

# The Use of Animations in the Educational Process

*Tibor Szabó<sup>1</sup>, Rastislav Žitný<sup>2</sup>*

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## Abstract

Appropriate instructional illustrations represent active elements in the educational process and play a significant role in supporting learners' understanding of subject matter. Animated visualizations may be used in traditional classroom instruction, distance learning environments, or blended and flipped classroom models. The visual impact of animations can function as a motivational factor while simultaneously supporting individual learning pace, which is an important consideration in contemporary education.

Although numerous ready-made animations are available online, they are not always freely accessible and are often limited by language, level of detail, or relevance to specific instructional objectives. In some cases, available materials may be either overly simplified or excessively complex for a given topic. Consequently, the creation of custom-made animations may offer a more effective solution. Recent developments in artificial intelligence have introduced new possibilities in this area, as AI-based tools can generate animations either from textual input (e.g., ChatGPT, Copilot, AskGPT, Claude) or through specialized animation platforms (e.g., RunwayML, Kaiber, NVIDIA Omniverse).

*Keywords:* Animation, Education, Artificial Intelligence

## 1 Introduction

Visual instruction represents an important component of the educational process and, when used appropriately, plays a significant role in supporting learners' understanding of subject matter. One commonly used form of visual instruction is animation. Animations are widely employed not only in media, marketing, and video games, but also in educational contexts. In education, they can be used to illustrate natural phenomena and processes, such as the water

<sup>1</sup> Constantine the Philosopher University in Nitra, Tr. A. Hlinku 1, 949 01, Nitra, Slovakia.

*E-Mail:* [tszabo@ukf.sk](mailto:tszabo@ukf.sk)

<sup>2</sup> Constantine the Philosopher University in Nitra, Tr. A. Hlinku 1, 949 01, Nitra, Slovakia.

*E-Mail:* [rzitny@ukf.sk](mailto:rzitny@ukf.sk)

cycle, animal life cycles, chemical reactions, and electrical circuits, as well as to support the comprehension of mathematical concepts, including functions and geometric transformations. Similar applications can be identified across a wide range of subject areas. Animations may be integrated into traditional classroom instruction and also play a significant role in distance learning environments, such as e-learning, as well as in blended learning models, including the flipped classroom. According to Vécsey (2020), the use of animations in the educational process is already common practice. Several studies confirm that students who participated in teaching supplemented with animations achieved better results than control groups. (Islam et al., 2014; Liu a Elms, 2019; Shreesha a Tyagi, 2018; Tani, Manuguerra a Khan, 2022; Teplá, Teplý a Šmejkal, 2022).

The use of animation in educational contexts is often so widespread that it may go unnoticed. The visual effects of animations can function as motivational elements within the educational process and may also support individualized learning pace. These considerations suggest that animations play, or have the potential to play, a significant role in education. However, their instructional effectiveness depends on appropriate and purposeful use within the curriculum. Vécsey et al. (2020) address the question of when static images or animations should be employed in instructional design. According to their findings, attention should be paid to factors such as cognitive load, selective visual perception, learners' prior knowledge, spatial perception, and the temporal characteristics of the instructional content.

## 2 Creating Digital Animations

Numerous ready-made animations are available online for use by teachers; however, they are not always freely accessible, and some are language specific. In addition, existing materials may be incomplete, overly detailed, or unsuitable for a particular instructional topic. Fully customized animations are generally produced only through the creation process undertaken by the educator. According to Towler (2023), the process of developing scientific animations should include the following steps: writing a script, creating a voice-over, storyboarding the script, illustrating the storyboard, animating the illustrations, obtaining feedback on the draft, and producing and delivering the final animation.

When creating your own animations, especially when using AI tools, this procedure may no longer be strictly valid. For example, we can compose a real animation according to certain templates and based on pre-animated objects or characters. In some cases, the animation may not even contain an audio channel.

According to the method of creating animation, we could divide it into three groups: stop-motion (e.g. using a series of photographs, plasticine, paper), digital and traditional (e.g. cartoon). Below we will only deal with digital animations.

Of course, there are many software programs suitable for creating digital animations, but working with them is usually time-consuming.

