Impact effect of using computer graphics animation in education

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Abstract

Animation development has changed over time, and usage context illustrates phenomena and concepts that are difficult to understand. Animations may not always be useful; however, teachers who use animations need to understand their importance of them. This paper focused on illustrating the potential applications of animations in learning and education. Animation, a form of pictorial presentation, has become the most prominent feature of technology-based learning environments. Educational computer animation has become one of the most elegant tools for presenting multimedia materials for learners, and its significance in helping to understand and remember information has greatly increased since the advent of powerful graphics-oriented computers. This study used data analysis processing to analyze the frequency of responses to each question from the collected survey data. All interviews were transcribed for qualitative analysis of in-depth interview data. This research aims to investigate whether animation aids learners' understanding of dynamic phenomena and has come up with positive, negative, and neutral results.

Keywords: Animation, Education, Computer graphics, Technology

Extended Abstract

Introduction: Animation contributes significantly to education and has a positive impact on the lives of students. It also mentions how animation allows students to demonstrate and adapt their creativity relatively simply. There are multimedia products available in various combinations of text, still images, animation, video, and sound. Few studies identify the principles that can effectively combine these media within instructional materials to maximize their learning potential. Students may become bored with regular lectures, but if provided with something simple and easy to understand, it will help them remember much more. Graphically animated content has the most significant and positive impact on students' lives because it makes concepts more understandable and memorable.

Purpose and scope: The paper discusses how animation in education improves things. The primary purpose of this study is to explore the effectiveness of animations and graphics on student learning. This paper demonstrates the strategy of how computer graphics animation helps in the field of education for students. This study investigated whether animation helps learners understand dynamic phenomena and found positive, negative, and neutral results.

Method: This study designed the empirical study as a survey for statistical processing of the frequency of responses to each question from the 35 survey data collected. All interviews were transcribed for qualitative analysis, and then the contents of the same context, divided by topic questionnaire questions and structured interview questions, for in-depth interview data. Data analysis processing was used to determine the frequency of responses to each question from 35 survey data collected for this study. Transcribing all interviews for qualitative analysis of in-depth interview data. On March 17, 2022, the ethics committee granted permission to begin a research survey titled (Impact effect of using computer graphics animation in education). The quantity of work (15/2022). The study survey was based on samples of students who agreed to use and implement graphic elements and tools.

Findings and conclusion: According to the findings of this study, using computer graphics animation as teaching material has several advantages. However, some restrictions may apply depending on the subject's suitability and the student's background. Teachers play a critical role in determining the best and most appropriate teaching approach to use in class, as well as effective teaching delivery that can help students improve their visualization and comprehension abilities. Several useful discoveries have been made in the context of teaching and learning. Computer animation allows students to visualize content or subjects that would be difficult to see in person. As a result, the teaching and learning process is

no longer limited to a physical space where learning takes place in person and in real-time. However, it occurs in a variety of settings, including virtual spaces. Nowadays, information and communication technologies (ICT) offer a plethora of new communication channels, as well as simple technological tools to assist in this process. Computer animation has proven to be an effective teaching tool in a variety of fields and stages. To assess students' opinions, quantitative data collection techniques, such as questionnaires, are used. It adapted educational content and evaluation strategies to innovative teaching and learning strategies developed specifically for computer animation education. Computer graphics and design provide opportunities for integrated learning and the development of skills for effectively transferring knowledge and understanding across disciplines quantitative. Universities and professors must also understand how to foster interdisciplinary learning and support students in developing their creative potential. The animation can explain materials that are difficult to imagine. Furthermore, using computer animation in language development as an example, many theoretical paradigms can be explained. Computer animation is an intriguing teaching and learning method. Computer animation, as opposed to traditional static pictures and images, is useful in explaining verbs such as reading, writing, and listening. Using computer animation in education has expanded and continues to expand. Technology changes the animation itself, such as from 2D to 3D and low-resolution images to high-resolution images, based on the importance of computer animation. The evolution of animation is being aided by the advancement of software and applications for digital images. The primary purpose of education is to help students face the challenges of life, link science to students' lives, and work to create a scientifically and technically sound environment and a society capable of continuity and survival, by providing students with many opportunities to discover, understand, analyze and evaluate the surrounding problems. It is a prominent educational means characterized by its ability to attract attention and influence behavior and trends.

