International Journal of Social Science And Human Research

ISSN(print): 2644-0679, ISSN(online): 2644-0695

Volume 05 Issue 07 July 2022

DOI: 10.47191/ijsshr/v5-i7-75, Impact factor- 5.871

Page No: 3336-3344

Impact of Using Visual Effects and Animation in the Educational Environment on Transferring the Knowledge and Motivation for Science and Technology Learning

Bahaa Mustafa

Assistant Professor, Technology of Multimedia and Graphic, Arab Open University – Jordan Branch, Jordan, 0000-0002-9475-9610

ABSTRACT: Abstract: The study described here is one of the first of its kind to look at the systemic effects of learning with integrated animations on knowledge transfer and motivation to learn science and technology. A study involving 418 6th and 9th-grade students from Jordan was conducted. Students in the experimental group took part in science and technology lessons that included the animation environment at least once a week. The experiment lasted between 2 and 4 months. The findings revealed that an animation-based online learning environment had a significant impact on knowledge transfer and learning motivation. Furthermore, the findings revealed that students' perceptions of science and technology learning changed because of teaching and learning with integrated animations. Students perceived themselves to play a more central role in classroom interactions, expressed greater interest in learning, and placed a greater emphasis on using technology and experiments during lessons.

KEYWORDS: Animation, Education, Environments, Technology.

INTRODUCTION

BrainPop is an animation-based online learning environment that includes a variety of animation videos, as well as additional tools for teachers and students. Brain pop's educational-scientific rationale has the potential to improve students' understanding and learning motivation. Starting in 2006-2007, dozens of. We have used Brain pop animation videos in teaching and learning in Jordanian schools. The primary goal of this study was to investigate the impact of incorporating an animation-based environment into the learning process on knowledge transfer and student motivation to learn science and technology. Along with several studies that investigated the effects of technology-enriched learning environments on higher-order thinking skills (e.g., Hopson, Simms, & Knezek, 2001-2002), the current study is one of the first to investigate the effects of an animation-based learning environment on higher-order thinking skills, with a focus on developing transfer abilities.

ICT (information and communication technology) has created new opportunities for improving the effectiveness of teaching and learning processes (e.g., Bransford, Brown, & Cocking, 1999; Salomon, 2002). The animation-based learning environment is one of the most promising. Animation is a dynamic representation that can be used to help learners understand change and complex processes (Schnotz & Lowe, 2003). Several studies have found that learning in computer-based animation environments improves understanding of complex concepts and systems when compared to traditional learning environments that focus on verbal explanations (Park, 1994; 2002). For example, it is difficult to describe the movement of electrons in an electric system in traditional classroom settings.

Or chemical reactions that occur between substances (e.g., Williamson & Abraham, 1995). Animation facilitates the creation of mental representations of phenomena, thereby promoting greater comprehension. Computer animation is extremely effective in demonstrating processes that cannot be seen naturally or are difficult to demonstrate in the classroom or laboratory (Fleming, Hart, & Savage, 2000). Learning environments with animation-based technology was extremely effective in developing algorithmic thinking in computer science (e.g., Ben-Bassat Levy, Ben-Ari, & Uronen, 2003; Esponda-Arguero, 2008).

Understanding abstract concepts in chemistry and biology (Kelly & Jones, 2007; Rotbain, Marbach-Ad, & Stavy, 2008), and biotechnology learning (Reed, 2005; Rubio Garcia, Suarez Quiros, Gallego Santos, Gonzales, & Morán Fernanz, 2007). (Good, 2004; Yarden & Yarden, 2006).

Studies comparing the effectiveness of animation-based learning environments to static images produced mixed, if not contradictory, results. On the one hand, studies have shown that animation-based learning has no significant advantage over static images (e.g., Betrancourt, 2005; Tversky et al., 2002). Meta-analytic findings, on the other hand, show that dynamic animations have significant advantages in promoting learning success (Hoeffler & Leutner, 2007). Other research has found that giving learners control over animation and cooperative learning can boost the effectiveness of animation-based learning environments (Betrancourt, 2005; Mayer & Chandler, 2001; Schwan & Riempp, 2004).