Such tools include, for example: Pencil2D, Synfig Studio, OpenToonz, TupiTube for 2D-animations, and Blender, K-3D pre 3D animácie. A revolutionary change in this area can be brought about by artificial intelligence-based tools that can create animations based on text input (e. g. ChatGPT, Copilot, AskGPT, Claude etc.), as well as specialized tools developed specifically for this purpose (e. g. RunwayML, Kaiber, NVIDIA Omniverse etc.).

The following chapter illustrates how simple animations can be generated using the generative artificial intelligence tool M365 Copilot. Although these tools are not specifically designed for animation creation, they can still produce meaningful outputs. Other AI tools have been developed for this purpose and may yield more refined results. M365 Copilot was selected for this study due to its widespread availability within the educational system as part of MS Office 365 Education.

### 3 Methodology

Artificial intelligence can support the understanding of learners' questions and requirements, allowing educators to address specific learning needs. Interactions with AI-based conversational assistants generate variable responses, which may lead to divergent outcomes in the learning process. The present study aims to explore the potential of contemporary AI tools in educational practice. To this end, available AI applications suitable for the creation of animated educational materials were examined, with consideration of established best practices and the selection of multiple illustrative case studies. These case studies, which exemplify the implementation of new pedagogical procedures, were subjected to qualitative analysis commonly employed in educational research.

As an illustrative case study, this work presents a method for integrating information technology, cloud-based APIs, AI, and software applications incorporating built-in generative AI tools.

Another case study involved iteratively providing instructions to a conversational assistant with the objective of generating image-based animations, while considering the associated cognitive load.

Based on the analysed case studies, several paradigms were identified. Animation provides a visualisation of a dynamic phenomenon, when it is not easily observable in real space and time scales (Betrancourt, 2005). Ginns tries to point out that presenting instructional materials using a combination of an auditory mode for textual information, such as spoken text, and a visual mode for graphical information, such as illustrations, charts, animations, etc., will be more effective than presenting all information in a visual format, such as printed text with illustrations, charts or animations (Ginns, 2005). The success of education using animations is investigated using various methods, e.g. eye movement tracking. Increasing number of physics education researchers are using eye tracking to learn more about physics learning by analysing students' visual attention (Hahn & Klein, 2022).

When deciding whether a static or animated approach to a topic is more effective for educational purposes, it is important to consider the recipient's prior experience with animation as a medium and their spatial abilities (Vécsey, 2020).

Another issue becomes the use of materials that are intellectual property. OpenAI and other large technology firms focused on developing generative AI models have claimed their use of text protected under copyright is permissible under United States “fair use” doctrine (Stark, 2024).

A certain level of attention-grabbing in education can be the attribution of human behaviour to inanimate objects, avatars, natural phenomena, plants, animals, etc., which we refer to as anthropomorphism (e. g. Sad Mac icon indicated a problem with the computer at startup.). Anthropomorphism is defined as the attribution of human characteristics, emotions, and behaviours to animals or other non-human things (including objects, plants, and supernatural beings). It involves interpreting nonhuman entities in terms of human traits, such as emotions and intentions (Nikolopoulou, 2023).

## 4 AI-Generated Animations

To understand functions, we use a familiar diagram, according to which we imagine a function as a machine that processes input values according to the function's prescription (see Figure 1) and then displays the result at the output. The animation accurately illustrates this process by processing various input values.

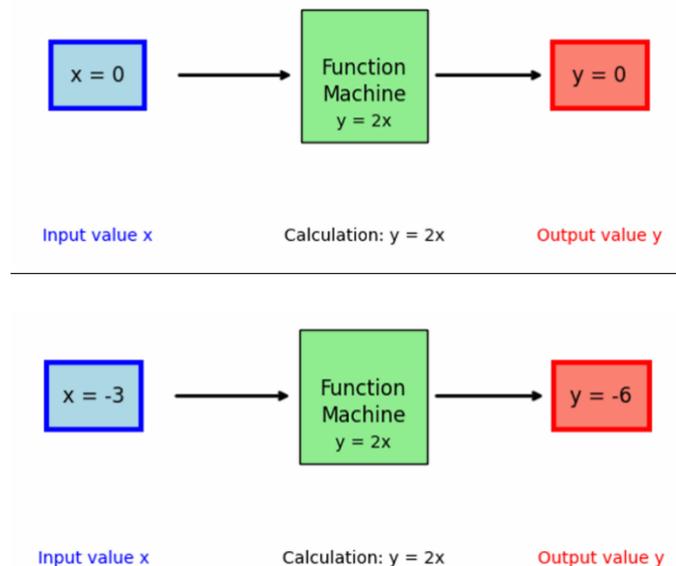


Figure 1: Animating the Function  $y = 2x$ . (Created by M365 Copilot)

Figure 2 also shows a very simple animation that aims to present the process of photosynthesis. The image clearly shows leaves, the sun, and arrows with hatched fills attached to them, symbolizing the so-called moving light rays. These light rays indicate the

direction of movement and thus add dynamism and animated character to an otherwise static image.