Keywords: Animation, Education, Computer Graphics, Technology

INTRODUCTION

Animation has been the most visible feature of the technology-based learning environment. According to (Mayer et al., 2002: 7), the animation is a pictorial presentation of motion pictures that shows associations between drawn figures. Things that correspond to this idea are motion, picture, and simulation. As far as videos and illustrations are concerned, these are motion pictures depicting the movement of real objects. Pictorial forms of teaching have been observed to emerge as a counterpart to verbal forms of teaching. Although verbal ways of presentation have long dominated education, the addition of visual forms of presentation has enhanced students' understanding (Mayer et al., 2008: 5). In fact, disciplines are taught in universities that deal with dynamic subjects, and animation or graphic illustration is more favored as a way of addressing the difficulties which arise when presenting such matters verbally or numerically (Lowe, 2004: 11). Even though such multimedia instructional environments hold potential for enhancing people's way of learning (Ainsworth, 2008a: 37), there is still much debate surrounding this area; indeed, animation presentations are less useful for education and training than was expected. Moreover, little is known about the way animation needs to be designed to aid learning (Hasler et al., 2007: 13) and not to act solely as a way to gain aesthetic attraction. For instance, some animators who work in the entertainment industry create animations for the sake of entertainment and they are therefore unlikely to be interested in helping to build a coherent understanding using their work (Barut Tugtekin et al., 2021: 10). In some cases, animation can hold back rather than improve learning and may not promote learning, depending on how they are used (Mayer et al., 2005: 6). Animation may require greater cognitive processing demands than static visuals as the information changes much, especially critical objects, and thus cognitive connections can be lost during the animation. The developers of multimedia learning materials face a lack of principled guidance on how some elements of such materials should be designed to enable comprehension.

They developed seven guidelines for using animation in multimedia instruction. Some of these principles are multimedia principles; students learn more deeply when narration and animation come together than narration or animation alone (Parnis et al., 2020: 24). Learners can easily create mental connections between corresponding words and pictures when both animation and narration are presented. The other principle was coherence; students learn more deeply from animation and narration when irrelevant words, sounds (even music), and clips are absent. This is due to the possibility of the learner having difficulty making mental connections due to a lack of cognitive resources between relevant parts of the narration and animations. (Ayres & Paas, 2007: 5).

Fundamental Principles of Computer Graphics Animation

First traditional animation, basically, this is 2D animation techniques such as in between (Musa et al., 2013: 10-15), keyframe animation (Terra et al., 2004: 7), multiplane background, scan/paint, and storyboarding (Kevoy, 1977: 18). 3D computer animation uses 3D models instead of 2D drawings (Takayama et al., 2011: 6). In addition to that, 3D animations were script-based, with a few spline-interpolated key frame systems. Some large companies such as Abel Image Research, Alias Research Inc., and Wavefront Technologies Inc., arrived at these reliable use possible (Wojtan et al., 2006: 4).

In the late 1920s and 1930s, animation was developed from an innovation to a fine art form by the Walt Disney Studios. They set up drawing classes at the Chouinard art institute in Los Angeles, spearheaded by Don Graham. Here the students/animators learned the standardized formula of old cartoons, which led to the discovery of ways of drawing moving figures and humans (Sultana et al., 2013: 3). With this came a keen investigation of action made through the advancement of animation and its principles (Harrison et al., 2010: 6). Traditional animation is based on 11 fundamental principles, which are as follows: Timing, anticipation, staging, follow through and, overlapping action, straight-ahead action, and pose-to-pose action, show in and out, arcs, exaggeration, secondary action, and appeal are all important.

