

Enhancing Health, Safety, and Environmental Awareness through Animation: A Multifaceted Approach

Titas Jana^{1*}, Subhabrata Khara²

Abstract

Animation is a process of visualizing different modes of communication by making an illusion of motion in sequences, which makes an easy medium between the maker and the viewer. Animation design is poised to revolutionize the realms of environment, health, and safety in the future world. This study explores the pivotal role of animation in these domains and its potential impact on shaping a more sustainable and secure future. Concerning health and safety, animation offers a unique platform for educating individuals on preventive measures, emergency protocols, and health-related information. In the future world, animated simulations can provide comprehensive training modules for healthcare professionals, emergency responders, and the general public. These simulations can simulate realistic scenarios, enabling learners to practice decision-making in controlled, risk-free environments. Additionally, animated content can illustrate health guidelines, hygiene practices, and safety procedures, enhancing public awareness and promoting adherence to protocols for a healthier and safer society. In the field of environmental studies, animation serves as a powerful tool for visualizing complex ecological systems, climate change scenarios, and the consequences of human impact on the environment. Through immersive and interactive animations, concepts related to biodiversity, deforestation, pollution, and sustainable practices can be effectively communicated to a broad audience, fostering awareness and inspiring proactive change. Furthermore, the visualization of innovative solutions, such as renewable energy sources or conservation efforts, through animation, can encourage global participation in environmental preservation.

Keywords: Animation, health, safety, environment, computer graphics, visualization

INTRODUCTION

*Author for Correspondence

Titas Jana
E-mail: titasjana16@gmail.com

¹Student, Department of Media Science, Maulana Abul Kalam Azad University of Technology (MAKAUT), Government of West Bengal, NH-12 (Old NH-34), Simhat, Haringhata, Nadia, West Bengal, India

²Student, Department of Computer Science and Engineering, Haldia Institute of Technology, Indian Centre for Advancement of Research and Education Complex, Purba Medinipur, Haldia, West Bengal, India

Received Date: February 15, 2024

Accepted Date: March 21, 2024

Published Date: April 23, 2024

Citation: Titas Jana, Subhabrata Khara. Enhancing Health, Safety, and Environmental Awareness through Animation: A Multifaceted Approach. *Research & Reviews: A Journal of Health Professions*. 2024; 14(1): 58–68p.

Our aim was to provide a thorough examination of how immersive technologies, specifically Augmented Reality (AR) and Virtual Reality (VR), are transforming the landscape of the manufacturing sector. Industry emphasizes on the use of advanced technologies to enhance manufacturing processes, reduce time-to-market, and increase flexibility in product development. Manufacturers are adopting technologies to meet the demands of customers who seek product variance without compromising quality, all while adhering to globalized manufacturing standards. Immersive technologies like AR and VR are facilitating real-time instruction, training, and simulation in manufacturing environments. Virtual Reality (VR) offers users a complete immersion by transporting them into virtual worlds where they engage with lifelike simulations. Mixed Reality (MR) merges

aspects of both physical and virtual realms. Augmented Reality (AR) serves as a tool for instructing and guiding workers, improving efficiency and reducing errors in tasks. VR systems simulate manufacturing processes, enabling training and analysis in a virtual environment. Extended Reality (XR) expands immersive experiences beyond traditional AR/VR, with applications in assembly line monitoring, remote assistance, maintenance, and education/training. Marker-less AR techniques and context-aware technologies enhance AR applications in mobile and workshop environments.

VR systems face challenges in replicating real-world interactions and working conditions accurately, impacting fidelity and trustworthiness. Real-time performance remains a challenge for VR systems despite advancements in computation techniques. Here we will concentrate on how the animation technology has revolutionized the area of health, safety and environment.

Research by Banerski and Abramczuk explored the effectiveness of utilizing 3D animation to encourage individuals to adopt self-protective measures during floods, focusing on components derived from the Protection Motivation Theory (PMT) [1]. The investigation evaluated whether motivation to enact protective measures against flood risks could be heightened through 3D-enhanced messages emphasizing different aspects of PMT. Additionally, it examined the retention of self-protective actions and the underlying assumptions of PMT, including the assessment of perceived risk. Furthermore, another study investigated a comprehensive virtual reality-based serious game, tailored for training occupational health and safety procedures in underground mines [2]. The integration of serious games like MINING-VIRTUAL in occupational health and safety training represents a forward-thinking approach that leverages technology to enhance preparedness and risk mitigation in the mining industry. The positive feedback from both mining engineers and game developers supports the potential effectiveness and widespread acceptance of this innovative training methodology. There was a documented systematic review regarding the utilization of immersive technologies for safety and health management within the construction industry [3]. The diverse applications of these technologies in construction OSH management were reported to be used, it also highlighted important limitations, including the low adoption rate, research gaps, and the need for comparative studies, is essential for realizing the full potential of immersive technologies in improving occupational safety and health practices within the construction industry.