Nonetheless, it was discovered that in the context of complex systems, user control over the animation has no advantage (e.g., Boucheix, 2007; Lowe, 2004), so the effectiveness of the animation is not limited to cases in which the learner is required to perform specific actions in addition to watching the animation.

The Criteria Challenge

One of the major challenges of studies that investigate the effectiveness of innovative learning environments in developing evaluation criteria. The challenge is to identify measures and tools that can accurately represent the psychological-pedagogical characteristics of both technology-intensive and traditional learning environments. Usually, criteria for assessing learning success are uniform and based on traditional measures. Traditional achievement evaluation measures were used to assess the impact of learning in a technology-intensive learning environment. However, technology-rich learning environments serve specific educational goals. Evaluation measures that can express the effect of technology-intensive learning environments must consider innovative environments, and unique educational goals (Rosen & Salomon, 2007). These objectives include the ability to explain problems, creative problem solving, knowledge transfer to new and unfamiliar situations, and a proclivity for challenges.

Problem-solving in groups and learning motivation. Brown and Campione (1994) used non-traditional evaluation measures in their studies, such as the creativeness of learner suggestions and solutions, analogies, and argumentation methods. Scardamalia, Bereiter, and Lamon (1994) developed and implemented a thinking-level measure as part of their CSILE project. The Jasper project's primary measures assessed information explanation, creative problem solving and learning motivation (Hickey, Moore, & Pellegrino, 2001).

An Investigation into the Effects of Animation-Based Learning

The new educational measures developed during various research projects dealing with technology-intensive learning environments are suitable for assessing the educational goals specific to these environments. The current study is based on these measures. This study aimed to learn more about the effects of using animations in teaching and learning. The study specifically looked at the effect of animation-based learning environments on knowledge transfer and motivation to learn science and technology. Regarding knowledge transfer, the study concentrated on the effect of. The impact of the learning experience on students' ability to apply knowledge to new situations, a conscious and directed transfer of abstract concepts that can be widely applied in other fields and situations (e.g., Bransford & Schwartz, 1999; Halpern, 1998; Salomon & Perkins, 1989). This ability is critical for learned knowledge and serves as a thinking tool for learning and comprehending new topics.

Several previous studies have found that animation-based learning was more effective at problem-solving transfer than text-based learning (e.g., Chandler & Sweller, 1991; Mayer & Anderson, 1991, Mayer & Sims, 1994, Mayer, Steinhoff, Bower, & Mars, 1995). Although animation is thought to be a promising teaching and learning tool, research on its effectiveness in fostering transfer and learning motivation is mixed.

From the previous studies, there are several positive impacts have been widely discussed in the context of teaching and learning. Teaching and learning in schools based on computer animation can change existing methods as examples of verbal and traditional instruction. Interactive learning can respond positively to blending techniques, namely computer-aided, by other means. Interactive animations are a great learning medium for students today.

This is because learning how to use animations is not as boring as studying in a school just by paying attention to the teachers who make it clear in the classroom. Creative and innovative teaching with an interactive learning system is an example of Learning interactive animation used by both lecturers and students (Kholis, A. 2015). Multimedia technology can be used in many ways to develop a teaching tool that incorporates various learning media such as text, graphics, animation, audio, and video (Ariyati, S., & Misriati, T. 2016).

Animation, which is essentially a visual presentation, has become the most prominent feature of the technology-based learning environment. It refers to a simulated motion picture that shows the movement of a drawn object. To date, computer animation in education has become one of the most powerful tools for presenting multimedia materials for students.