Using computer graphics animation in education

Nowadays, life in a digital era is inescapable. The advancement of technology and the drastic changes in the surroundings affect our needs and desires, be they psychologically, socially, or emotionally. Similarly, the need for change in education has enormously accelerated as time passes. Students tire of the teacher-centered model and complain that the class is very boring and monotonous, and they want something new and different. Though traditional methods are still used, there is a growing demand for a more competitive tool that will meet the needs of students more effectively. This entails "modifications to both the instructional strategy and the teaching and learning environment" (Vonganusith & Pagram, 2008: 543). Computer animation, specifically educational computer animation, is one of the most important tools available to teachers today for promoting effective learning by assisting students in visualizing something that is difficult to see in the real world (Ainsworth, 2008b: 34). Special effects for transitions between instructional frames, moving symbols or characters, and animated prompts help to clarify relationships through visual means to illustrate events that are not inherently interesting. Animation may be especially useful in supporting students in comprehending the flow of blood through the body (Weiss et al., 2002: 4). And the inner life of the cell. To assist the users with animated agents (Johnson et al., 2000: 17), where lifelike characters are animated to include gesture and movement. The use of computer animation in education has broadened and continues to grow rapidly. Because of the speed of change, teachers need to learn how to adopt new roles, such as facilitator and guide, integrator, researcher, designer, and collaborator need to train teachers capable of dealing with technology. Also, since the new pedagogical paradigms involve more than the mere transmission of knowledge, which was once considered the norm, teachers may need the training to develop the professional expertise that computer animation in education requires. The success of computer-assisted instruction (CAI) has been the subject of continuing examination for over a decade (Vernadakis et al., 2005: 4). The use of CAI as delivery media is expanding, and an understanding of how students learn and benefit from such computer-based instruction is disputable. Appropriate graphics with text has been demonstrated to be effective in learning. However, computers can make static graphics into dynamic animations. This study explores the potential of combining animations with text in a computer-assisted instructional environment. Animation is the computerized simulation of processes using images to form a synthetic motion picture. It is a process of putting still images together in sequences or manner, so they appear one after the other creating the illusion of movement. One can feel or see that the images are moving in the context of learning. Animation assists learners in visualizing a dynamic process, which, otherwise, may be difficult to visualize. The animation might thereby reduce the cognitive load (Wouters et al., 2008: 21). In Kehoe's (1996) review of studies on animation in education, visual aids are found to have a positive effect on learning if certain conditions (Hanif, 2020: 15). Several positive effects have been widely discussed in the context of teaching and learning based on previous research. Computer animation-based teaching and learning in schools has the potential to transform existing methods such as verbal and traditional instruction. By other means, interactive learning can respond positively to

computer-aided blending techniques (Islam et al., 2014: 5). Today, interactive animations are an excellent learning medium for students.

This is due to the fact that learning how to use animations is not as time-consuming as studying in a classroom, and it can be accomplished simply by paying attention to the teachers who make it clear in the classroom (Utomo et al., 2015: 8). In creative teaching with an interactive learning system, both lecturers and students used interactive learning animation. Multimedia technology can be used to create a teaching tool that incorporates various learning media in various ways, such as text, graphics, animation, audio, and video (Ariyati & Misriati, 2016: 3-4). Animation, which is essentially a visual presentation, is the most visible feature of the technology-based learning environment. It is a computer-generated animation that depicts the movement of a drawn object. In education, computer animation has evolved into one of the most effective tools for presenting multimedia materials to students. Furthermore, animation serves as an engaging learning medium. Learning outcomes differ from oral learning styles, particularly regarding applying Java programming concepts, procedures, and principles (Negara, 2017: 3). Animation is one of the multimedia elements that is used in the teaching and learning process because it can bring a human fantasy to life. Text, graphics, animation, and audio are used in computer graphics animation software to make teaching and learning more interesting, active, and enjoyable (Tsukazaki et al., 2019: 4). People are uninterested in or understand the value of using media in education, particularly computer-based animation applications (Ruiz et al., 2009: 8). When choosing a model, it is critical to use specific learning media. Computer animation is one type of media that can be used. For example, computer animation presents many challenges and constraints during the teaching and learning process (Wang, 2017: 3). To get started, the person should be familiar with animation software such as Adobe After Effects and Adobe Animate.