EXPERIMENTAL

We conducted a comprehensive study focusing on health education, specifically on personal oral hygiene, targeting the age group of 8–10 years. The study involves experimenting with three different learning methods: traditional board and chalk, 2D animation, and 3D animation.

Context and Purpose: The study is conducted amid the ongoing COVID-19 pandemic, emphasizing the need for globally deployable and engaging content that aligns with WHO recommendations. The primary focus is on health education, specifically addressing sedentary behavior and personal oral hygiene among children and adolescents.

Video Intervention Strategy: A video intervention strategy is employed to deliver key messages related to the spread of the novel coronavirus and preventive measures. The emphasis is on creating "evergreen" content to ensure relevance throughout the pandemic.

Animated Video on Sedentary Behavior: The animated video produced addresses sedentary behavior, explaining its definition, included activities, and methods to reduce related habits. Targeting children and adolescents, the video aims to educate them about the impact of sedentary behavior on health. The video development process involves four stages: design, animation, composite, and rendering.

Oral Hygiene Education Experiment: The study discusses an experiment on oral hygiene education for the age group of 8–10 years, employing three learning methods: traditional board and chalk, 2D animation, and 3D animation.

Traditional Method: The traditional approach involves using chalk and board to explain the topic, with illustrations of different parts of the tongue in English and Bengali. Different taste buds are marked, and the tasting process is explained with markers. This method aims to understand the speed and ease of learning in a familiar environment.

2D Animation: A descriptive video is created using 2D animation, illustrating how the tasting of food works through the tongue and nasal system. The video is designed in a sticker-ish style to make it fun and attractive for children, incorporating hygiene tips as well.

3D Animation: A 3D video features a 360° rotation of a tongue model created with NOMAD sculpt. The model includes colored and textured areas representing different taste buds. Texts indicating various tastes like bitter, salty, sour, and sweet are added during video editing using Adobe Premiere Pro.

Our study combines health education, animation techniques, and language considerations to create engaging and informative content for a specific age group. By employing both conventional and digital techniques, it becomes possible to thoroughly investigate the efficacy of various learning methods.

For the use of animation in Safety and Environment fields, we made some cartoony pictures on how to use a fire extinguisher in an emergency situation and different environmental issues. We present here a comprehensive framework utilizing animation technology to simulate and address various construction hazards, aiming to enhance safety awareness among workers and mitigate work-related accidents. The developed modules effectively demonstrate the most prevalent accident types, offering a valuable tool for educating and training personnel in the chemical process industries. As technology continues to advance, the importance of designing safe systems and environments becomes increasingly crucial. We highlight the significance of utilizing virtual reality (VR) to expose personnel to hazardous situations in a secure, highly visual, and interactive manner, fostering a proactive approach towards accident prevention [4, 5].

RESULTS AND DISCUSSION

Role of Animation in Health

Animation plays a crucial role in the field of health by contributing to various aspects of healthcare, medical education, and public health communication. Here are several ways in which animation is instrumental in the health sector:

Medical Education and Training

Anatomical Visualization: Animation is used to create detailed and accurate visualizations of complex anatomical structures and physiological processes. This aids medical students, healthcare professionals, and researchers in understanding the human body and its functions more comprehensively.

Surgical Procedures: Animated simulations of surgical procedures provide valuable training tools for surgeons. These simulations can be used for preoperative planning, skill enhancement, and familiarization with new techniques, contributing to improved patient outcomes.

Patient Education

Disease Awareness: Animation helps in creating educational materials that explain various medical conditions, their causes, symptoms, and treatment options. This assists patients in understanding their health conditions and making informed decisions about their care.

Medication Guidance: Animated videos can demonstrate the proper use of medications, including dosage instructions, administration techniques, and potential side effects. This ensures that patients adhere to prescribed treatments and manage their health effectively.

Public Health Communication

Health Campaigns: Animation is used in public health campaigns to communicate important messages about preventive measures, vaccinations, and healthy lifestyle choices. Animated content is often more engaging and can reach a diverse audience.

