The Motivation for the Treatment of Dental Anxiety among Children Using 3D Animation

Azrulhizam Shapi'i[1], Norazimah Awang[2], Salyani Osman[3], Rosnita A. Rahaman[4],
Nik Nordiana N Ab Rahman[5], Halimaton Sa'adiah Sa'don[6]
[1] Universiti Kebangsaan Malaysia, Malaysia, azrulhizam@ukm.edu.my
[2] Universiti Selangor, Malaysia, azimah@unisel.edu.my
[3] Universiti Selangor, Malaysia, salyani@unisel.edu.my
[4] Universiti Selangor, Malaysia, rosnita@unisel.edu.my
[5] Universiti Selangor, Malaysia, niknordiana@unisel.edu.my
[6] Sultan Azlan Shah Polytechnic, Malaysia, halimaton.sadon@psas.edu.my

ABSTRACT

Dental fear is a problem faced by most children in Malaysia. For some, a visit to a dental clinic has become a bad experience. They will only meet dentists once they experience uncontrollable pain or when their dental problem becomes chronic. Dental fear is the main reason children avoided meeting their dentists—this research project aimed to employ 3D Animation to reduce dental anxiety in children between 7 and 9. Presented in a storytelling manner, this Animation is used to attract children besides conveying knowledge and information about dental care and problem. 'GIGI Animation' was developed using various software and hardware types to ensure that this Animation's quality is maintained. The Digital Production approach used in this Animation includes pre-production, production, and post-production phases. The effectiveness of this output was tested to the children, and it was found that 30% of them managed to slightly reduce their dental fear level.

Key words: Dental Fear, 3D Animation, Digital Production, Animation Pipeline.

1. INTRODUCTION

The use of 3D animation computers has increased over the past ten years. In our country, 3D Animation is a growing industry. It is used in entertainment media such as film, TV, or video games and other areas such as science, architecture, simulation, medicine, and more. [1] through his book entitled 3D Animation Essentials, 3D Animation can be defined as a moving object in a three-dimension space that can rotate and move like a real object. 3D Animation can also be understood as traditional frame-by-frame Animation, an illusion of movement created by a sequence of images. It moves the images at high speed, between 12 to 30 frames per second.

3D Animation is widely used in a range of media as it is fun for children. Its effectiveness has proven to interest children by using cartoons and Animation as a medium to deliver knowledge and information. The 3D animation project method is employed in reducing fear among children aged 7 to 9 years old on dental treatment.

According to [1], the fear of dental care (Dental Fear) can be described as a fundamental emotion that can not be prevented, reinforced response or stimulus in times of risk, and encouraged cautious action, thus giving children ways to adjust to the pressures of life. So it is common for children to be afraid of life-threatening new possible circumstances. It is also fair for them to fear a condition that had previously affected him.

The researcher stated that the first response to an object or stimulus is to avoid dangerous situations [2]. It can help to minimize fear by avoiding dangerous situations. Individuals, therefore, prefer to stay away from the case to prevent anxiety. Unfortunately, it does not encourage the individuals to know whether their first impression is right, thus decreasing the chances of learning them ultimately.

Dental fear is one of the main problems that has affected the dental department widely [2]. Prevalent studies identify the prevalence of fears about child dental care in Northern Europe (3%-21%), depending on the child's age, and the level of experience anxiety varies.

The study conducted by [3] stated that deep anxiety is rare among children, but some can overcome this fear problem during adulthood. If the fear issue is not addressed, it may continue and grow into a phobia or psychiatric fear. This will cause emotional children are increasingly critical and may require intervention using three therapeutic methods. It is crucial to remember that there is no way to expect fear or phobia to recover. Using these criteria, this study will use the positive effects to watch unique Animation to reduce dental treatment fears among children.

2. RESEARCH BACKGROUND

Up to now, children between the ages of 7 and 9 still fear dental care. In dental treatment, there are two types of fears, which are objective and subjective. Objective fear is direct awareness. For example, a child has been given a tooth issue dental care, and his teeth can be pulled using a stretcher that causes various frightening sounds such as suction, tooth drilling, and others. After that, the child needs dentistry again in the future, and the removal of his teeth is required.