The visual effects of computer graphics animation on education

The visual outcomes, or student art exhibits, demonstrate concepts related to computer art graphics creation and computer graphics integration with science teaching. Demonstrate some examples of student artwork produced as a result of completing science-related assignments creating computer working habits in students the stimulation of their artistic growth and production is an important goal in computer art graphics instruction. The aesthetics of student computer graphics should probably come first (Kainz et al., 2013: 11). To assist people in developing strong visual and aesthetic values as well as technical and programming skills, as well as to train them to create visually stunning products (Matsuda & Shindo, 2001: 7). A broad understanding and skill set in computer science are required. As a result, students combine technical development with their visual response to create high-quality artwork. With computer art graphics assignments, developed new forms in this visual language. Students should be able to overcome their fear of creating art (Baglama et al., 2018: 5). Educators understand that computer graphics applications use symbols. Using computer graphics in scientific visualization makes it easier to integrate verbal and graphic information (Barron et al., 2002: 38). Visual thinking aids in recognition of mathematical relationships as well as physical interpretations of formulas and graphs. Research advances on mental images in human cognition confirm the importance of mental imagery as a form of nonverbal processing. Cross-disciplinary development programs allow student response to computer-generated feedback and develop new curricula of computer graphics (Kahraman, 2015: 7). Using technology in education has improved image reception, as shown by student achievement because of computer graphics instruction. Building computer art graphics representations of scientific concepts improves student achievement and artistic production (Usui et al., 2017: 6). Following the research line related to computer graphics instruction, one may often notice a teacher's approach focusing on visualizing ideas in graphical form. The ideas for an integrative approach are presented in the form of a cognitive map, as shown in Figure 1.

Many computer graphics classes base their instructional approach on a structured and skills-oriented method of tracking students' work and assigning tasks. Instruction in computer graphics animation assists students in interpreting and manipulating scientific concepts to represent them by their education -this method of applying newly acquired knowledge about a new educational method. However, students may find it easier to continue creating graphics rather than starting from scratch. The integrative approach to computer graphics should cause significant departures from current practice in computer graphics instruction.
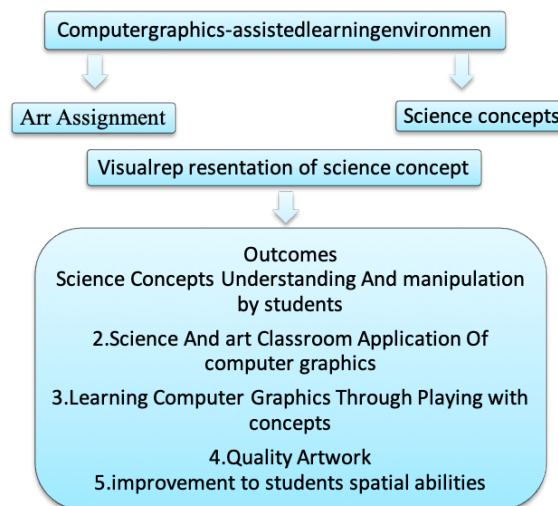
Figure 1. Integrative approach ideas cognitive map