Outbreak Response: During disease outbreaks, animation can be employed to explain the spread of diseases, the importance of vaccination, and preventive measures. This aids in promoting public awareness and mitigating the impact of the outbreak.

Rehabilitation and Physical Therapy

Exercise Demonstrations: Animation can illustrate specific exercises and rehabilitation routines prescribed by healthcare professionals. This helps patients understand and perform exercises correctly, facilitating the rehabilitation process.

Biomechanics Visualization: Animated visuals can depict biomechanical principles, helping both healthcare providers and patients understand the mechanics of movement and the impact of various exercises on the body.

Medical Research and Data Visualization

Molecular and Cellular Processes: Animation is valuable in visualizing molecular and cellular processes, aiding researchers in studying complex biological mechanisms. This can enhance the understanding of diseases and contribute to the development of new treatments.

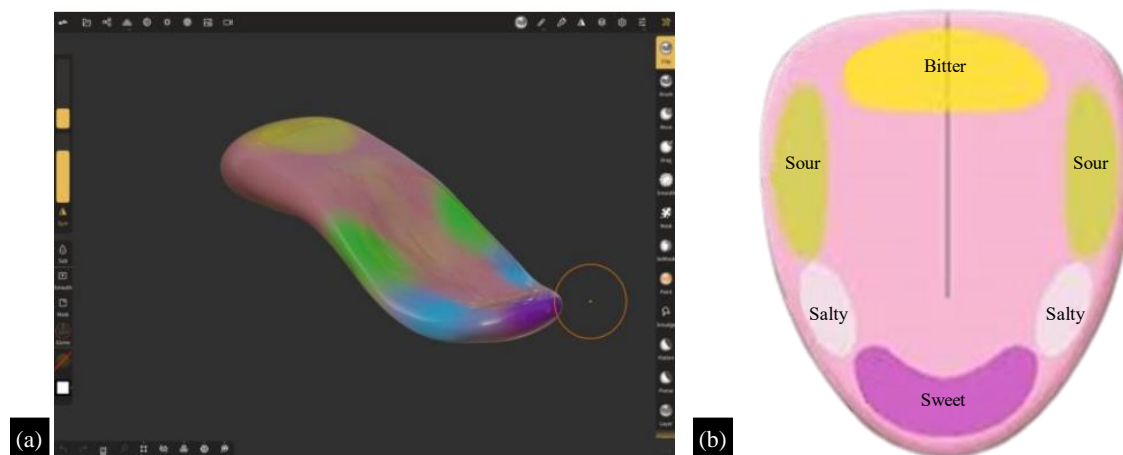
Data Representation: Animated graphs and charts can be used to represent medical and health-related data, making it more accessible and understandable for researchers, healthcare professionals, and policymakers.

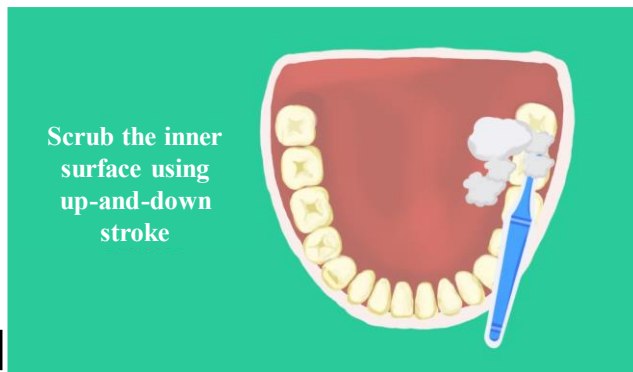
Mental Health Support

Psychoeducation: Animation is used to create psychoeducational materials for mental health conditions, reducing stigma, and providing information on coping strategies and available resources.

Mindfulness and Relaxation Techniques: Animated content can guide individuals through mindfulness exercises, relaxation techniques, and stress management strategies, contributing to improved mental well-being.