The children would have been afraid of their previous encounter. If the child tells his experience to his friends and needs treatment, there will instantly develop a sense of fear for dental treatment. This will become a subjective fear.

Several methods can be used to cope with the fear of dental treatment [4]. The tell-show-do process is one of the standard techniques used by dental, medical practitioners. Dental medical officers, can tell the dental problem that is being shown, indicate the equipment to be used, and conduct the same procedure. However, the method is only useful for some adults, and it is less effective for children, as when looking at the dental instruments used, the child becomes more frightened.

[1] have shown the effectiveness of Virtual Reality Technology (VR) to distract patients during dental care. In this research, virtual reality with natural scenery is used as a distraction to ongoing care. However, it can only distract the child during dental care and can not reduce dental anxiety until dental care is performed.

The impact of Animation on children can be seen in a great deal in this regard. Therefore, by using Animation's influence, this study will use the 3D Animation storytelling method in the form of entertainment to reduce dental fear among children aged 7 to 9 years old. The research aims to create a 3D animation design that can dash the anxiety of children's dental treatment. The goals are listed below: First, check that you have the right paper size design. This template has been tailored to the size of the A4 paper output. If you use a US letter size document, please close this file and download the Microsoft Word Letter file.
 Designing a 3D animated main character model.
- Create animated modules and contents that include dentistry and treatment.
- To reduce the fear of dental treatment.
- To evaluate the effectiveness of developed Animation.

3.LITERATURE REVIEW

3.1 Animation
Through his book titled 3D Animation Essential [5], Andy Beane says that Animation comes from Latin literature that brings meaning to life or brings to life. According to the Dewan Bahasa and Pustaka Dictionary, Animation refers to an act or process that makes objects appear alive.

Computer Animation Dictionary describes Animation as a method of generating motion illusions in film or video through photographs. Each frame contains a different image between them, and when presented in a time frame, it will form the illusion of a movement. From the definitions of Animation stated, Animation refers to the process of adding motion to an image that is static to make it look more exciting and alive. It can also be created by moving the integrated model, which is then recorded.

According to [6] and [8], Animation can also be obtained by cutting pieces of paper that contain different shapes and are then presented in sequence. It is just another way to render Animation.

In sum, there are different ways that something stagnant or dead will transform into something more complex. All these processes or techniques then produce a necessary animation effect. Animation has been described as a simulation of created movement by displaying a series of pictures or displaying computer graphics. Animation occurs when a series of objects with a slight change from the next one; the images are moved smoothly and continuously [8]. Although there is no physical movement, the illusion of movement is apparent since it relies on viewers' mental modes and viewpoints.

The view that Animation is divided into three forms, namely classic animations involving drawings made on transparent papers, and that the paper is painted on each other to combine character and background; stop-motion animation, which captures an image of an object moving with a slight change in the location of the item being built in each image; computer animation, which uses computer technology to produce moving images and Animation, is created using a computer device only [9]. The choice of animation type that wants to be used depends on the concept and expected visual results [8]. Examples of good animations can be seen on TV and in advertising.

Around 1910, early animations started to appear, and this consisted of a framed drawing, one picture after another. The invention of transparent painting paper around 1913 makes the Animation easier to create. Mr. Walt Disney brought the Animation to a new stage when he added a sound to the cartoons in 1928. John Whitney began using computer graphics in the mid-1940s, surprised by digital computers' everyday use in the early 1960s. Initially, it is used for experimenting with technology, engineering, and art.

Many 2-dimensional animations started to enter public media in the mid-1970s. By the 1980s, the use of 3D photo-realistic has begun in some films, and by the mid-1990s, it has evolved in which 3D Animation has been used for the entire production of films. As we continue to transform in line with the changes and developments in technology, the transformation has given rise to many different people's experiences. Today, many animated outputs are created using computer technology. Traditional

procedures still follow: development, scripts, and characters; story-board, background combine to illuminate; This is the same method that should be used for this study to produce a 3D project.

3.2 The anxiety of Dental Treatment

Until now, it has been understood that toothache will decrease more frequently when the dentist is seen. However, according to [4], patients' fears towards dentists are still an issue among them to this day. Fear of dental care is not an easy issue to avoid. Fear of dental care has become a stranglehold problem, as many countries worldwide report the same problem.