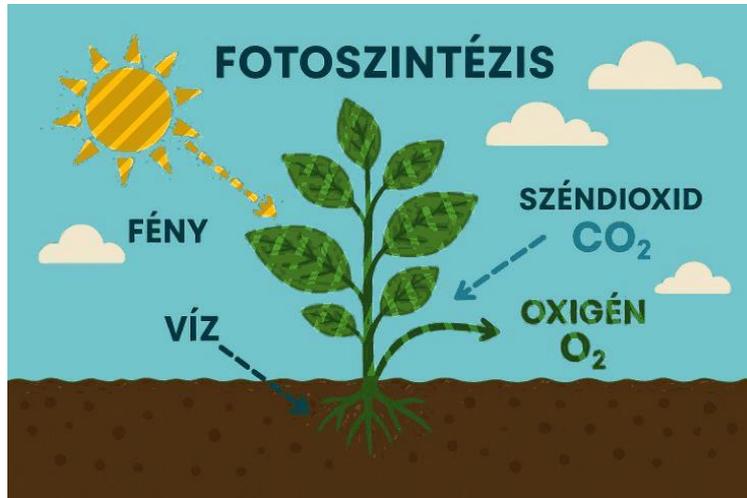


Figure 2: Animation of Photosynthesis. (Created by M365 Copilot)

Figure 3 shows an animation used to illustrate the Riemann integral, which approximates the area under the curve of the function  $f(x) = x^2$  on the interval  $[0, 2]$ . Using the so-called lower sum method, i.e. by adding the contents of the rectangles, the value of the integral is approximated. The animation clearly shows that with an increasing number of rectangles; the approximation becomes more accurate.

On the interval  $[0, 2]$ , the volume of the body that is created by rotating the function  $y = x^2$  around the  $x$ -axis is further investigated. The sought volume is approximate using the method of disks, i.e. as the sum of the volumes of the individual disks (see Fig. 4).

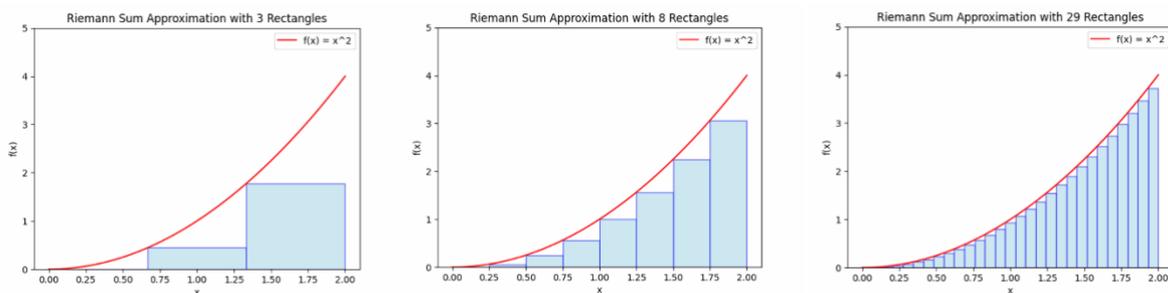


Figure 3: Lower Riemann Sum. (Created by M365 Copilot)