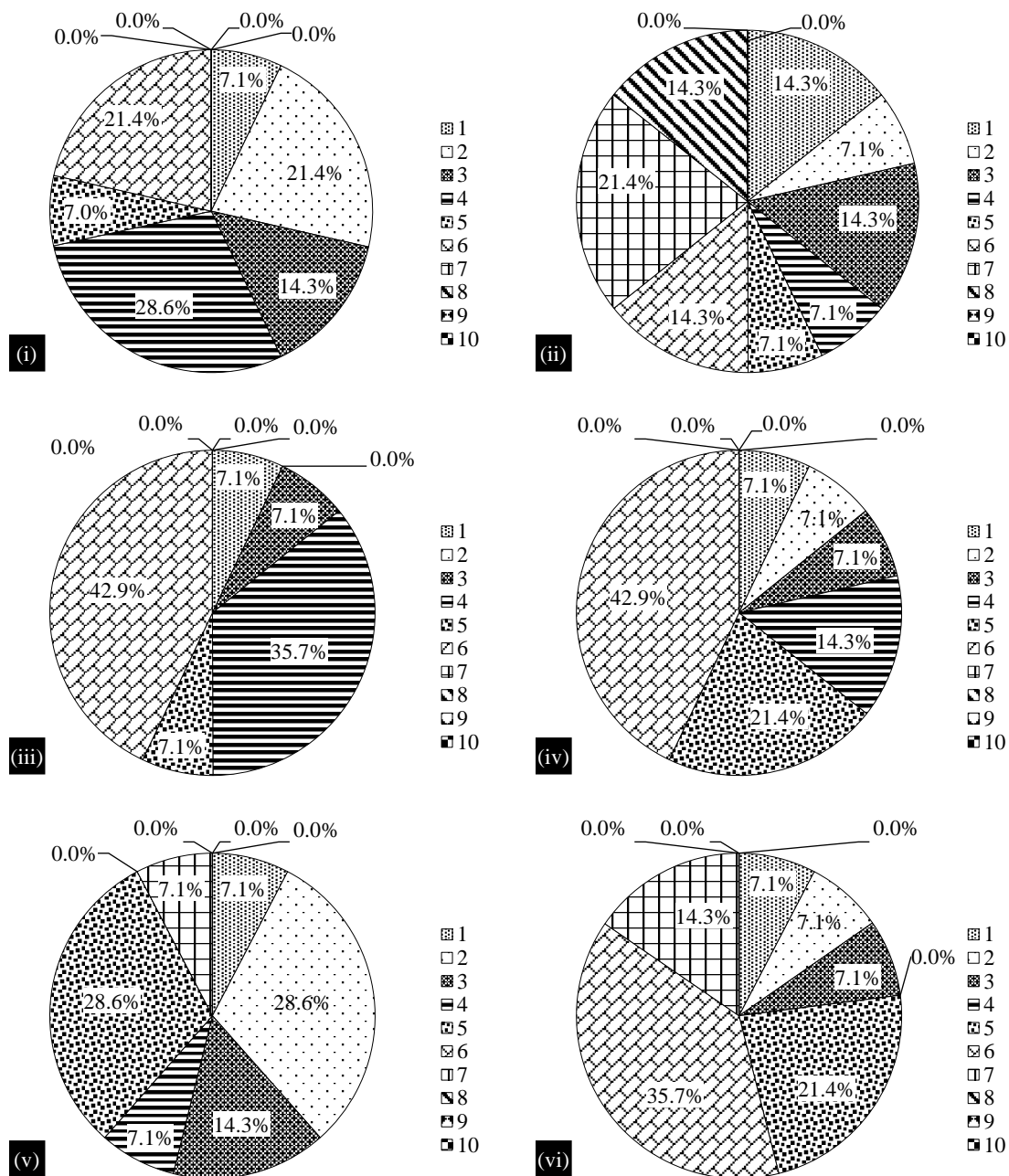
In Figure 1, we have presented the 2D and 3D models of Tongue and Teeth showing taste buds at different regions: (a) 3D model of Tongue, (b) 2D model of Tongue described in regional language, and (c) 2D model of Teeth.





(c)

Figure 1. 2D and 3D models of Tongue and Teeth showing taste buds at different regions (a) 3D model of Tongue, (b) 2D model of Tongue described in regional language, (c) 2D model of Teeth.