Besides, animation plays a vital role as an exciting learning medium. Learning outcomes differ from oral learning styles, especially in the application of Java programming concepts, procedures, and principles (Negara, I. K. R. Y. 2017). Animation is one of the elements of multimedia that is also applied in the teaching and learning process as it can bring a human fantasy to the real world.

The combination of media in computer graphics animation software such as text, graphics, animation, and audio makes teaching and learning more interesting, active, and fun (Tsukazaki, K., Shintoku, T., & Fukuzoe, T. 2019). Sometimes people have no interest or knowledge of the importance of using media in learning, especially computer-based animation applications (Ruiz, J. G., Cook, D. A., & Levinson, A. J. 2009). When it comes to choosing a model, the use of specific learning media is essential. One of the media that can be used is computer animation media for example the use of computer animation is also allowing several challenges and limitations during the teaching and learning process (Wang, Y. 2017). Firstly, needs skills in using animation software such as adobe after Effects and adobe animate.

METHODOLOGY

The research was carried out in five elementary and three secondary schools in Jordan during the 2021-2022 school year. All participating schools incorporated BrainPop-based teaching and learning into their standard curriculum about "Science and Technology." The participating schools were chosen to use the following inclusion criteria:

a. the presence of same-grade control groups in which science and technology instruction was delivered using traditional methods (without using BrainPOP animations or another technology-enhanced learning environment);

b. the administrative and pedagogical staff's willingness to fully cooperate with the research staff; and

c. the presence of the technological infrastructure required by the BrainPOP learning environment.

Table 1 summarizes the grade and gender distribution of students who participated in the experimental and control groups.

The study included 518 students: 240 from the Sixth grade and 277 from the Ninth grade. Students in the experimental group took part in science and technology lessons that included the animation environment at least once a week. Depending on the topic being taught, the experiment was carried out for 2 to 4 months.

None of the students had previously participated in this type of instruction. After school, the students had full access to the animation environment. The study's volunteers included eight science and technology teachers. To end or reduce the teacher effect, the same teacher usually taught the experimental and control groups. All teachers have at least seven years of experience.

The Learning Environment

The research focused on two topics from Israel's elementary and secondary school science and technology curricula:

a. The Earth and Space (6th grade)—22 Brainpop animations about the moon, sun, galaxies, asteroids, the Big Bang, and star life cycles.

b. Materials and their properties (9th grade)—17 Brainpop animations on topics such as the atom model, aggregation state, compounds, isotopes, and acids

The animation content is tailored to the curriculum, with a focus on scientific accuracy and pedagogical suitability. The teaching and learning process is based on Tim (a boy) and Moby (a robot), the main educational figures in the animations. An animation typically lasts 3–5 minutes.

Table 1. Shows the research population by grade level and gender

Group	Male	Female	Elementary	Secondary	Overall
experimental	81(36%)	132(58.7%)	128(56.9%)	97(43.1%)	225
Control	56(29%)	119(61.7%)	122(63.2%)	71(36.8%)	193
Overall	247	270	245	267	517

Most videos include a lesson plan for the teacher, a quiz, and a database of questions and answers for students. Students can also send questions to system operators and receive responses via email.

The current study concentrated on knowledge transfer to new, and unfamiliar situations. One of the most important components of higher-order thinking skills is knowledge transfer. Raising questions, making comparisons, resolving non-algorithmic and complex problems, coping with disagreement, identifying hidden assumptions, and planning scientific experiments are all examples of higher-order thinking skills.

The desire to learn science and technology. This variable is defined as an internal state that stimulates, directs, and supports student behavior in science and technology learning. Students generally regard science and technology learning as a significant and profitable activity, and they strive to get the most out of it.

Sample and Data Collection

The study used the pre-post method to administer a multi-measure self-report questionnaire:

• Pre-test: Before taking classes that incorporate the BrainPOP animation environment.

• Post-test: Following the completion of the relevant topics learning period (2–4 months) for each grade.