The study conducted by [2] reported that in some countries, the percentage of children who feared dental care alone was 43%, while [3] stated that estimation of fears about dental treatment among Australian adults is about 16%. A high percentage of fearful of dental care and the consequences of the disease experience and treatment they receive is vital to a deeper understanding of the process of apprehension against dental treatment that is getting worse from day to day.

In girls are reported to have more fear of dental treatment than boys [3]. There is an ongoing discussion about whether this is due to the shyness inherent in girls, their education (adults forcing girls to display fear and boys to conceal them), and fewer boys ready for girls to disclose their concerns. In truth, these three factors are not the actual nature of the child.

In particular, dental anxiety can emerge due to specific incidents, such as dental trauma or other medical procedures. Dental anxiety can also be caused by parents, friends, reading comics, or watching television. Fear of dental care can arise due to particular events such as past trauma in dental surgery or other medical procedures (general fears)[2]. Dental worries can also be contagious by parents or teachers concerned about themselves by watching TV or reading children's comics.

In 1990, Liddell argued that the current anxiety could be a weakness for the person and could cause the child to be traumatized to see the dentist in the future. In conclusion, the child's willingness to manage dental care fear depends on the child's maturity and knowledge of overall dentistry.

3.3 Effectiveness of media use in providing children with complimentary messages Equations

The researcher has stated that television (TV) is one of the most popular and practical ICT applications in communicating with children. He/She explained that creative effects allow unique messages and images to be transmitted through media and Animation [12,13]. TV is a type of digital communication technology, enabling people to communicate and exchange information digitally. Many studies concerning children-television links have concentrated on studying the types of messages transmitted to children via the media when they think of their ability to grow and develop.

They include health and safety (including ergonomics, that is, children's safety due to child-related TV placements); fixed distance focus (meaning the time the child uses when communicating with the TV); access; equality (including gender and physical disabilities); ethics; software previews to ensure graphics and sound quality; information accuracy; and religious, cultural practice The World Health Organization (WHO 2005) stated that considerations to consider include: reporting on current issues; pointing to a limited target audience in providing supplementary messages in terms of executing health campaigns for children on TV [14].

3.4 The Use of ICT Methods in Dental Fear Destruction (Dental Fear) Some Common Mistakes

The study has shown virtual reality (VR) efficacy in distracting patients when receiving dental care [6]. In this study, virtual reality with a natural scene is used to distract the ongoing treatment, reducing the patient's fear of dental treatment. Studies such as [6] were conducted by [8], using physiological tools to measure heart rate and the dental care performed on patients. Patients that use the environment's virtual reality produce low heart rates and lower respiratory rates than ever before.

Also, the effectiveness of the use of information technology has been studied by [4]. This study has used the same method as the two above, with the limitation of using audio-visual glasses instead of visual reality. The surroundings are still visible and unable to transfer the attention of children to the dental treatment fully. To conclude, ICT may only distract certain children during dental care in fear of current dental fears. Until dental care, they can not reduce the anxiety of dental treatment. Therefore, to reduce a child's fear of dental treatment, this study will create 3D Animation. This research would produce 3D Animation by integrating fantasy elements and implementing dental problems and dental care animation.

4. METHODOLOGY

The animation is an unlimited medium of storytelling. Designers can create the world against gravity, switch from fact to fantasy, and bring viewers to places they never imagined. This section will discuss the process of designing a 3D animation project to reduce the fear level of dental treatment among children ages 7 to 9 years deeper. In this regard, this section will further explain the methodology or development phases involved in project development.

The methodology used to develop a 3D animation project is Digital Production Methodology, better known as Animation Pipeline by the Malaysian animation industry. This methodology contains three phases, namely Pre-Production, Production, and Post-production. Also, each phase has its activities used by the Malaysian animation industry in Figure 1.

Figure 1: Methodology of Digital Production

4.1 Pre-production

The first phase in Digital Production Methodology and one of the most critical stages in pre-production. It requires analysis to determine project objectives and objectives. Figure 1 shows the pre-production process in sequence, namely Idea and Concept, Storytelling, Storyboarding, and Character Design.