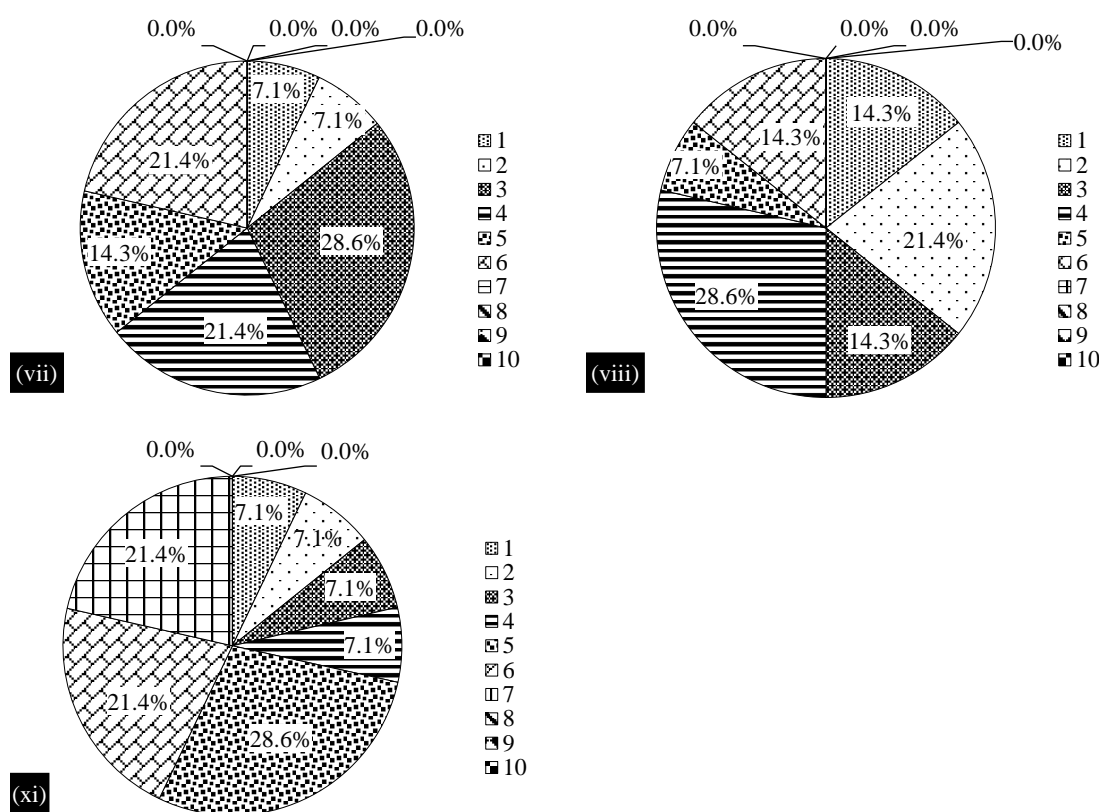


Figure 2. Survey results (i) how often watch animated content, (ii) how much understand English language in animated videos, (iii) how much prefer the Hindi language, (iv) how much prefer your mother tongue, (v) how much idea about the topic before this discussion, (vi) how much of the concept of the topic is clear on black board, (vii) how much concepts are cleared while watching the video, (viii) how much 3D Video help to learn and understand the topic, (ix) how many animated videos used to self-educate. The ten (10) different colour codes for ten (10) levels of remarks ranging from bad (level 1) to excellent (level 10) is shown as the level bar alongside.

The Figure 2(i) shows that 28.6% of the students watched the animated content of their 80% time spent on watching the TV etc.; (viii) shows that 3D Video help to learn and understand the topic effectively; and (ix) shows that 21.4% of the students used the animated videos for their self-education.

The findings of survey experiment conducted to understand the preferences and needs of students regarding educational content and animations; appear that students prefer content in their native language and may benefit from more exposure to animated educational materials (Figure 2). Here are some key points based on the observations:

Preference for Native Language: Students prefer educational content in their native language. This suggests that providing materials in the language that students are most comfortable with can enhance their comprehension and engagement.

Limited Exposure to Educational Animations: While students are accustomed to watching animated content in their daily lives, they may not be as familiar with animated educational materials. This indicates an opportunity to integrate more animated content into educational settings to enhance learning experiences.

Potential Benefits of Animated Content: Animated content can facilitate understanding and engagement among students. By incorporating animations into educational materials, students may find it easier to comprehend complex topics and visualize abstract concepts.

Increased Familiarity with Topics: Offering classes on various topics using animations can help students become more familiar with subjects and visuals, thereby enhancing their understanding and retention of the material.

Role of Animation in Safety Engineering

Animation can play a significant role in safety engineering by providing effective means to communicate, educate, and analyze safety-related information [6–9]. Here are several ways in which animation contributes to safety engineering:

Training and Education

Visual Representation: Animation allows the creation of visually engaging content that can represent complex safety procedures, equipment operations, and emergency scenarios. This visual representation helps in conveying information more effectively than traditional methods.

Interactive Learning: Animated simulations and interactive modules can be designed to allow workers to engage with and practice safety protocols in a controlled virtual environment. This hands-on approach enhances learning and helps in better retention of safety procedures.