The following items were included in the questionnaire:

Transfer of knowledge. Six questions on topics related to earth and space or materials and their properties (based on grade), assessing students' ability to apply knowledge in a new and unfamiliar situation, such as

• You are part of a space crew! The crew was supposed to meet the spaceship on the bright side of the moon, according to the plan. The spaceship landed 220 kilometers away from its intended location due to a technical failure.

Most of the equipment was damaged during the landing. Your crew's survival is dependent on reaching the mother ship. You must therefore select the most critical items that will keep your crew alive during the 200-kilometer journey to the mother ship. Attached is a list of six unharmed items (Matchbox, sky map, magnetic compass, space suit, 25 liters of water, and solar-powered transmitter). List them in order of importance to your crew, from most important to least important. Explain how each item can help your crew and how to use it.

• You need to organize a basketball game on the moon. The ability of the players to throw a ball from one side of the field to the other determines the size of the field on Planet Earth. The relative difficulty of jumping to reach the basket determines its height. Would you suggest changing the field's length and the height of the basket? Explain your response (it is assumed that the mass of the ball has not changed).

Consider tying two similar balloons together, one filled with helium and the other with carbon dioxide. What will become of the balloons? Describe the various options.

• They turned a fan on for an extended period in a sealed room with no people inside. Will the room's temperature rise or fall? Explain your response.

Graduate education students coded independently. 83 percent of elementary students and 88 percent of secondary students agreed with the answers.

Learning science and technology requires motivation

The questionnaire contained ten items designed to assess students' interest in science and technology learning. On a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree), participants reported their level of agreement with each item, such as I enjoy learning science and technology; scientific matters are related to my fields of interest; I want to continue learning science in the future; I want to be a scientist. The SQM-Science Motivation Questionnaire was used to develop the items. The questionnaire's reliability (internal consistency) was.87. Participants were also asked to draw or write something.

The researchers and a focus group of two teachers developed the questions based on the conceptualization of higher-order thinking skills with a special emphasis on transfer, as well as questions from Jordan's science and technology curriculum for elementary and secondary schools.

A typical science and technology lesson is described in the text. The qualitative data were collected to supplement the quantitative information gathered through the motivation questionnaire. The drawings were analyzed quantitatively on drawing components. Following the establishment of the categories, three graduate students in education independently coded student drawings. For both elementary and secondary students, the inter-coded agreement was 84%. The following categories were used to code the drawings:

• Student at the center—position Students in the learning environment

• Student enjoyment—Representing positive emotions, such as smiling or words like "happy" • Computer use; • Blackboard use

• Student experiments

Students were also asked to provide background information such as their gender, parents' occupation, and participation in extra-curricular scientific activities. This data was gathered due to the possibility of interaction with study variables.

RESULTS

Before and after the experiment, students in the experimental and control groups were asked to complete the transfer of knowledge questionnaire. The six questions were designed to assess students' ability to apply their knowledge to new situations in the context of science and technology. Correct answers to the six summarized questions result in a grade of 100.

The results for elementary school students are shown in Table 2. The results showed that incorporating Brain pop animations into the learning process significantly improved elementary-school students' ability to transfer scientific and technological knowledge (ES = 1.00, t = 11.50, p.001). During the same period, the findings revealed only a minor increase in the control group's ability.

The results of secondary school students are shown in Table 3. The results showed that learning with animations significantly improved students' ability to transfer scientific and technological knowledge (ES =.94, t = 9.42, p.001). During the same period, the control group's transfer of knowledge and ability increased only slightly. Furthermore, the study found that incorporating Brain pop animations into the learning process increased classroom homogeneity among secondary-school students regarding knowledge transfer ability (SD change of 9.63 in the experimental group and 5.03 in the control group).

Table 2. Shows the effects of BrainPOP animations on the development of knowledge transfer ability in elementary school students.