Computer graphics animation's future

Understanding how people learn from pictorial and verbal media to use animation effectively is useful. Multimedia presentations should be designed to promote the cognitive processes required for meaningful learning, such as selecting, organizing, and integrating. In the next millennium, pictorial forms of teaching are likely to expand as a complement to verbal forms of teaching (Cadiero, 2006: 13). Predicting the future is a dangerous business, particularly in high technology, where seers tend to be overly optimistic in the short run (3-5 years) and overly cautious in the long run (10-20 years). Forecasts in computer graphics began about ten years ago, and almost all appear to have been overly optimistic. However, the pace is now quickening, and the next ten years' developments may finally outstrip the visions of ten years ago. At least, that is how it seems to us right now, and so join the optimists, even though they have all been wrong so far. Computer graphics are entering a new era characterized by rapid growth. While using computer graphics in traditional applications will continue to grow, a fundamental structural change occurring in graphics use. This change will make graphics more prevalent in our workplace (Miyai & Yamaguchi, 2015: 6). Computer graphics tools and techniques help to improve computer productivity and human factors: computer users no longer have to rely solely on verbal/linguistic skills, but can combine these with spatial/graphic skills (Takacs, 2005: 44).

In a future marked by rapid and continuing advances in digital technologies, where visual solutions are central to how people use, share, develop, and process information, learners must learn how to use such technologies to solve problems and visually communicate knowledge and ideas (Parent, 2000: 4). Learners will apply their understanding of form and function to develop design solutions within the context of computer graphics. Through developing design thinking and problem-solving skills, computer graphics animation design prepares students for work in the digital age (Leslie & McKim, 2017: 9). While associated with the design and technology strand of learning, computer graphics and design also incorporate and provide rich learning opportunities to embed skills and knowledge from the arts, math, and sciences. As a result, computer graphics and design offer the opportunity to engage in integrated learning opportunities and develop skills to effectively transfer knowledge and understanding across disciplines. Universities and professors must also understand how to foster interdisciplinary learning and support students in developing their creative potential. Computer graphics animation can enable the integration of active pedagogies that foster deep and long-term knowledge. It has the potential to become a democratic factor in education, allowing for global participation on an equal footing that is not limited by geographical boundaries.

METHOD

This study designed the empirical study as a survey for statistical processing of the frequency of responses to each question from the 35 survey data collected. All interviews were transcribed for qualitative analysis, and then the contents of the same context, divided by topic questionnaire questions and structured interview questions, for in-depth interview data. Used data analysis processing to determine the frequency of responses to each question from 35 survey data collected for this study. All interviews were transcribed for qualitative analysis of in-depth interview data. On 17 March 2022, the ethics committee of the Arab Open University permitted to start a research survey titled "Impact effect of using computer graphics animation in education". The quantity of work (15/2022). The study survey depended on samples of students consenting to using and implementing graphic elements and tools.

FINDINGS

Thirty-five questionnaires were used for this study's data analysis, and all questions were faithfully answered. Figure 2 depicts the survey respondents' demographics. The demographics of the faculty members who responded to this survey were as follows: assistant professors had the highest (25%), while research professors had the lowest (6%). Students (27%), in terms of educational experience. Professors from associations (25%) and universities (9%) (Figure 2).
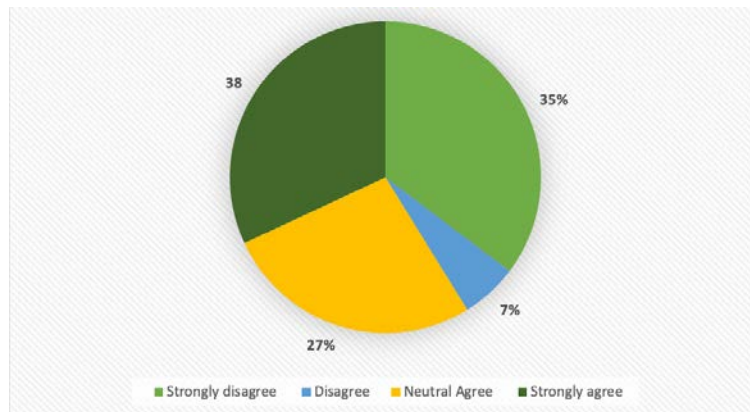