Hazard Visualization

Animation enables the dynamic representation of various hazards and their consequences. This can include simulations of fire, chemical spills, equipment malfunctions, and other potential dangers. By visualizing these scenarios, safety professionals can better assess risks and develop appropriate safety measures.

Emergency Response Planning

Animated scenarios can be created to simulate emergency situations, allowing safety engineers to analyze and optimize emergency response plans. This includes evacuation procedures, first-aid protocols, and coordination of emergency services.

Process and Equipment Demonstration

Animated visuals can demonstrate the proper operation of machinery, equipment, and processes. This aids in ensuring that workers have a clear understanding of how to use equipment safely, minimizing the risk of accidents due to improper use.

Behavioral Analysis

Animation can be employed to study and analyze human factors in safety, such as worker behavior and decision-making in various situations. This information can be valuable for designing safety protocols that are more aligned with human tendencies and capabilities.

Communication of Safety Messages

Engagement: Animation has the advantage of being more engaging and memorable than text-based or traditional training methods. Safety messages conveyed through animation are likely to capture the audience's attention and promote better understanding and retention of critical information.

Risk Assessment

Animated models can dynamically represent changes in the environment, allowing for real-time risk assessment. This helps safety engineers to identify potential hazards and assess the impact of changes in different scenarios.

Maintenance and Inspection Procedures

Animation can be used to create step-by-step guides for maintenance and inspection procedures. This ensures that workers follow the correct protocols, reducing the risk of accidents during maintenance activities.

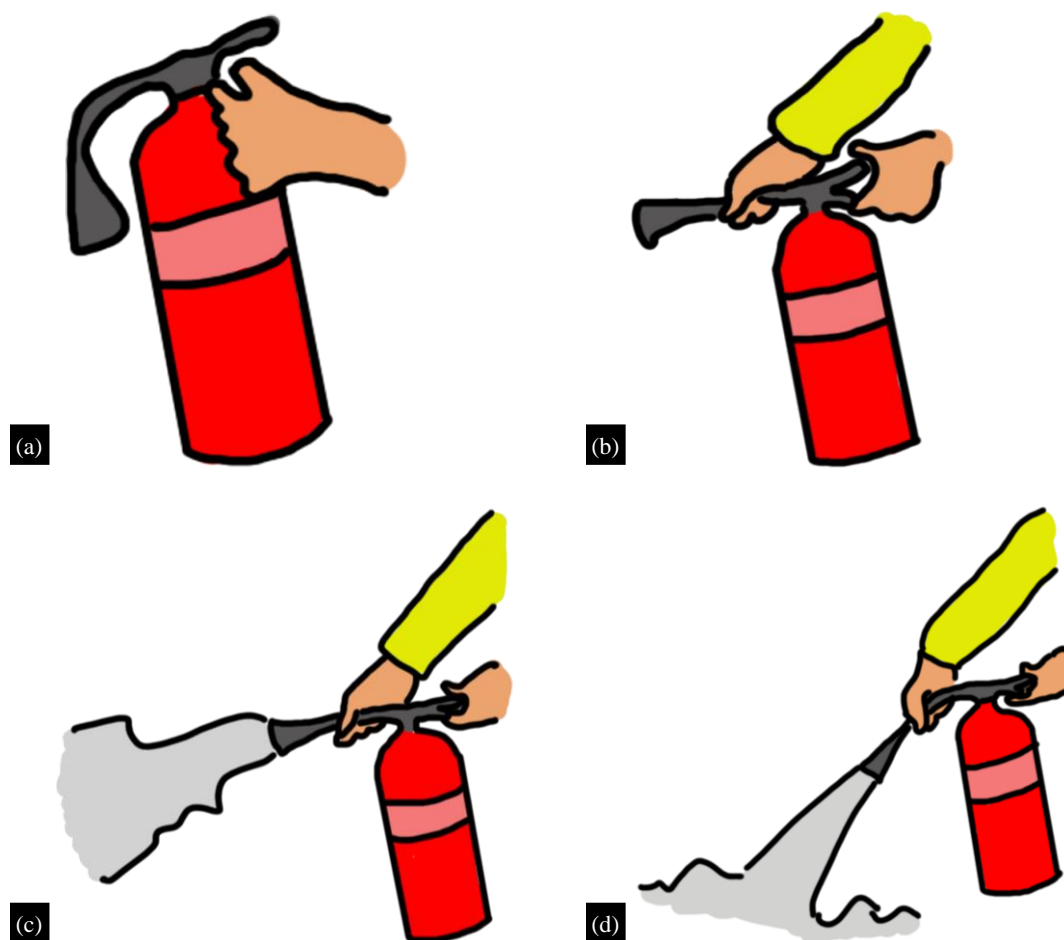


Figure 3. The cartoony pictures are shown how to use a fire extinguisher in an emergency situation. There is a *PASS* method to operate the Fire Extinguisher, which stands for (a) *Pull the Pin*, (b) *Aim the object*, (c) *Squeeze the nozzle*, and (d) *Sweep through on Fire*.