Group	Mean of the Pre-Test (SD)	Mean of the Post-test (SD)	t (df)	ES
experimental	42.21(31.85)	53.54 (14.37)	10.30***(120)	2.00
Control	46.32 (31.34)	35.03 (30.41)	2.47* (113)	.09
*p < .05. **p < .01. ***p < .001				

Table 3. Shows the effects of Brain pop animations on developing knowledge transfer ability in secondary school students.

Group	Mean of the Pre-Test (SD)	Mean of the Post-test (SD)	t (df)	ES
experimental	47.45(31.57)	74.54 (23.94)	9.42***(92)	.94
Control	52.67 (24.13)	53.58 (24.13)	.06* (63)	.06
*p < .05. **p < .01. ***p < .001				

There were no significant relationships found between incorporating BrainPOP animations into the learning process and either elementary or secondary school students' gender, parents' occupation, or participation in extra-curriculum science activities.

The Influence of Science and Technology on Learning Motivation

Before and after the experiment, students in the experimental and control groups were asked to complete a motivation questionnaire. The results for elementary school students are shown in Table 4.

The results showed that incorporating Brain pop animations into the learning process significantly increased elementary-school students' motivation to learn science and technology (ES = 1.60, t = 14.27, p.001). The findings revealed a decrease in motivation in the control group during the same period.

The results for secondary school students are shown in Table 5. The findings revealed a similar pattern among secondary school students. Learning with Brain pop animations significantly increased secondary-school students' motivation.

Table 4. Shows the effects of incorporating Brain pop animations into the learning process on elementary-school students' motivation to learn science and technology

Group	Mean of the Pre-Test (SD)	Mean of the Post-test (SD)	t (df)	ES
experimental	3.21 (.77)	4.36 (.54)	14.24***(1 16)	1.60
Control	3.15 (.77)	2.78 (.74)	– 4.36***(11 3)	–.22
*p < .05. **p < .01. ***p < .001				

Table 5. Shows the effects of incorporating Brain pop animations into the learning process on secondary-school student's motivation to learn science and technology

Group	Mean of the Pre-Test (SD)	Mean of the Post-test (SD)	t (df)	ES
experimental	4.00 (.94)	3.87 (.72)	9.70*** (92)	.92
Control	2.84 (.72)	2.82 (.67)	– 3.82*** (63)	–.46
*p < .05. **p < .01. ***p < .001				

Students are more likely to learn science and technology (ES =.92, t = 9.70, p.001). The findings revealed a decrease in motivation in the control group during the same period.

Student Drawings Have an Impact on Students' Perceptions of Science Learning

Before and after the experiment, students in the experimental and control groups were asked to draw pictures of the science and technology lesson. They analyzed the drawings using the following categories (see the section on research tools): students in the center, scientific equipment, student enjoyment, learning with computers, and learning through experiments. Table 6 displays the findings of a qualitative analysis of the drawings of elementary students before and after learning with Brain pop animations.

After incorporating Brain pop animations into the learning processes, the majority of elementary-school students' drawings placed the learned at the center of classroom interactions (54.2 percent compared with 22.5 before the expert- meant and with 19.5 percent in the control group during the same period). The illustrations demonstrated the use of ICT (62.5%) and placed a greater emphasis on scientific equipment (34.4 percent). The majority of the students' figures were in the drawings.

Table 6. Shows the impact of learning with Brain pop animations on students' perceptions of science and technology learning based on elementary school drawings

Group	Experimental group		Control group	
	Pre-test (%)	Post-test (%)	Pre-test (%)	Post-test (%)
Student at the center	19.5	54.2	21.4	17.5
Scientific equipment	22.6	56.6	24.2	30.6
Student enjoyment	35.3	63.4	30.7	26.5
Learning with computers	12.5	62.5	13.9	12.7
Learning through experiments	17.9	34.4	19.2	21.3

Demonstrated interest in learning (63.4 % compared with 35.3 % before the experiment and with 26.5 % in the control group at the same time). There were only minor differences between pre-and post-test drawings in the control group. The results of the qualitative analysis of secondary-student drawings before and after the incorporation of BrainPOP animations into the learning process are shown in Table 7. Following the incorporation of BrainPOP animations into the learning experience, most secondary-student drawings placed the students in the center of the classroom interaction, similar to elementary-school students (53.2 % compared with 7 % before the experiment and with 14.5 % in the control group during the same period).

