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Exploring the Role of Animation as a Learning Tool in Indian Education

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***Abstract*- This study examines the role of how animation can help learning in the Indian education system. It follows the history of animation from a fun entertainment medium to a tool for teaching explaining ideas keeping students interested and using technology. The study also compares how animation was used in teaching with how it is used today including computer-made animation, online learning platforms, traditional animation and animation that uses artificial intelligence. The review focuses on how animation affects student interest, conceptual understanding, memory of learning and long-term success. It considers how animation can help students of ages, schools and skill levels. It discusses new AI tools that can create educational animations and the challenges they bring. The main finding is that animation can greatly improve learning in India that fits the curriculum and is used together with teachers help and active practices.**

***Keywords- computer-based animation, conceptual understanding, AI-assisted animation, technology enhanced learning, traditional animation*.**

I. INTRODUCTION

A. Meaning of Animation in Education Animation in education is the use of pictures, graphics, characters, and sound to show ideas, processes and concepts. It helps students to understand abstract and difficult topics, especially to show how things change. It can be used in several subjects to show the various processes like the different systems in the body and how they function and interact, the different processes of cell division, etc. Animation in education plays an important role in encouraging students to take an active role in learning by increasing their attention, understanding and motivation as well as improving their retention [1].

B. Background of the Study

Recently, digital resources and tools have been widely adopted in the Indian education system. These include, DIKSHA, PM e-VIDYA, SWAYAM and use of 'Smart' classrooms. Many of these digital resources incorporate the use of animations and interactive medias to facilitate school level learning. The National Education Policy (NEP) 2020 also encourages technology-based learning, digital literacy, and equitable access to quality education [2].

C. Indian Education Context and Statement of the Problem

India's education system is large and varied, with differences in school infrastructure, language, access to devices and the internet, and teacher training. There are digital platforms such as DIKSHA and PM e-VIDYA that offer animations. However, many of the rural and government schools in India still face challenges with the lack of reliable electricity and internet, digital devices, and prepared teachers [2]. Increasingly, animation is being used in Indian education. However, the actual role and impact of animation in the Indian classroom is yet to be determined. Therefore, this study examines the use of animation to provide evidence on the role of animation in improving students' understanding and engagement as well as their motivation and performance in Indian classrooms.

D. Need and Importance of the Study

This study is needed because animation is increasingly being used in digital education. However, teachers and students still need to understand how to use animation in education effectively. Animation can help students visualize difficult concepts, but it cannot replace teachers or textbooks. The importance of the study lies in its potential to:

1) Help students grasp different concepts in an engaging manner, thus improving their overall learning experience.

2) Assist teachers to integrate animation in classroom teaching in an effective manner.

3) Facilitate the development of attractive and engaging teaching aids based on the academic curriculum.

4) Help formulators of education policies design improved digital educational resources. Proper use of animation in Indian classrooms has been found to enhance students communication, comprehension and academic performance, according to an Indian experimental study [1].

E. Scope of the Study

This study examines the use of animation in learning in Indian schools. It can cover any level of Indian education, whether primary, secondary or higher education. It can cover any of the school subjects, including science, mathematics, social science, and language. It can also cover different formats of animation including 2D and 3D animation, Whiteboard animation and educational videos. The study aims to understand the role of animation in students' academic performance, by improving their level of understanding, helping maintain their attention and interest,

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motivation and other similar parameters. The study also aims to understand the views of teachers and the challenges encountered by users of animation in Indian schools.

F. Central Argument

The central idea of this study is that animation has potential in Indian education provided it is designed appropriately within the curriculum and is language-appropriate, and is supported by teachers. Animation can bring simplicity and interest to various abstract and complicated concepts and aid in memory retrieval. However, excessive use of animation and poor quality animation can negatively impact its efficacy. Thus, animation should be considered an add-on method of teaching along with textbook-based teaching and classroom teaching, and supported by a teacher.