Industry has recognized the paramount importance of safety on job sites, leading to increased efforts in spreading awareness. To address the challenge of engaging learners in Occupational Health and Safety (OH & S) training, serious games have emerged as an effective tool. The design and development of an informative and entertaining game aimed at motivating users to learn about workplace hazards are discussed. The game's objectives include enhancing user retention of crucial concepts related to workplace hazards and management, as well as facilitating knowledge transfer into real-world scenarios (Figure 3).

The study involved participants who watched video clips and shared their views on their effectiveness in educating people about the proper use of safety equipment. Subsequent modifications were made to the videos based on participant feedback before the main intervention; animation helps to increase the awareness among the participants.

Role of Animation Environmental Awareness

Animation can play a pivotal role in raising environmental awareness by leveraging its ability to convey complex information in an engaging and easily understandable manner. Here are several ways in which animation contributes to environmental awareness:

Visual Storytelling

Animation allows for the creation of compelling visual narratives that can tell stories about environmental issues, such as climate change, deforestation, pollution, and habitat destruction. These

stories can resonate emotionally with the audience, making the information more memorable and impactful.

Complex Concept Simplification

Environmental issues often involve complex scientific concepts and data. Animation can simplify these complexities through visual representations, making it easier for a broader audience, including those without a scientific background, to grasp the key points and implications.

Behavioral Change Communication

Animated content can effectively communicate messages aimed at promoting environmentally friendly behaviors and sustainable practices. By illustrating the consequences of certain actions on the environment, animation encourages viewers to adopt eco-friendly habits.

Illustration of Environmental Processes

Animation allows for the dynamic representation of environmental processes, such as the water cycle, carbon cycle, and ecosystem dynamics. Visualizing these processes helps in enhancing the understanding of how ecosystems function and the interconnectedness of various elements in the environment.

Showcasing Conservation Efforts

Animated content can highlight successful conservation projects and initiatives, showcasing positive examples of efforts to protect the environment. This can inspire viewers to get involved in similar initiatives and contribute to conservation efforts.

Global Impact Representation

Animation is well-suited for illustrating the global impact of environmental issues. By showing how actions in one part of the world can affect ecosystems and communities globally, animation helps viewers understand the interconnected nature of environmental challenges.

Interactive Learning Experiences

Interactive animated experiences, such as virtual reality (VR) or augmented reality (AR) applications, can provide immersive learning opportunities. These technologies allow users to explore virtual environments and witness firsthand the consequences of environmental degradation, fostering a deeper understanding of the issues.

Awareness Campaigns

Animation can be a powerful tool for creating awareness campaigns related to environmental conservation. Short animated videos, infographics, and social media content can quickly capture attention and disseminate key messages to a wide audience.

Educational Initiatives

Animated educational materials can be integrated into school curricula to teach students about environmental science and conservation. Animated content makes learning more engaging and can inspire a sense of responsibility towards the environment from an early age.

Promoting Sustainable Practices

Through animated demonstrations, individuals and businesses can be educated on sustainable practices. Whether it is energy conservation, waste reduction, or eco-friendly transportation, animation can illustrate the benefits and encourage the adoption of sustainable choices.

Industrial planning, suggesting that pictorial visualization, particularly through computer animation, can facilitate communication among professionals in planning working environments and production.

The analysis involves evaluating the preferences of managers, supervisors, machine operators, and occupational health and safety officials regarding paper drawings and computer animation for both shop floor and workplace views. Computer animation is generally favored over paper drawings, especially for dynamic planning issues. Specifically, computer animation of workplace views proves valuable for considerations related to the working environment. However, all four visualization types are deemed less significant for illustrating or describing physical factors of the working environment [10–12].

