to bolster language and communication skills through engaging literary content. The pedagogical approaches employed in the book were rooted in theoretical foundations of the field, emphasizing the importance of practical application in educational settings. By aligning with theoretical frameworks and leveraging practical applications, the book aimed to expand its reach and contribute to inclusive education initiatives. Through this integrated approach, the research strived to enhance educational outcomes and foster a more inclusive learning environment (KAPLÚN, 2003).

"The Others Are Us" is a children's tale depicting the kingdom of fools, a grim realm inhabited by uniform beings under the rule of the king of fools. In this desolate kingdom resides Bo, weary of his existence in this place. However, everything changes when Bo encounters Marcha, a blind girl who has endured torment from Bo since moving into a supposedly haunted house. Marcha possesses a mysterious Braille book that holds the key to escaping the kingdom of fools, and only she can aid Bo in his quest. Initially, Bo and Marcha struggle to communicate, as Bo speaks the language of fools while Marcha speaks the language of science and knowledge. Nonetheless, they develop a new means of communication through Braille. As Marcha gradually introduces Bo to the world of science, he becomes increasingly skeptical of the king of fools' rhetoric and begins to comprehend Marcha's perspective, forsaking the language of fools. Bo's transformation is not merely internal; his outward appearance also undergoes a metamorphosis, evolving from a "monster" of the kingdom of fools into a human being. Through the exploration of the mysterious book, the duo uncovers a revelation that forever alters their lives.

"The Others Are Us" serves as a metaphor for intolerance and the disregard for science, casting those who do not embrace it as outcasts with perilous ideologies. Typically, such individuals are governed by cunning yet foolish figures. However, akin to Marcha's role in saving Bo through knowledge, science has the potential to transform the lives of those dwelling in ignorance (SANTOS, 2021, p. 74).

"Others Are Us" is a paradigmatic book created based on the axes proposed by Kaplun (2013). It emerged from bibliographical research and theoretical discussions, demonstrating the

feasibility of such an endeavor. Drawing inspiration from inclusive literature, the book strives to promote reflection on the impact of science on human beings while also addressing real societal situations.

The narrative follows Marcha's inclusive journey, depicting her as an independent girl who asserts her autonomy, accessibility, and social integration. Her family advocates for inclusive education, forming partnerships with schools to ensure quality education for Marcha. She exemplifies her fight for equal rights, emphasizing that tolerance is not merely an act of sympathy but a form of support for justice and the law. Marcha quickly integrates with João and his friends, initiating group activities to enhance learning opportunities. The creative process is deeply rooted in literature, enriched by thorough research and diverse readings, guided by Kaplún's principles. This approach ensures the book's educational value. Moreover, the author introduces a fresh perspective to the story, enabling exploration of its characteristics and didactic potential. The chosen scientific concept, rarely explored in paradigmatic literature, enriches the narrative and engages readers (SANTOS, 2021).

Regarding film categorization, definitions of feature films, short films, and medium-length films are standardized internationally in terms of duration. However, cultural and industrial differences may influence their application. In Europe, a feature film is typically at least 60 minutes long, while in the United States, it is often considered to be at least 40 minutes long. In Brazil, a feature film is generally recognized if it exceeds 70 minutes, according to ANCINE. Short films are generally up to 30 minutes long in Europe and Brazil, while in the United States, they are typically 40 minutes or less. The medium film category, less common and defined, may encompass films that fall between short and feature length, subject to organizational or contextual variations.

The exact definition of medium-length films may not be as standardized as the definitions of short and feature films in Europe, the United States, and Brazil. This classification often relies on local conferences, film festivals, or industry standards. In Brazil, the developed film is typically considered a medium-length film.