II. HISTORICAL DEVELOPMENT OF ANIMATION IN EDUCATION

A. *Early History of Animation*

Animation started as a type of visual entertainment. In 1892, French inventor Émile Reynaud presented Pauvre Pierrot in Paris using his Théâtre Optique, a projection of one of the earlier examples of publicly projected, sequential moving images. One of the first examples of an animated film comes from 1911 with the release of Little Nemo by Winsor McCay. .In 1914, McCay created Gertie the Dinosaur, which is considered the first animated film to feature an audience engaging character.

B. Transition from Traditional Animation to Digital Animation

In the late 20th Century, significant technological advances permitted the Indian educational animation industry to switch from traditional, cell-based animation to completely digital animation.

The possibilities for educational interactivity, flexibility and scalability improved tremendously. The widespread use of digital animation tools in education led to improvements in teaching and learning methodologies.

C. Development of 2D, 3D, Stop-Motion, and Interactive Animation

Developments in animation technology generated the use of different animation styles in education. 2D animation remained a key style for storytelling and visualization of simple and easy concepts. 3D animation added realism to concepts and allowed visualization of moving objects, subjects like biology and physics, and spatially large concepts like geography. Stop-motion animation allowed visualization of subjects requiring tactile experiments. Personal computers and the Internet encouraged the development of virtual 2D and 3D interactive animations, especially on websites, encouraging individualized learning and learner engagement.

D. Evolution of Animation in Education Educational television pioneered the use of animation in instruction. Animation thrived in the education industry in the 1980s and 1990s with the advent of easier-to-use computers to create animations, simulations, and other forms of interactive learning. The continuing growth of the Internet made digital classrooms and virtual labs a reality and boosted the development of animated explainer videos and online tutorials. In India, PM e VIDYA and DIKSHA platforms offer animation and interactive learning content for school children, among other online resources.

TABLE I

HISTORICAL DEVELOPMENT OF ANIMATION IN EDUCATION:

Year / Period	Development
1892	Émile Reynaud demonstrated early forms of animated moving images.
1911–1914	Winsor McCay produced early examples of hand-drawn animation.
1969	Sesame Street used animation to support educational activities.
1980s–1990s	Educational multimedia and computer-based animations gained popularity.
2000s onwards	Online videos, explainer animations, and virtual labs grew in use and availability.
Present	Animation is widely used in PM e-VIDYA, DIKSHA, and smart classrooms to support digital learning.

E. Indian Experimental Research

Researchers in India have undertaken experimental studies to understand the impact of animation on student learning. These studies compared animation-based instruction with conventional teaching methods, like using textbooks, blackboard teaching and lectures. In primary education, one experimental study showed that animation can be an effective teaching and communication tool, enhancing students' comprehension and academic performance, provided it was integrated with the taught contents.

F. Animation as a Learning Tool

Along with the development of motion pictures and film during the early 1900's, the use of film in the classroom began. Projectors connected to a classroom chalkboard (and later, overhead projectors) were used to create animated drawings, line by line. A major shift came in 1969 with the release of Sesame Street. Created by Joan Ganz Cooney and Lloyd Morrisett, the children's program focused on using songs, characters and skits to teach children 3-6 basic skills using an interdisciplinary approach. With a focus on younger children, it enhanced the perception on importance of using animation as an educational tool.

III. RESEARCH AIM, OBJECTIVES AND QUESTIONS

A. Objectives of the Study

1. To understand the meaning, need, and significance of animation in education as a learning tool and in improving classroom teaching and learning [1].
2. To compare the purpose and use of animation in

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education in the past and at present [2].

3. To examine the perks of learning through animation, like visualization, concept clarity and engagement.
4. To understand the limitations and challenges of animation in education in India that includes digital access, cost, teacher understanding and students distraction [3].
5. To examine the role of animation generated through AI in education, that includes its opportunities, challenges and future scope.
6. To examine the rise of EdTech platforms and their contribution, to providing animated learning content in India.