The illustrations depicted ICT (46.7 %) and emphasized scientific equipment (52.4 %). The majority of the students' figures in the drawings expressed joy and enthusiasm for learning (52.2 %). In the control group, only minor differences in pre- and post-test drawings were discovered. To summarize, before incorporating Brain pop animations into the earning environment, students' perceptions of science learning were characterized by the use of the blackboard, minimal learning through experiments, and limited use of ICT. In classroom interactions, students perceived themselves as peripheral, with the teacher as the central figure. The majority of the students' drawings included an element that was unrelated to the lesson.

Table 7. Shows the effect of learning with Brain pop animations on secondary students' perceptions of science and technology learning

Group	Experimental group		Control group	
	Pre-test (%)	Post-test (%)	Pre-test (%)	Post-test (%)
Student at the center	7.0	53.2	11.2	14.5
Scientific equipment	25.5	52.4	23.4	25.5
Student enjoyment	20.3	52.2	18.6	20.1
Learning with computers	14.6	44.6	12.1	10.3
Learning through experiments	23.0	42.9	26.4	28.8

DISCUSSION

The purpose of this study was to investigate the effect of BrainPOP animations integrated into the learning environment on knowledge transfer and science and technology learning motivation. The findings revealed that learning with BrainPOP animations significantly improved students' ability to transfer.

Applied scientific and technological knowledge to new and unfamiliar situations (ES = 1.00, t = 11.50, p.001; secondary students: ES =.94, t = 8.7, p.001). The findings indicate that a technology-enhanced learning environment that combines traditional teaching components with ICT-assisted learning (animation videos and online quizzes) produces thoughtful learners with the ability to transfer knowledge, which is one of the most complex abilities (Haskell, 2001; Marini & Genereux, 1995).

Knowledge transfer is a process in which knowledge is used significantly in a new context (target task) based on knowledge constructed in a different situation (source task), including knowledge reconstruction, and adaptation (Presseau & Frenay, 2004). Educational objectives that emphasize thinking as well as knowledge construction can be met in a learning environment based on current psychological principles and educational objectives (Rosen & Salomon, 2007). The Brain pop animations' learning environment is based in part on these principles, which emphasize multidimensional thinking and the demonstration of complex phenomena.

Teachers and subject matter experts serve as learning facilitators, blurring the distinction between the classroom and home learning. The characteristics of the animations, particularly their heroes, encourage students to take different perspectives. Children identify with the heroes of the animation and see the content in their eyes. The psychological-educational dimensions of animated teaching and learning lead to the development of knowledge transfer ability—one of the most important thinking skills (e.g., Bransford & Schwartz, 1999; Halpern, 1998; Salomon & Perkins, 1989). This finding is consistent with the findings of previous studies, which show that computer-based animations have a high potential for learning about complex systems when compared to a traditional learning environment that focuses on verbal explanations provided.

By the instructors (e.g., Park, 1994; Rieber, 1991; Tversky, Bauer-Morrison, & Betrancourt, 2002). The Brain pop learning environment's graphic interface provides a highly effective stimulus for the learner through sound and animation. The environment encourages visual thinking, which is critical in the information age (Eshet, 2004).

The study found that learning with integrated animations significantly increased motivation for Science and Technology learning (elementary students: ES = 1.60, t = 14.27, p.001; secondary students: ES =.91, t = 9.90, p.001), whereas the control group's motivation decreased over the year. The motivational elements of the animations are consistent with the concept of flow (optimal experience), which includes feelings of concentration and enjoyment, excitement, internal motivation, and a proclivity to repeat the experience.