This Animation's idea and concept were developed from a discussion with a dental, medical officer regarding dental problems, problems, and dental treatment. According to the dentist, dental caries, commonly known as cavity and calculus teeth, is a problem most often faced by children in Malaysia. This tooth problem occurs because of the emergence of bacteria resulting from the remnants of food that accumulates in teeth, especially sugary foods such as sweets and chocolates. Dental treatment for dental caries is a tooth patch; meanwhile, calculus is necessary to wash (scaling). Dental instruments used for dental treatment are Scaler, Amalgam Condenser, and Amalgam.

Based on dentistry ideas and concepts, dental problems such as dental problems, cause problems, dental treatment, and dental instruments will be transformed into characters, weapons, and power to create fantasy illusions to ensure that children are attracted to this Animation shown in Table 1.

Table 1: Combined Idea and Concept Results

Character	Power & Weapons
• Protagonist - Agent D / Dental Agent. • Antagonists – Bacteria.	• Dental Caries - Laser explosion cavities • Calculus - Calculus Wall • Filling - Filling Bomb • Scaling - Scaler sword

2-dimensional (2D) design is the process of developing a 2D character. Two 2D character designs are produced in this GIGI animated project of the Dentist character and the Bacterial character. This 2D character design process is based on the basic principles of character design in the aesthetic aspects as Figure 2. Figure 3 shows the results of the built-in character skeleton.

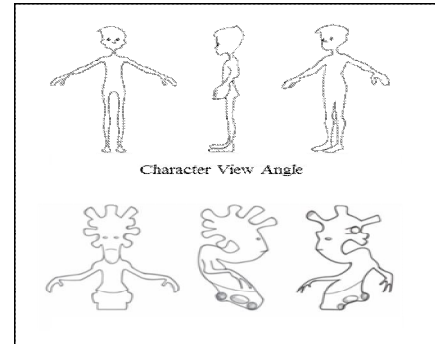**Figure 2:** Principles of Character Design in Aesthetical Aspects

Figure 3: Character Frames from Three Viewing Angles

4.2 Production

Production is the second phase in the Digital Production Methodology. It is the beginning of this GIGI animation project in 3-Dimensions. This production phase's development should be based on the pre-production phase's outcome to determine the project's objectives and objectives.

Figure 1 shows the processes in sequence production, namely 3D Modeling, Texturing, Rigging, Animation, Lighting, and Rendering. Figure 4 to Figure 6 shows the modeling, texture, and animation process of 3D characters using various software.
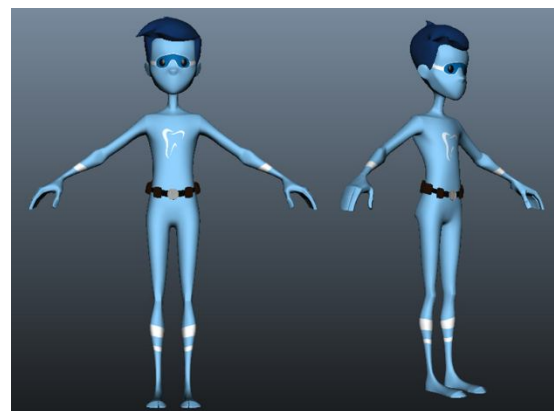

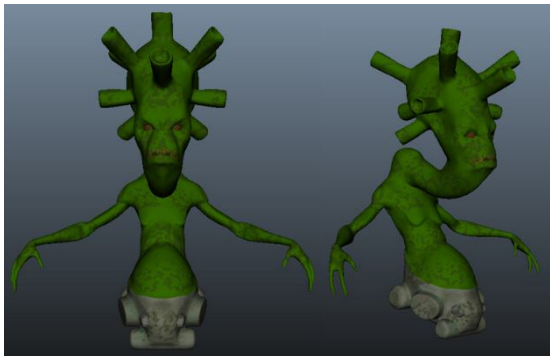**Figure 4:** 3D Modeling Results and Dental Agent Characteristics

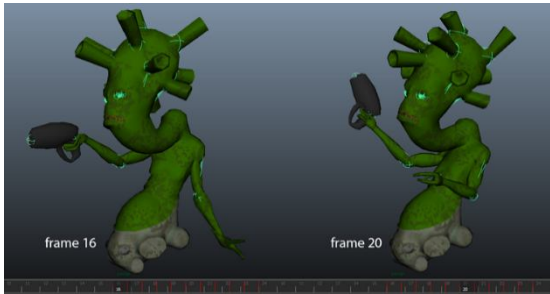**Figure 5:** 3D Modeling Results and Bacteria Characteristics