B. Research Questions

1. How did animation develop from entertainment into an educational learning tool?
2. Who were the important people involved in the early development of educational animation?
3. How does animation affect students' learning before and after its use?
4. Does animation improve students' conceptual understanding?
5. Can animation support long-term learning and academic achievement?
6. What are the major challenges in using animation as a learning tool in Indian education.

IV. EFFECTIVENESS OF ACROSS DIFFERENT EDUCATIONAL LEVELS AND LEARNER GROUPS

A. Studies involving diverse ages and educational groups

1. *Primary group:* Youngsters are highly responsive to visuals, audio cues, and stories, thus explaining the success of animation in holding their interest and helping them understand simple ideas. Most studies done in India so far have been done at this level [1].
2. *Secondary group*: At the secondary stage, animation helps in visualizing abstract concepts in subjects like Science, Math and Grammar. Studies that have been conducted in India so far, however, have been few and far between in this case.
3. *Higher secondary and undergraduate:* At higher secondary and undergraduate stages, animation can help conduct simulated experiments as well as explain complicated processes with several steps. But studies in this context are very scattered.
4. *Professionals, Vocational training, and Adults:* Animation also helps in skill development among professionals and vocational and adult education, which includes fields like design education [8] and awareness education [9]. They are the least studied category.

B. Improvement in Learning Before and After

Prior to using animation, students may find it difficult to understand concepts, may find them boring, or may find them unclear. Using animation may facilitate students' attention, interest, and understanding of the topic as well as their recall of the topic [1]. This figure illustrates the type of improvement that is expected after the use of animation-based teaching. Actual results may vary based on the school, subject, students, and teaching style.

C. From Short-Term Learning to Long-Term Achievement

Animation facilitates short-term learning through capturing students' interest and helping them to understand concepts immediately. Animation's long-term value lies in whether the concepts are remembered and understood later [1]. Long-term achievement is ensured with the help of combined teaching practices, such as revision, practice questions and teaching aids. Use of animation coupled with other teaching practices improves students' academic achievement [2].

V. ROLE OF ANIMATION IN LEARNING

A. Advantages of Animation

One of the reasons that animation plays a role in students' learning is that it allows for the visualization of ideas and representation of information. It allows for the explanation of difficult or abstract concepts. Animation enables students to see processes, movements and changes that may not be easily observable in the real world [1]. The main benefits are:

1. *Better understanding*: Animated videos have the potential to explain ideas and processes in ways that may not be easily visible to a student (e.g. how the water cycle works, how the body works, etc.) [2].

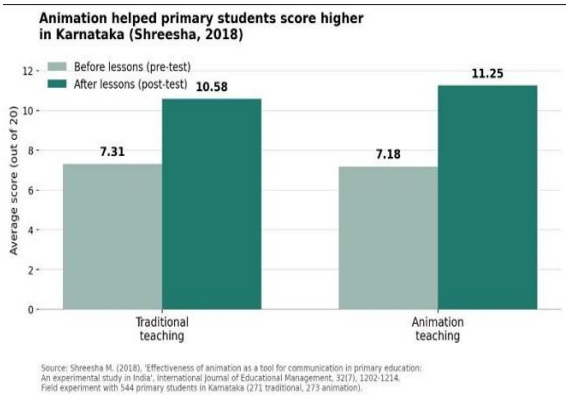


Fig. 1 Average test scores before and after lessons, traditional teaching vs animation teaching (Shreesha, 2018)

2. *More fun way of learning*: Students tend to get bored with the traditional way of learning (reading) and need a change. Animation helps in that regard.
3. *Improves retention*: With animation, students are more prone to remember ideas and details that they have previously learned [1].
4. *Self learning:* Students, at their convenience, can learn through animated videos and can repeat the process if needed [4].
5. *Practical learning:* Animated videos help learn ideas that may require a laboratory or field work (e.g. Chemical reactions, machines, historical process, etc).