The study found that learning with integrated animations changed students' perceptions of science learning. Students perceived themselves to play a more central role in classroom interactions, expressed greater interest in learning, and placed a greater emphasis on the use of ICT and experiments during lessons. Thus, the change was not only motivational but also conceptual in terms of the nature of learning. Whereas conceptual change among learners was the result of learning in a new environment, teachers reported the need for an innovative conception among teachers as a necessary condition for teaching in a new environment. Their creativity, confidence, and dedication distinguished teachers from their students in creating a new and improved learning environment.

The study also discovered that among secondary school students learning with integrated animations, there was an increased tendency toward class homogeneity in terms of knowledge transfer (a change of 9.63 in SD). This finding could be explained by the fact that learning in traditional settings is especially difficult for students with learning disabilities. The new animation-based environment provided those students with feelings of optimal experience. These feelings increased the learning motivation and depth of understanding of students with learning disabilities. This finding is consistent with previous research on the effects of technology-enhanced learning environments on students with learning disabilities (e.g., Ford, Poe, & Cox, 1993; Ota & DuPaul, 2002).

RECOMMENDATIONS

The study looked at differences in knowledge transfer and motivation in the context of science and technology learning. An unanswered question is whether animation-based learning works in other contexts, such as social sciences and mathematics. Elementary and secondary school students took part in the study. It is unknown whether the results would have been different for high school or college students. The findings showed that learning in an environment that incorporates animations is especially beneficial for students with learning disabilities, based primarily on an increased tendency toward class homogeneity in terms of knowledge transfer. It is critical to design a study that specifically examines the effects of learning in a setting with integrated animations on students with learning disabilities.

LIMITATIONS

The current study focused on students' ability to apply knowledge in new situations. One unanswered question is whether animated learning affects other aspects of knowledge, abilities, and skills.

The distinctions between near and far transfer, general and specific transfer have the potential to be of great research and practical importance in terms of the effect of a learning environment with integrated animations. Far transfer refers to the application of knowledge and skills in situations that are vastly different from those in which they were developed.

Near transfer, on the other hand, refers to a transfer to a new but partially similar learning situation (e.g., Misko, 1995, 1999). The transfer is considered general when the task is multidisciplinary, and specific when it occurs within the original field in which the knowledge and skills were developed (e.g., Cormier & Hagman, 1987; Salomon & Perkins, 1989). It is advised to investigate the impact of animation-based learning on various transfer types.

The study looked at differences in knowledge transfer and motivation in the context of science and technology learning. An unanswered question is whether animation-based learning works in other contexts, such as social sciences and mathematics.

CONCLUSION

Based on the review mentioned above, this study can conclude that using animation as teaching material has several advantages. However, depending on the subject's suitability and the student's background, some restrictions may apply. Teachers play an important 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 skills and understanding. Several useful discoveries in the context of teaching and learning have been made. To begin, animation enables students to visualize content or subjects that are difficult to see in person.

Furthermore, the animation can explain difficult-to-imagine materials. Furthermore, many theoretical paradigms can explain using animation in language development as an example. 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 animation in education has grown and continues to grow. Based on the importance of animation, technology changes the animation itself. The advancement of software and applications for digital images is contributing 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, in which the student is at the center of the teaching and learning process, to overcome new educational challenges of the twenty-first century, thus moving away from previous education strategies such as masterclasses, in which the professor was at the center of the educational process, and toward innovative ones, in which the student is at the center of the teaching and learning process. 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 rather occurs in a variety of settings. 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, animation has proven to be a useful teaching tool. The education and evaluation strategies contents are to be adapted to innovative teaching and learning strategies specifically designed to apply animation education. In that way, universities and students would find broader possibilities to adapt to a constantly changing world.