Figure 6: Results of the Animation Process

4.3 Post-Production

Post-production is the final phase in the Digital Production Methodology. It begins after the completion of the rendering process in the production phase. This phase is crucial in completing this GIGI animation project. Figure 1 shows the processes involved in the post-production phase in sequence, namely Composition, Special Effects, Editing, and Testing. Figure 7 to Figure 9 shows the process of composition and the result of the special effects using various software.
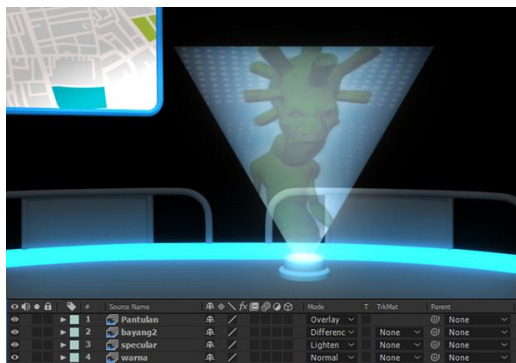

Figure 7: Composition process

Figure 8: Results of Special Effects

Figure 9: Results of Special Effects

A. Testing

The GIGI animated video that has been successfully created should undergo the final process of the testing. This process will describe the testing strategy and results of the GIGI animation video testing. The purpose of the test is to ensure that this GIGI animation video meets the study's objectives.

i. Testing Strategy

GIGI's animated video development testing will be conducted by displaying the video to 7 to 9 years old children. Ten children were randomly selected to assess GIGI's animated video's effectiveness in reducing dental treatment fear. This test was conducted at SK Putrajaya Presint 9 (1) before the dental examination was performed.

To evaluate this GIGI animation video's effectiveness, questionnaires were distributed by providing three questions to the children in the form of figures and verbally assisting them in understanding them. Figure 10 shows the three questions given.

Question 1 and question 2 are regarding the level of fear of dental treatment. These questions are asked to evaluate the effectiveness of GIGI animated video before and after watching sessions. Question 3 considers the interesting factor regarding GIGI animated video.

Figure 10. Test Question

ii. Test results

The results of the GIGI animation video test will assess the effectiveness of fear reduction towards dental treatment. Questions from the questionnaire were analyzed. Figure 11 shows the level of the fear chart on dental treatment (before watching GIGI animation). It shows that all selected children fear dental treatment.
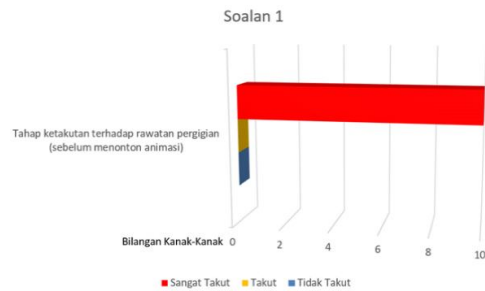

Figure 11: Chart of Fear of Dental Treatment (Before Watching GIGI Animation)

Figure 12 shows the level of fear chart towards dental treatment (after watching GIGI animation). It shows a 30% drop from terrified of dental treatment to fear after watching GIGI animations. Three children who managed to lower their fear level gave good comments. Among the remarks given includes they know the tooth problem faced during a dental examination. One of the children mentioned that he could imagine GIGI animation's situation occurring during a dental exam.
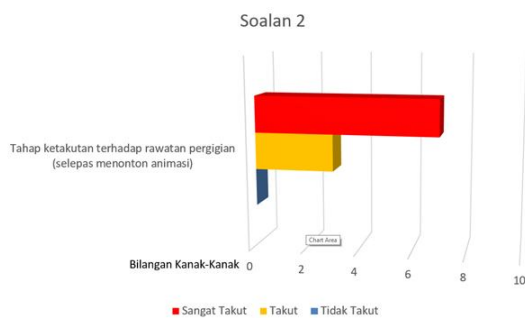

Figure 12: Dread Level on Dental Treatment (After Viewing GIGI Animation) Chart of Fear of Dental Treatment (Before Watching GIGI Animation)

Based on the test results, only 30% of children managed to lower their fear of dental treatment. This effort is not applicable for some children. They cannot receive the impact of this Animation as they only watch it for the first time. Therefore, this study proposes developing GIGI animation in the form of an animated series and making this Animation a dental icon's main character.