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B. Challenges and Limitations

While there are many opportunities that animation offers to Indian education, there are challenges and restrictions with animation. If used incorrectly, it may hinder your learning. The major challenges and limitations are:

1. *Access to digital devices:* Not all schools have smart classrooms or projectors. Internet access is still a challenge in rural and government schools [3].
2. *Overuse and passive learning:* Teachers overly dependent on animation results in students' lack of development of reading, writing and critical thinking skills [2].
3. *Accessibility and inclusion beyond language:* It has nothing to do with using local languages. There are plenty of animations available in different languages, but not all of them are accessible to people with hearing or sight challenges [3].
4. *The platform trap:* Schools have to rely on private EdTech companies, which are usually filled with lots of ads, data tracking and/or limited free choices.
5. *Misaligned content:* Content becomes outdated quickly after it is created and, in the case of school animations, it rarely is updated.
6. *Lack of interaction:* When a teacher uses animations in replacement of examples or discussions, students miss opportunities to interact with the teacher and other students [1].

C. Future scope and Future Risks

1. *Future Scope:* The use of animation in Indian education goes beyond the limits of traditional teaching. It can find applications in virtual science and mathematics laboratories, animated language lessons and environmental education, health and awareness programs and skill-based training [5], [9]. Animation can help in designing training modules for teaching methods and other activities for teachers as part of teacher training programs. As a part of teacher training for English Language, there are several examples of the use of animation for NEP 2020 as well [6]. Comics and animation can make learning more enjoyable and help students understand lessons through visual storytelling. They can be used in subjects such as environmental studies, science, history, and language learning [7]. As part of education at higher and professional levels, animation can help in design education as well as architecture, fashion, media and other allied areas. It can also help in the development of various design ideas and serve as a way to demonstrate a product in use [8]. It is also possible to use animation for social awareness. In a simple and easy to understand way, various animations can be made on health, hygiene, nutrition, safety, environment and child education [9].
2. *Risks:* The first risk is that animation could distract more than teaching. If cartoons and music are overused, students might enjoy the video without learning anything [1], [2]. Ineffective animation or even incorrect facts could worsen the situation and, hence, it is the responsibility of the teachers to check if the content is accurate and appropriate [2]. The last risk is on access in India. In rural and government schools, which lack sufficient teachers, devices, steady electricity and the Internet, the negative effects of excessive screen time for students (poor vision, attention span and physical activity) are more pronounced [3], [5].

V. AI-ASSISTED ANIAMTION FOR EDUCATION

A. Meaning of AI-Assisted Animation

The term 'AI-Assisted Animation' refers to the application of AI technologies to create animated content for educational purposes. This process allows AI technology to be used to generate scripts, characters, background scenes, voice recordings, subtitling, translations, as well as short animated videos based on text or lesson plans [4]. The use of such a technology will allow for faster production of the visual learning material by teachers and other content providers. The text-based lesson can be converted into an animated video.

B. Importance in Education

The use of AI-assisted animations in education involves easy content creation by teachers. These animated videos may include scientific process videos, mathematical videos, geography videos, history videos, and language learning videos. In addition, AI-assisted videos can facilitate preparation of learning content in multiple languages because it is possible to create subtitles, translations, and even audio for the video. This becomes relevant in India, where children study in various languages [3].

C. Manual AI Animation

The manual AI animation requires that the teacher or the content developer is always in charge when using AI. The teacher provides the subject matter, script, illustrations, voice, and instructions, while the AI creates the animation [4]. As an example, the teacher can write a short script of the topic, pick appropriate images and voice, then the AI software will generate the animated video. However, before being used in class, the teacher needs to validate the facts, the language, illustrations, and alignment with the syllabus [5]. This approach is more advantageous because the teacher is still in charge of the content's accuracy and suitability. Therefore, AI should only assist teachers and not replace them [3].