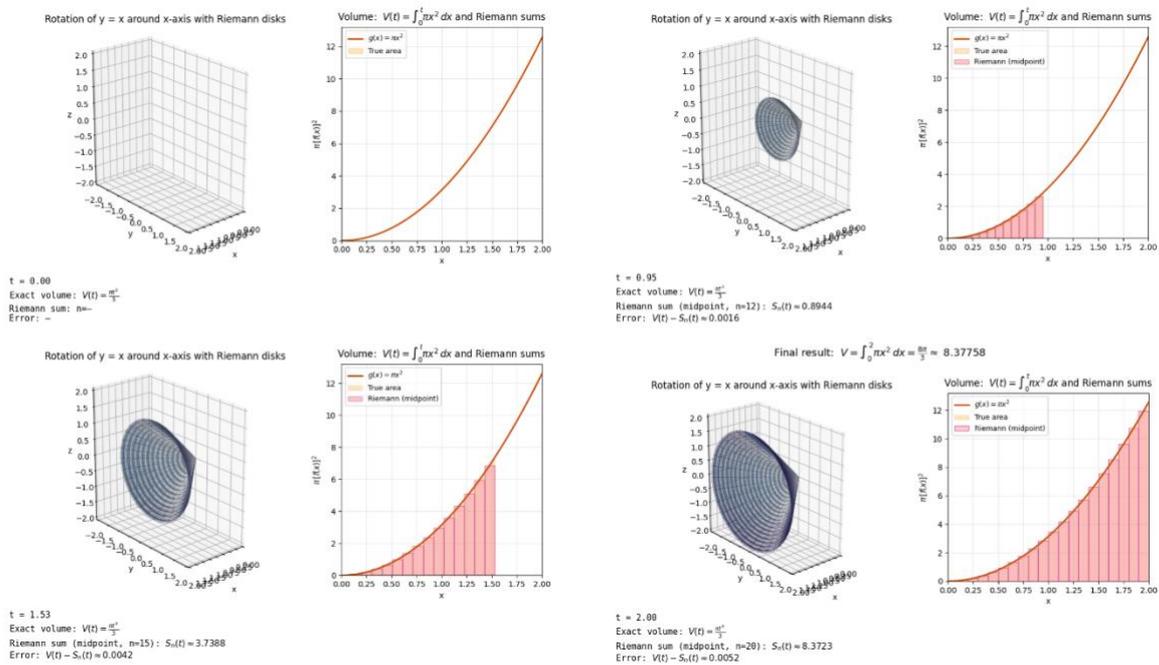


Figure 4: Volume of a Solid of Revolution. (Created by M365 Copilot)

Figure 5 shows an animation of a volcano eruption. We generated the individual frames (image sequences) using the 2.5 Flash model in Google Gemini. Although it generates images, this version (free version) cannot combine them into a GIF or a video file. We could have combined the images using various video editing software, or for example using M365 Copilot.



Figure 5: Animation of a volcanic eruption.

The following case presents the application of AI in the preparation of educational material according to Figure 6. We use AI to convert text to an mp3 audio file. To create interactive educational material, we used the Internet cloud application Visual Paradigm Online using its visual materials, namely diagrams. Subsequently, the production of the diagram was animated and recorded as a screen in Windows. The accompanying text of the animation was formulated in English. The conversion of the written text was provided by the Applio application based on the principle of using the AI method Text-to-Speech. We ensured the integration of text and video sequences with the standard Adobe Premiere tool, but we also recommend using other tools e.g. Pinnacle Studio, DaVinci Resolve, Shortcut or MS

ClipChamp. However, in a higher version of the cloud application Visual Paradigm Online, it is also possible to apply directly built-in AI to create various visual materials. Figure 7 shows a schematic representation of the creation of animated educational material using AI.

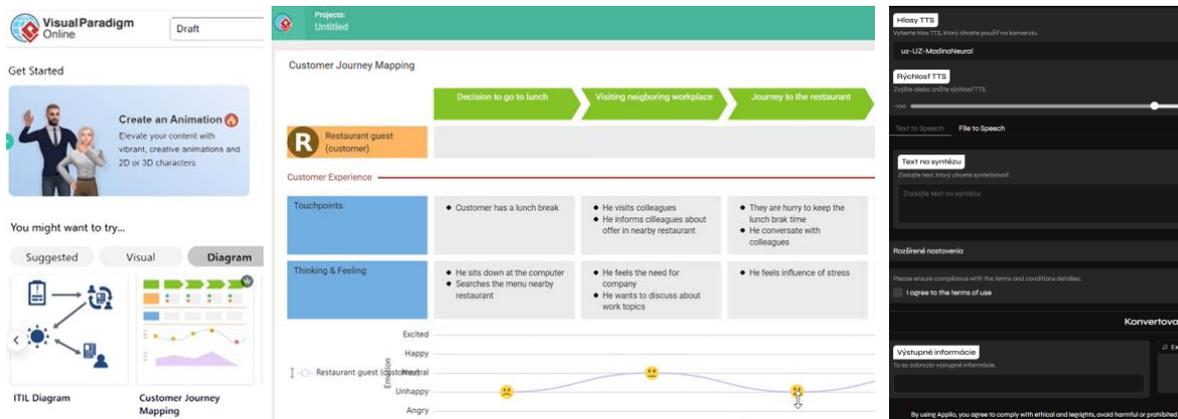


Figure 6: basic elements of creating a video and audio sequence (Own elaboration, 2025)