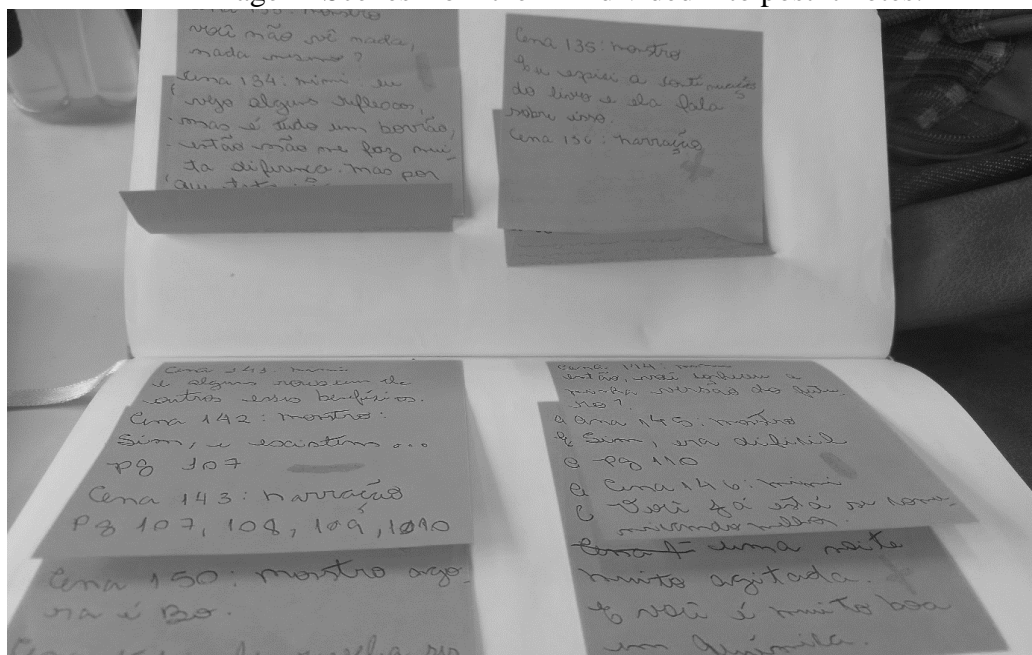
Building upon the preceding discussion, the objective of this work is to provide a detailed account of the development of an animated film titled "Lady K" and to explore its educational potential. The deviation in the film's title from that of the book is intentional, aiming to create a more captivating and fitting title that aligns well with the audiovisual medium.

## DEVELOPMENT

Initially, a comprehensive and detailed reading of the book "The Others Are Us" was undertaken. This aided in grasping the storyline, characters, main themes, and crucial elements to be incorporated into the film. Following the reading, an in-depth analysis of the plot was conducted, pinpointing key plot points, character development arcs, and noteworthy visual elements. Drawing from the analysis of the book, the process of crafting the film's script commenced. This entailed adapting the narrative to cinematic format, devising dialogue, structuring scenes, and shaping the overall narrative framework.

Once the script was finalized, or at least in its preliminary form, a meticulous storyboard was crafted. This facilitated visualization of how each scene would unfold on screen and enabled strategic planning of visual elements. Each scene was depicted on a post-it note and assigned a numerical identifier, laying the groundwork for subsequent dialogue recording and animation sequences, as depicted in the image below:

Image 1- Scenes from the film divided into post it notes.

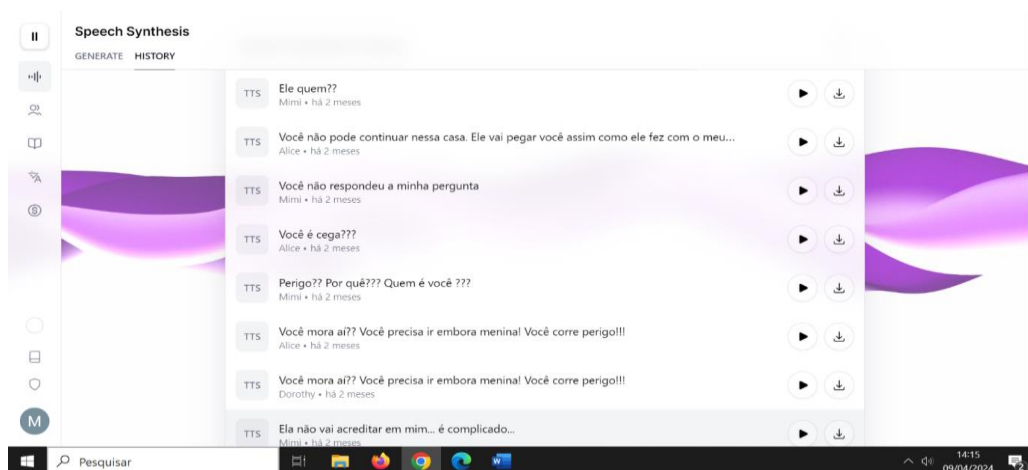


Source: Prepared by the author.

Eleven Labs (2024) was utilized for recording the dialogue of the film. This tool provides top-notch audio recording features, guaranteeing an exceptional listening experience for the audience. It allowed for the selection of characters' voices from a variety of options provided by artificial intelligence. Each voice was carefully chosen to align with the respective

character's personality. The dialogues were recorded individually and later synchronized during the editing process.