D. New Areas Related to AI-Assisted Animation in Education

1. *Personalized Animated Learning:* Artificial Intelligence can tailor the animation according to the learning level of the student. If a particular student is having trouble understanding science, then Artificial Intelligence can generate an animated video with examples at a lower level of difficulty and a slower pace. It can prove to be beneficial for slow learners and underprivileged learners. Artificial Intelligence can adjust the language used, speed, visuals, and level of difficulty according to the learner's requirements [4].
2. *Multilingual Animation for Indian Classrooms*: There

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are numerous languages in India, and the efficiency of learning increases if the content is in the mother tongue or regional language of the student. Artificial Intelligence can help translate the educational animation into various languages including Marathi, Hindi, Tamil, Telugu, Bengali, and other languages. The inclusion of voiceover, subtitles, and regional examples is also possible. This can make animation more inclusive for rural students, tribal students, and learners who are not comfortable with English [3].

3. Animated Lessons for Disabled Students: Animations powered by AI can be used to make educational processes more inclusive through the creation of videos involving avatars of sign language, audio descriptions, subtitles, simplification of visuals and slow narration, which are intended for people suffering from different types of impairments, including auditory, visual, or learning disabilities. These animations could help to make instruction accessible for students with special needs, making it easier for them to understand the lesson [3], [5].

4. Animation for Rural and Remote Areas: In many rural or remote areas, schools have no teachers who would be qualified enough, as well as no laboratories, libraries, and other specialists in the matter. Animated lessons could be sent to such schools using mobile devices, projectors, TV, or even offline digital content. The usage of AI could help to produce affordable animated lessons that do not require permanent access to the Internet [3].

5. Animation for Vocational Training: Animation can provide vocational training where different skills can be taught using animation like tailoring, agriculture techniques, computers, electricity, health care, and small business skills. The AI-based animation can help to learn the process with step-by-step instructions, safety measures, and practical examples.

E. Future Directions

In future, AI-assisted animation can create affordable, syllabus-based contents for schools in India. They can be integrated with the national digital platforms such that animation contents in regional languages reach the learners [3]. Future research could concentrate on creating tools that are user-friendly; those that automatically transform lesson notes into animation, translates automatically to accommodate inclusivity, and performs quality assurance of the facts used [4], [5]. AI can also be employed in creating virtual labs, skills-based learning, and personalized learning material depending on the students levels.

VI. EDTECH PLATFORMS' CONTRIBUTION

Platforms like BYJU'S, Vedantu, and Unacademy have introduced animated learning as a part of the regular Indian education system, making it an on-demand tool for the learners to use from their homes.

Key contributions

1. Illustration of complex ideas: Animated videos help in explaining ideas like chemical reactions, geometries, and human body systems that cannot be explained easily using traditional classrooms.

2. Accessible: Small-town students can get good and well-made content.

3. Engagement: Use of characters and tests helps in keeping learners engaged.

4. Self-paced learning: Learners have an opportunity to stop, repeat and go through content again.

5. Continuity of educational processes: Edtech platforms have continued educational processes during the school closures during COVID-19.

6. Personalized learning: Tests and progress tracking help in giving personalized topic suggestions along with animations.

7. Interactive learning: Edtech platforms like Vedantu provide live interactions with teachers using animated content.

8. Innovation and employment of skilled people: Development in the field led to production of good quality content and also provided job opportunities to animators, instructional designers, and content developers.

These platforms show strong demand and scalability of animation-based learning in India. Along with government-led platforms like DIKSHA and PM e-Vidya, they make animated learning accessible across India [5].

VII. CONCLUSION

Moden education uses animation to make learning more attractive, interactive and easy to grasp. The transformation of animation from traditional to digital with the help of AI has opened up ways to foster personalized, multilingual and inclusive learning. Animation aids understanding and creativity at all levels of education and helps individuals remember what they have learned. There are challenges of cost, accessibility and technological limitations. However, where EdTech meets animation, AI and other technologies, improvements in education can be expected. Animation can and should play a pivotal role in transforming future education in making it more effective and friendly to the student.

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