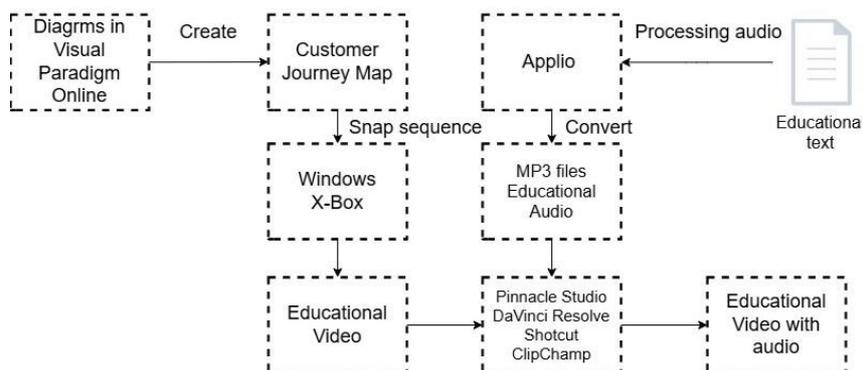


Figure 7: Scheme for creating animated educational material. (Own elaboration, 2025)

## 5 Surveying Student Attitudes

We investigated the opinions of student of Preschool and Elementary Education study programme on their attitudes towards the use of animations in education, their experiences with creating animations, the suitability of animations in subjects, their self-assessment of digital competencies, their experiences with AI, the most suitable tools for the work of a teacher, difficulties experienced using digital tools, and what problems they find in using AI in education. We investigated the research questions using a questionnaire with a total of 12 questions, of which 3 questions related to information about the student. We prepared the questionnaire as a pilot survey. We examined multidimensional questions using a Likert scale (number 3) and subjected them to multidimensional analysis using the Sourcetable API. We

evaluated the remaining six questions by expressing the percentage of responses and using qualitative analysis.

Table 1 presents the results of the Factor Analysis of Question 1, What is the attitude of students towards creating animations? Based on the scores of students' answers in the range of 1-5, we used factor analysis to identify two factors that we consider to be students' attitudes.

Factor 1	Factor 2
Applying experiences with creating animations during teacher training (High practical value – 3.90)	Animations introduce motivating effect (Strongest agreement – 3.93)
Preferring animations created by own (Self-creation valued – 3,86)	Help animations to better understand learning material (Moderate agreement - 3.45)
Afraid of too much time and technical knowledge (Some concerns exist- 3.38)	Using animations made by AI based tool (Lowest but still positive – 3.21)

Table 1: Attitude of students towards creating animations.

In the Table 2 we present the results of students' answers to question 2, Please indicate your experience with applications that enable the creation of animations. We expressed the students' experience as a percentage.

Stop motion (e.g., clay, paper, photo series)	14%
Digital (e.g., PowerPoint, Canva, Vyond, Animaker, etc.)	24%
Handdrawn / manually created	7%
AI based (e.g., using ChatGPT, Copilot, Pika Labs, Animoto, etc.)	0%

Table 2: Experiences with animation tools.

In the table 3 we introduce answers of students to question 3, What subjects students recognise using of animations. Students see the greatest use of animations in subjects Natural sciences, Kindergarden activities, and in English as a foreign language.

During kindergarden activities	66%
Mathematics	31%
Hungarian language and literature	48%
Slovak language and literature	34%
English as a foreign language	55%
Local history	38%
Natural sciences	69%

Table 3: Using animation in subjects.

Table 4 introduces the results of the factor analysis to question 4, How students evaluate their digital competencies according to arranging options. Based on students' response scores

ranging from 1 to 5, we used factor analysis to identify two main factors that moderate students' views of digital competence.