5.CONCLUSION

The development of this 3D Animation is based on the objectives and scope of this study. This study's main goal is to produce a 3D animation design that can reduce children's dental treatment fear. It can be achieved by designing a 3D model of the main character for this Animation. This Animation has also developed a module and animated content that includes causes of dental problems, dental problems, and dentistry in the form of fantasy. It also reduces dread towards dental treatment among children aged 7 to 9 years by assessing developed Animation's effectiveness. The objectives are achieved when the GIGI Animation video impacted children based on the animation test results. Overall, 3D animation production can attract children, and the storytelling of these animations helps children reduce the fear of dental treatment. The fear of dentistry can be changed by incorporating entertainment elements which synonymous with children.

REFERENCES

1. Orloff, C. (2020). **Scouting for dental education**. British Dental Journal. 229. 82-83. 10.1038/s41415-020-1971-2.
2. Fuad, H.A., Syahrir, P. & Abdul, H. (2020). **Assessment of patient satisfaction level to dental health care services in Indonesia.** Pesquisa Brasileira em Odontopediatria e Clínica Integrada. pp. 1-8.
3. Rosmawani, M. I. (2017). **Dental treatment cost awareness campaign amongst patients and students at Faculty of Dentistry UKM - a preliminary phase**. International Conference for Research and Management Executives 2017.
4. Chan, W. M., Chai, Y. Y. & Asma, A. (2016). **The use of information and communication technology among undergraduate students in dental training.** Journal of Education and Ethics in Dentistry. pp. 27-33.
5. Beane, A. (2012). **3D animation essentials**. Indianapolis, Ind. J. Wiley Sons.
6. Cai, Y. (2019). **A Survey and Empirical Research on Online Animation Course Based on User Perspective**. 2019 International Conference on Communications, Information System and Computer Engineering (CISCE), Haikou, China, 2019, pp. 575-578, doi: 10.1109/CISCE.2019.00133.
7. Tanja-Dijkstra, T.(2014). **Improving Dental Experiences by Using Virtual Reality Distraction: A Simulation Study**. PLoS One. 3(9).
8. Jintapitak, M. (2018). **Use of animation characters to motivate students in a higher education class**. 2018 International Conference on Digital Arts, Media and Technology (ICDAMT), Phayao. pp. 280-284, doi: 10.1109/ICDAMT.2018.8376540.
9. Mohd Salihan, A. R., Nazlena, M. A. & Masnizah, M. (2017). **Comelgetz Prototype In Learning Prayers Among Children**. Asia-Pacific Journal of Information Technology and Multimedia. 6(1), pp.115 - 125.

10. Haslina. A. (2020). **Integrating Interactive Multimedia Elements to Increase Melioidosis Awareness**. International Journal of Advanced Trends in Computer Science and Engineering. 9. pp. 4037-4042. 10.30534/ijatcse/2020/229932020.

11. Tazouti, Y., Boulaknadel, S. & Fakri, (2020). **A Virtual reality serious game for Language learning**. International Journal of Advanced Trends in Computer Science and Engineering. 9. 713-716. 10.30534/ijatcse/2020/101912020.

12. Al-Khotani, A., Bello, L. & Christidis, N. (2016) **Effects of audio-visual distraction on children's behavior during dental treatment: a randomized controlled clinical trial**. Acta Odontol. Scand. 6(74), pp. 494–501.

13. Mohd khalis, Faryna & Mustaffa, Normah. (2017). **Cultural Inspirations towards Malaysian Animation Character Design.** Jurnal Komunikasi: Malaysian Journal of Communication. 33. 487-501. 10.17576/JKMJC-2017-3301-32.

14. Shapi'i, A. & Ghulam, S. (2016). **Model for Educational Game Using Natural User Interface**. International Journal of Computer Games Technology. 2016. 1-7. 10.1155/2016/6890351.