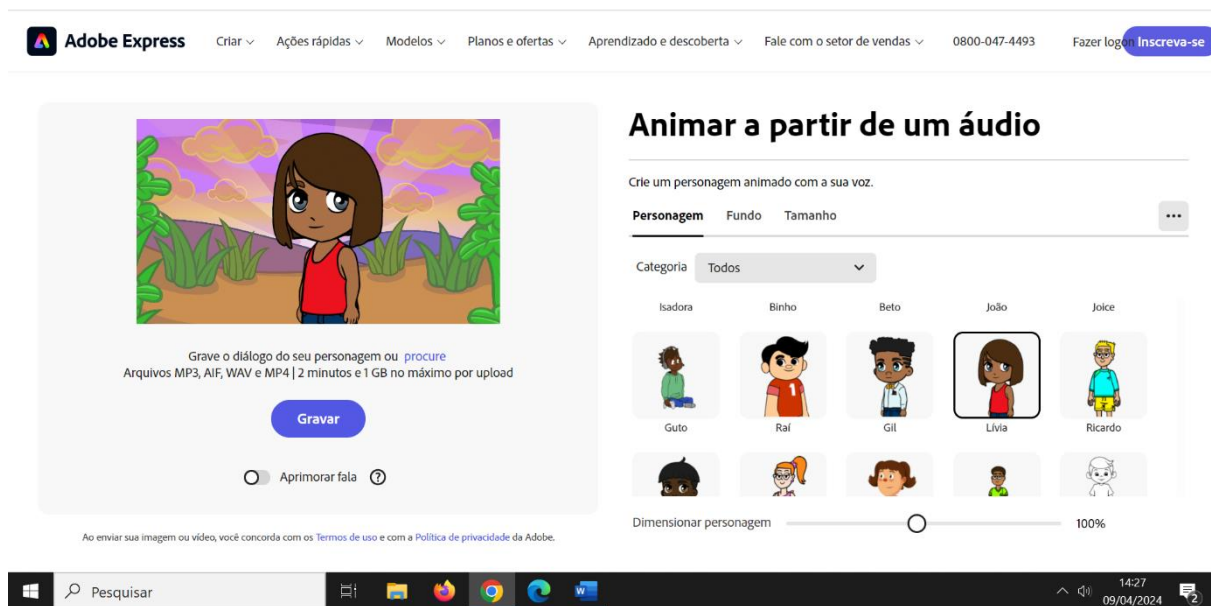
Image 2- Eleven Labs used to record audio for the film.



Source: ElevenLabs.

After the audio recordings were completed, Adobe software was employed to animate the film. Depending on the desired visual style, various tools from the Adobe Creative Suite were available for selection, including Adobe After Effects for 2D or 3D animations, Adobe Animate for traditional animations, or Adobe Premiere Pro for video editing purposes. In this instance, Adobe Express (2024) was utilized, generating animations optimized for YouTube and high-resolution output.

Image 3- Excerpt from the animation made in Adobe.



Source: Adobe Express.

Pixabay (2024), a free database for non-commercial purposes, was also utilized to source sound effects, pre-made videos, and images to enhance certain scenes in the film. This contributed to enriching the visual and auditory experience for the audience. Throughout the animation development process, considerable time was dedicated to character and environment design to ensure alignment with the book's vision and the intended visual style of the film. Canva served as the editing tool for the film, offering features to create and edit images, text, and visual elements. This facilitated the refinement of the film and the efficient addition of graphic elements. Multiple rounds of reviews were conducted to ensure that all aspects of the film were functioning as intended, with adjustments made as necessary based on feedback received. Once production was completed and all final revisions were incorporated, the film was prepared for release. A website was created to promote the film, providing free access to teachers, students, and the wider community. This ensures that the film is readily available for educational purposes and accessible to all interested parties.

The film was published on the research group's YouTube channel and can be watched here: <https://www.youtube.com/watch?v=WV256tek3Tw>

## RESULTS AND DISCUSSIONS

Considering the various elements involved in the film's production, one can anticipate a visually stunning cinematic piece, complete with a captivating narrative and well-crafted dialogue. Here are some reasonable expectations:



- i. The film is anticipated to capture the essence and key events of the book "The Others Are Us", maintaining fidelity to the source material.
- ii. Utilizing Adobe for animation and Canva for editing suggests that the film will likely boast a visually impressive aesthetic, featuring fluid animations, captivating character and environment designs, and polished editing.
- iii. Dialogue recording with Eleven Labs and the use of sound resources from Pixabay indicate that the film will offer high-quality audio, featuring clear dialogues and immersive sound effects that complement the visual experience.
- iv. The incorporation of Pixabay's resources allows for a wide array of visual elements, including images, videos, and special effects, which can enrich the narrative and viewer experience.
- v. With a script developed from an in-depth reading of the book, an engaging narrative is expected, complete with well-developed characters, exciting story arcs, and surprising twists that maintain audience interest from start to finish.
- vi. The film has the potential to evoke a range of emotions in viewers, from suspense and tension to moments of humor and reflection, providing an emotionally engaging cinematic experience.