Factor 1	Factor 2
I would be able to integrate digital tools into pedagogical work. (Excellent - 0.48)	I know and use educational digital platforms e.g., Kahoot, LearningApps. (Excellent - 0.35)
I confidently use word processing programs. (Excellent - 0.47)	I consciously manage online data protection and security. (Very Good - 0.35)
I can create digital learning materials. (Excellent - 0.34)	I can create digital learning materials. (Excellent - 0.34)

Table 4: Students' digital competencies.

Table 5 presents an analysis of question 5, What do you think about your knowledge and use of AI tools. Based on the students' response scores on a scale of 1–5, we used factor analysis to identify two main factors that moderate students' views on how they would use AI knowledge.

Factor 1	Factor 2
I understand how AI-based educational tools (e.g., ChatGPT, Quizizz AI) work.	I consider it important to address ethical issues of AI in teacher training.
I am able to critically evaluate AI-generated content.	I would gladly use AI tools in my future pedagogical work.
I have used AI content generation tools for learning or creating teaching materials.	I have used AI content generation tools for learning or creating teaching materials.

Table 5: Using AI knowledge.

Table 6 shows the answer to question 6, Which digital tools or applications do you find useful in education? Students also use an interactive whiteboard, a data projector, and the Canva design package in their education.

The Canva	7%
Cell phone	3%
Google Translator	3%
Photo math	3%
Interactive table	10%
Data projector	7%
Word wall	3%
Educational application	3%
ChatGPT	3%
Kahoot	3%
Other	3%

Table 6: Use of digital tools in education.

In question 7, we asked What difficulties have you experienced when using digital tools? Students indicated that they lacked knowledge about the effective use of digital tools, mentioned freezing applications when creating animations, limiting work by the presence of ads, The demanding requirement for knowledge and practice, and expressed concern about technical problems.

In question 8, we asked about experiences with using AI. We found that students had experience with the generative AI ChatGPT. Students used ChatGPT for searching and refining, for making suggestions and recommendations, and for generating ideas.

In Table 7, we analyse question 9. What problems or risks do you see in using AI in education?

Students give the greatest weight to the following questions:
Children forget to think independently and leave everything to artificial intelligence.
The negative impact of AI, regardless of how it is used, whether in education or in everyday life.
The answer is not always correct, especially in literature.
Excessive use of artificial intelligence when the student passively completes assigned tasks.
Children are also present on many internet platforms at home, so I don't think artificial intelligence should play a big role in education.
Students should be able to think without artificial intelligence, stay creative, create new things, write correctly, etc.
I agree with stricter rules when using AI.

Table 7: Obstacles (problems and risks) using AI in education.

## 6 Conclusion

Animations play a significant role in education, particularly in the areas of visualization, motivation, and support for individualized learning pace. Based on the examples presented, educational animations can be developed using both traditional tools and artificial intelligence. In this study, the M365 Copilot tool was employed; although it is not specifically designed for animation creation, it can generate educational content, albeit with variable success depending on the specificity of prompts. The use of such tools is widespread in educational institutions, highlighting their potential for instructional purposes.

The flipped classroom approach aligns particularly well with animated content, as it enables learners to acquire knowledge in advance and actively engage with the curriculum during instruction. It is essential for educators to select tools deliberately, considering student needs and pedagogical objectives. Accordingly, animation should be considered not merely as a technical resource but as a pedagogical method that can enhance learning. Future research should explore strategies to maximize the educational potential of animation effectively and appropriately.

This study presents two cases of animation creation. The first involved generating animations directly using generative AI, while the second explored the use of AI for simulating human

voice and integrating it with video sequences. As described in the methodology, the creation of educational materials was informed by established paradigms of good practice.

In the pedagogical process of developing animated educational materials, attention is given to spatial reasoning, cognitive perception, and mentalization abilities. The following paradigms are considered particularly important: cognitive load, eye tracking, fair use of textual content, and anthropomorphism.

Exploratory development work indicated that students perceive animations as motivating and useful tools for learning, particularly in natural science subjects, early childhood activities, and language acquisition. However, students reported challenges, including limited experience in creating animations, concerns regarding time requirements and technical skills, and a tendency to over-rely on artificial intelligence. Ethical considerations and responsible use of AI were also identified as key concerns. Effective integration of animations and AI in education therefore requires targeted training, technical support, and clear guidelines for use.

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