Figure 2. Demographic information about participants

Figure 3 shows that the study participants were aware of the possibility of using computer graphics animation in the educational field and classroom (over 35 people, 77.00%). Participants in the study taught actual classes using computer graphics animation, allowing freedom of movement in the educational field. This is evident in the animation graphics with which students interact, which aids in memorizing and consolidating information in their minds.
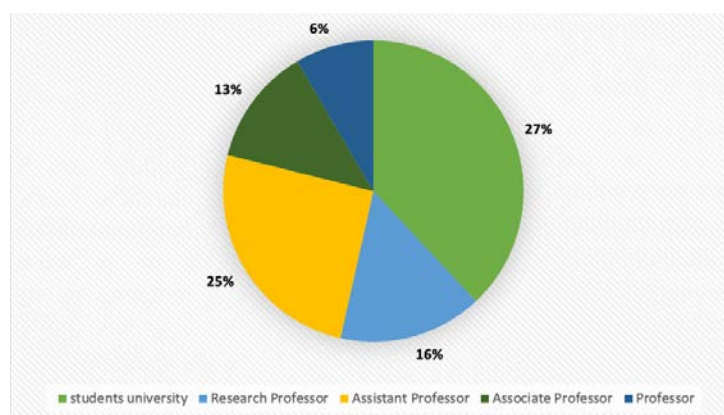

Figure 3. Recognition of computer graphic animation in education

As shown in Figure 4, they expected computer graphics classes to improve study participants' communication ability (27%) and creativity (35%). Participants in the study perceived computer graphics as a space where students can actively communicate with fellow and lecturers expect such communication to improve problem-solving abilities and broaden their perspectives rather than offline teaching and learning sites.

Participants in the interviews predicted that computer graphics, as an educational medium, could relieve the constraints of classes, a universal teaching and learning form in education. They recognized that by allowing learners to interact with other learners and instructors, computer graphics as an educational medium could increase cognitive flexibility related to creativity; it increases the opportunity to express one's thoughts rather than stereotypes. The study hopes to improve learners' creativity by using computer graphics as an educational medium.
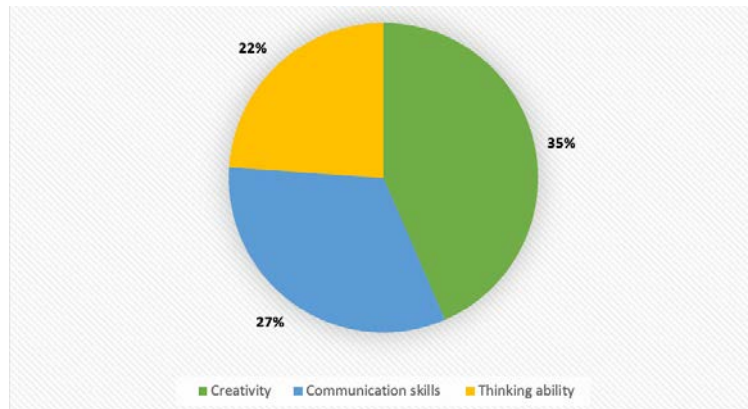

Figure 4. Expectations of improved education abilities by the use of computer graphics

As shown in Figure 5, they did not recognize the difficulties in implementing computer graphics animation in the absence of computer graphics animation experts, and the level of knowledge about computer graphics animation remains at the beginner level. Moreover, the teaching method and instructional design using computer graphics animation continue to apply. It demonstrates the importance of improving teaching competency and computer graphics animation-based teaching/learning methods that can be used in education.

It is difficult for instructors to build the infrastructure and technological environment, and instructors and schools must show active interest and willingness. Computer graphics animation in education will naturally boost creativity, problem-solving skills, and collaboration. To operate the computer graphics animation class, interview participants require assistance from the class operator and the educational environment, which includes providing guidelines for computer graphics animation class design and operation.
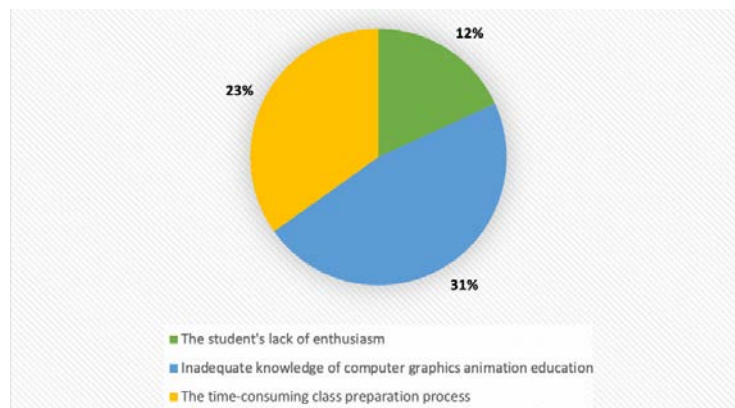