Researchers are actively exploring the use of artificial intelligence (AI) in education and have provided valuable insights into its benefits and challenges. One of the most promising aspects of AI in education is its ability to personalize the learning experience for each student, including adapting curriculum content, learning activities, and teaching strategies based on individual needs, learning styles, and pace.

AI has the capacity to offer immediate and adaptive feedback to students, aiding in their understanding of progress, pinpointing areas of difficulty, and offering personalized guidance for improvement. This personalized approach can significantly enhance the effectiveness of teaching and learning.

Furthermore, AI can streamline repetitive administrative tasks like grading assessments, organizing educational materials, and managing student data. This automation enables educators to allocate more time to valuable activities such as lesson planning and engaging with students.

By analyzing extensive educational data, AI can uncover patterns, trends, and actionable insights into student performance, teaching efficacy, and factors influencing academic success.

Such insights empower educators to make informed decisions regarding teaching strategies and personalized interventions.

However, while the potential benefits of AI in education are substantial, there are ethical concerns and privacy issues surrounding the use of student data. Researchers are actively exploring methods to address these challenges, emphasizing responsible and transparent AI use.

In conclusion, researchers acknowledge the transformative potential of AI in education but stress the importance of addressing ethical considerations, ensuring equity, and safeguarding student privacy. As technology advances and new methodologies emerge, the educational landscape continues to evolve, offering exciting opportunities for innovation.

AI-generated animations can be tailored to accommodate diverse learners, including those with disabilities or special needs. Features such as automatic captions, language translation, and audio descriptions enhance inclusivity, ensuring equal access to educational content for all students.

Once an AI-powered animation is developed, it can be easily scaled and distributed to a large number of students at minimal additional cost. This scalability facilitates access to educational resources for students in remote or underserved areas.

Animations serve as powerful tools for visualizing complex concepts and processes, facilitating comprehension and retention of material. By integrating AI-powered interactive elements and simulations, animations further augment learning outcomes.

In essence, leveraging artificial intelligence to create animations has the potential to revolutionize education, offering personalized, engaging, and effective learning experiences for students across diverse backgrounds and ages. Through harnessing AI capabilities, educators can develop dynamic and accessible educational content, empowering students to thrive in novel and stimulating ways (KÁPLUN, 2003; SANTOS, 2021; FREIRE, 1984).

## CONCLUSION

From the preceding discussion, it can be inferred that the film has successfully fulfilled its primary objective of serving as a potent educational tool, aesthetically captivating while illustrating the impact of audiovisual elements on science education. The forthcoming stages entail widespread dissemination of the film across various age groups and its integration into elementary and high school curricula. This endeavor aims to generate more substantive data for this research initiative.

The application of artificial intelligence (AI) in chemistry teaching offers a variety of significant advantages. Firstly, AI systems can personalize teaching, adapting to each student's learning pace, offering materials and exercises suited to their level of understanding. Additionally, AI can provide immediate, individualized feedback, helping students correct errors and improve their understanding.

AI can also create interactive simulations and virtual experiments that allow students to explore chemical concepts in a practical and safe way, without the risks associated with traditional laboratory experiments. This increases student engagement and motivates them to learn.

Another advantage is AI's ability to analyze large data sets and identify patterns, which can help students better understand complex phenomena and make accurate predictions. Furthermore, AI systems can help create dynamic and up-to-date educational content, keeping teaching materials in line with the latest scientific advances.

AI can also be used to develop virtual assistants that provide personalized support to students by answering questions, providing additional explanations, and directing them to relevant resources. This helps to promote student autonomy in the learning process.

Additionally, AI can be integrated into online learning platforms, allowing access to chemistry content anytime, anywhere, which is especially useful for students who do not have access to traditional educational resources.

Another advantage is AI's ability to identify gaps in students' knowledge and provide targeted interventions to help them overcome these difficulties. This can significantly increase the effectiveness of chemistry teaching, ensuring that all students receive the support they need to succeed.

In short, artificial intelligence offers a variety of advantages in chemistry education, including personalization, immediate feedback, interactive simulations, data analysis, virtual assistance, remote access to content, and identifying and bridging gaps in knowledge. These combined advantages have the potential to significantly improve the quality and reach of chemistry education.

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