REFERENCES

1) Ariyati, S., & Misriati, T. (2016). Perancangan animasi interaktif pembelajaran asmaul husna. Jurnal Teknik Komputer AMIK BSI, 2(1), 116-121.
2) Bétrancourt, M. (2005). The animation and interactivity principles in multimedia learning. The Cambridge handbook of multimedia learning, 287-296.
3) Boucheix, J. M. (2008). Young learners' control of technical animations. Learning with animation: Research implications for design, 208-234.
4) Bransford, J. D., Brown, A. L., & Cocking, R. R. 2000. How people learn: Brain, mind, experience, and school. Committee on developments in the science of learning and committee on learning research and educational practice, commission on behavioral and social sciences and education, national research council.
5) Brown, A. L., & Campione, J. C. (1994). Guided discovery in a community of learners. Classroom lessons: Integrating cognitive theory and classroom practice. K. McGilly
6) Chandler, P., & Sweller, J. (1991). Cognitive load theory and the format of instruction. Cognition and instruction, 8(4), 293-332.

7) Good, D. J. (2004). The use of flash animations within a WebCT environment: Enhancing comprehension of experimental procedures in a biotechnology laboratory. International Journal of Instructional Media, 31(4), 355.
8) Hickey, D. T., Moore, A. L., & Pellegrino, J. W. (2001). The motivational and academic consequences of elementary mathematics environments: Do constructivist innovations and reforms make a difference?. American Educational Research Journal, 38(3), 611-652.
9) Höffler, T. N., & Leutner, D. (2007). Instructional animation versus static pictures: A meta-analysis. Learning and instruction, 17(6), 722-738.
10) Hopson, M. H., Simms, R. L., & Knezek, G. A. (2001). Using a technology-enriched environment to improve higher-order thinking skills. Journal of Research on Technology in education, 34(2), 109-119.
11) Kholis, A. (2015). ANIMASI INTERAKTIF PEMBELAJARAN TAJWID PADA TAMAN QUR'AN ANAK (TQA) AL WASHILAH CIREBON. Jurnal teknik komputer AMIK BSI, 1(2), 159-170.
12) Levy, R. B. B., Ben-Ari, M., & Uronen, P. A. (2003). The Juliet 2000 program animation system. Computers & Education, 40(1), 1-15.
13) Negara, I. K. R. Y. (2017). The effect of animation in multimedia computer-based learning and learning style on the learning results. Turkish Online Journal of Distance Education, 18(4), 177-190.
14) Park, O. C. (1994). Dynamic visual displays in media-based instruction. Educational Technology, 34(4), 21-25.
15) Reed, S. K. (2005). From research to practice and back: The Animation Tutor project. Educational Psychology Review, 17(1), 55-82.
16) Rosen, Y., & Salomon, G. (2007). The differential learning achievements of constructivist technology-intensive learning environments as compared with traditional ones: A meta-analysis. Journal of Educational Computing Research, 36(1), 1-14.
17) Rotbain, Y., Marbach-Ad, G., & Stavy, R. (2008). Using computer animation to teach high school molecular biology. Journal of Science Education and Technology, 17(1), 49-58.
18) Ruiz, J. G., Cook, D. A., & Levinson, A. J. (2009). Computer animations in medical education: a critical literature review. Medical education, 43(9), 838-846.
19) Tsukazaki, K., Shintoku, T., & Fukuzoe, T. (2019, August). Teaching ICT Skills to Children and the Empowerment of Female College Students in STEM in Japan. In IOP Conference Series: Materials Science and Engineering (Vol. 551, No. 1, p. 012036). IOP Publishing.
20) 19)Wang, Y. (2017, March). Advantages and Disadvantages of Computer Assisted Instruction in Chemistry Teaching. In 2017 7th International Conference on Education, Management, Computer and Society (EMCS 2017) (pp. 1231-1235). Atlantis Press.
21) Williamson, V. M., & Abraham, M. R. (1995). The effects of computer animation on the particulate mental models of college chemistry students. Journal of Research in Science Teaching, 32(5), 521-534.