Figure 5. Difficulties to be expected in implementing computer graphics animation in education

As shown in Figure 6, because computer graphics animation is used in classes, active environmental support and incentives within the school and platform education are required. And system support for classes that use computer graphics animation results from investigating the elements and conditions for computer graphics

animation classes that university teachers can support and the Teaching Learning Development Center, as well as the direction of the workshop for computer graphics animation classes.
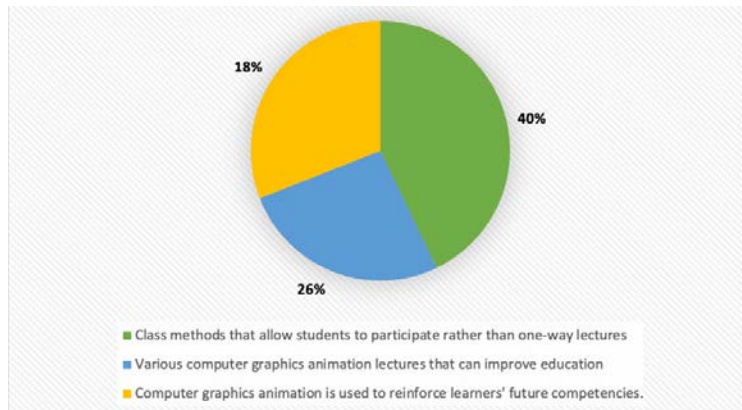

Figure 6. Educational advantages that students can expect when computer graphics animation is used in education

According to Figure 7, study participants identified classroom setting (17%) and class design support (12%) as elements and conditions required for computer animation-based classes. In the order community of teaching (34%), it can be stated that the research participants had higher demands for expert support such as class consulting and the establishment of a class environment such as a platform for classes using computer graphics animation. Interviewees will learn about the appropriate computer graphics animation platform for their classroom environment to use computer graphics animation as a teaching/learning medium. When the questionnaire and interview contents are combined, it is clear that most recognize the need for a customized platform that can reflect the subjects and learned characteristics. This type of education is limited in its ability to provide learners with an experience comparable to the existing classroom teaching/learning environment. However, the class instructor must investigate and conclude the formula to implement and establish computer graphics animation in the classroom. As a result, this study was conducted to ascertain the general perception of computer graphics animation-based education.
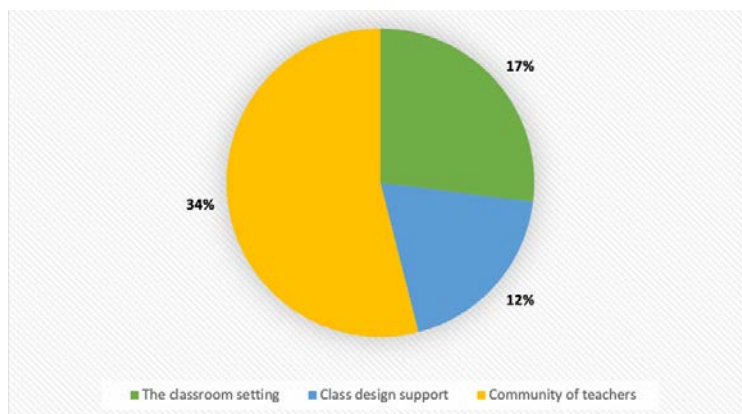

Figure 7. Elements required for applying computer graphics animation to the educational field

CONCLUSION

Based on the above review, this study can conclude that using computer graphics animation as teaching material has several advantages. However, some restrictions may apply depending on the subject's suitability and the student's background. Teachers play an important role in determining the best and most appropriate teaching approach to use in class and effective teaching delivery that can help students improve their visualization skills and understanding. Several useful discoveries in the context of teaching and learning have been made. Computer animation allows students to visualize content or subjects difficult to see in person.