CONCLUSION

In the current educational landscape, there is a growing recognition of the need to engage children's thinking in order to facilitate effective learning, requiring well-thought-out plans. A study underscores the positive impact of a beautiful and sustainable environment on human health and safety, emphasizing the importance of incorporating environmental education from elementary school onwards. The global challenge of diminishing energy sources, stemming from inefficient usage and a lack of awareness about energy conservation, is addressed in the research. The study aims to enhance energy awareness through 3D computer animation, envisioning it as a tool to encourage efficient energy use and reduction.

The future of animation design in environmental studies, health, and safety is positioned at the intersection of technology, creativity, and education. This suggests a multidisciplinary approach that leverages advancements in animation techniques to address crucial global challenges. The role of cutting-edge technologies such as augmented and virtual reality, artificial intelligence, and interactive storytelling in advancing animation design will become important. These technologies are expected to enhance the effectiveness and impact of animated content in the fields of environmental studies, health, and safety. The integration of animation design in environmental studies and health and safety initiatives is proposed as a catalyst for transformative change in the future. This implies that animated content has the potential to drive positive and impactful shifts in how we approach and understand these critical areas.

REFERENCES

1. Banerski G, Abramczuk K. Persuasion illustrated: Motivating people to undertake self-protective measures in case of floods using 3D animation focused on components of protection motivation theory. *Int J Disaster Risk Reduct.* 2023 Apr 15; 89: 103575. <https://doi.org/10.1016/j.ijdrr.2023.103575>
2. Gürer S, Surer E, Erkayaoğlu M. MINING-VIRTUAL: A comprehensive virtual reality-based serious game for occupational health and safety training in underground mines. *Saf Sci.* 2023 Oct 1; 166: 106226. <https://doi.org/10.1016/j.ssci.2023.106226>
3. Babalola A, Manu P, Cheung C, Yunusa-Kaltungo A, Bartolo P. A systematic review of the application of immersive technologies for safety and health management in the construction sector. *J Safety Res.* 2023 Jun 1; 85: 66–85. <https://doi.org/10.1016/j.jsr.2023.01.007>
4. Arif M, Nasir AR, Thaheem MJ, Khan KI. ConSafe4All: A framework for language friendly safety training modules. *Saf Sci.* 2021 Sep 1; 141: 105329. <https://doi.org/10.1016/j.ssci.2021.105329>
5. Nasios K. Improving Chemical Plant Safety Training Using Virtual Reality. Nottingham ePrints. Nottingham.ac.uk. 2017. Available from: <http://eprints.nottingham.ac.uk/10039/>
6. Greuter S, Tepe S, Peterson JF, Boukamp F, d'Amazing K, Quigley K, Harris T, Goschnick T, Wakefield R. Designing a game for occupational health and safety in the construction industry. *Proceedings of The 8th Australasian Conference on Interactive Entertainment: Playing the System.* 2012 Jul 21: 13(8p). <https://doi.org/10.1145/2336727.2336740>
7. Lecky DM, Dhillon H, Verlander NQ, McNulty CA. Animations designed to raise patient awareness of prudent antibiotic use: patient recall of key messages and their immediate effect on patient attitude. *BMC Res Notes.* 2017 Dec; 10(1): 701(6p). <https://doi.org/10.1186/s13104-017-3048-0>
8. Adam M, Bärnighausen T, McMahon SA. Design for extreme scalability: a wordless, globally scalable COVID-19 prevention animation for rapid public health communication. *J Glob Health.* 2020 Jun; 10(1): 010343. <https://doi.org/10.7189/jogh.10.010343>

9. Muktiarni M, Rahayu NI, Lestari N. Animation Videos Promote Health Education for Children and Adolescents. *Journal of Advanced Research in Applied Sciences and Engineering Technology*. 2023 Sep 3; 32(1): 252–62. <https://doi.org/10.37934/araset.32.1.252262>
10. Sahabuddin ES, Dirawan GD. Green School-Based Animation Video Media in Increasing Student's Awareness of The Environment. *Int J Elem Educ*. 2022 Dec 13; 6(3): 386–92. <https://ejournal.undiksha.ac.id/index.php/IJEE/article/view/54084>
11. Prayoonrat C. Raising Energy Awareness through 3D Computer Animation. *Appl Mech Mater*. 2015 May 25; 752: 1116–20. <https://doi.org/10.4028/www.scientific.net/amm.752-753.1116>
12. Bengtsson P, Johansson CR, Akselsson KR. Planning working environment and production by using paper drawings and computer animation. *Ergonomics*. 1997 Mar 1; 40(3): 334–47. DOI: 10.1080/001401397188189.