Furthermore, the animation can be explained as difficult-to-imagine materials. Furthermore, many theoretical paradigms can explain using computer animation in language development as an example. Computer animation is an interesting method of teaching and learning. In comparison to traditional static pictures and images, computer animation is useful in explaining verbs, such as reading, writing, and listening. Using computer animation in education has grown and continues to grow. Based on the importance of computer animation, technology changes the animation itself, such as from 2D to 3D and from low-resolution images to high-resolution images. The advancement of software and applications for digital images contributes to the evolution of animation.

Education extends far beyond the infrastructure that defines academic spaces; thus, educational goals must include learning to know, learning to do, learning to live together, and learning to be, as defined by UNESCO. In recent years, the educational system has begun to use innovative learning tools, which has resulted in a shift away from traditional education strategies. And concentrate on new educational technologies for the twenty-first century. Furthermore, the COVID-19 pandemic has heightened the importance of changing educational practices.

As a result, the teaching and learning process is no longer limited to a physical space where learning occurs in person and synchronously but in various settings, including virtual spaces. Nowadays, Information and Communication Technologies provide a plethora of new communication channels as well as simple technological tools to aid in this process. Over the years, computer animation has proven to be a useful teaching tool in various fields and stages. Assessing students' opinions through using quantitative data collection techniques, such as questionnaires. It adapted the content of education and evaluation strategies to innovative teaching and learning strategies designed to apply computer animation education. In that way, universities and students would find broader possibilities to adapt to a constantly changing world.

DISCUSSION

Finally, students discussed better the benefits and challenges of deploying computer education and project-learning strategies online. Before 2015, there was some reluctance on the part of the students to carry out their activities using computer animation. However, after implementing this educational framework in 2020 and 2021, it was discovered that students are much more open and motivated to use computer animation. They have also been engaged and motivated to create their computer animations. Because of recent technological advances in new animation software, these results appear to be promising. This could make incorporating computer animation strategies into online education more natural and easier. Educational animation is one of the most elegant tools for presenting materials to students. Its importance in supporting learners to understand and remember information has grown significantly since the introduction of powerful graphics-oriented computers. It may be very useful for learning about some topics in the natural sciences, where educational modelling and the preparation of learning materials can reduce the amount of time spent in class and increase the efficiency of the educational process. The ability to create animated multimedia books, on the other hand, can benefit the English language and literature. Students develop skills in visual communication, storytelling, observation, and sensory aspects; problem-solving, and innovative aspects, such as concentration, and other cognition, ethics, and aesthetics, using animation.

This work seeks to establish an interdisciplinary field of study focused on increased educational effectiveness. Traditional, with today's high educational demands. Educational methods have fallen short of keeping up with the rapid changes brought about by the digital era. Educational animation materials may be insufficient for learners or fail to meet their needs if many important factors are not considered. This study is likely to have wide benefits in the field of education. Designing educational materials with the aid of computer animation software while considering students' temperament types is a promising avenue to improve the learning process. Teachers will be able to feel more confident in the presentation of their lessons. Additionally, they will become more competitive and professional.

Authors' Contributions

1st author contributed conceived of the presented idea 100%, developing the theory and performing the computations 100% writing the paper 100% drafting the manuscript and designed the figures100% designed and implementation of the research100%.

Competing Interests

There is no potential conflict of interest.

Ethics Committee Declaration

Ethics committee approval dated 17.03.2022 and numbered 15/2022 was obtained for the study titled "Impact effect of using computer graphics animation in education" from Arab Open University.

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