Computer-based learning: 3D visualization and animation as content development for digital learning materials for traditional Indonesian cloth (Songket Palembang)

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Abstract. The animation is currently developing very rapidly, especially in 3D animation. Animated 3D visualization not only develops in the field of film, but also develops in digital-based learning such as interactive applications, presentation slides, e-books, and games, as well as supporting content for immersive technology, such as Augmented Reality, Virtual Reality, Mix Reality, and others. The development of 3D animation nowadays, but not accompanied by the use of animation as the delivery of information with local cultural content. The young generation's lack of interest in local cultural arts is accompanied by a lack of digital learning materials and the delivery of interesting information for the younger generation. Therefore, the researcher aims to create 3D animated visualization assets that can motivate students to learn Indonesian cultural arts. Researchers applying the method Subdivision Surface, UV-mapping, 3d Painting, and walk cycle animation in the 3D visualization animation production process. The final result of this research is 3D Visualization and Animation as Content Development for Digital Learning Material for Indonesian Traditional Fabrics: Songket Palembang based on cloud for elementary school students.

1. Introduction
The animation is currently developing very rapidly, especially in 3D animation. 3D animation is a type of animation that has real depth and dimensions with a length, width, and height (z-axis) so that the visualization shown is closer to the original and real form. 3D visualization is a technique in computer graphics to create a digital representation of a 3D object, usually in the form of character modeling or supporting object modeling. Animation has 3 main features: (1) image - animation of a depiction; (2) movements - animations describe a movement; (3) simulation – animation consists of objects drawn by drawing or other simulation methods [1]. 3D animation not only develops in the field of the film but also develops in digital-based learning such as interactive applications, presentation slides, e-books, games, as well as immersive technology support content.

The importance of teaching materials that connect education with technology [2]. And in the future education cannot be separated from science, technology and engineering [3]. Contextual Learning can help students understand the concept of science in a timely and appropriate manner based on the surrounding environment [4]. The development of 3D animation nowadays is not accompanied by the
use of 3D animation as the delivery of learning information with local cultural content. This is also related to the problem of the younger generation who are starting to have a change in taste in capturing information in the current industrial revolution era. If this happens continuously, the values of Indonesian art and culture will disappear in line with the flow of globalization. Weaving is the result of handicraft cloth made from yarn (cotton, silk, etc.). Songket Palembang is one of the best traditional woven fabrics in Indonesia. Songket Palembang has a philosophical value that is born from cultural meanings and becomes a strength in every accent and detail of its motifs [5]. 3D animation can be an alternative way to preserve or revitalize culture in the current era of information technology, so it is very relevant if the animation component is used as sustainable development of learning materials about art and culture [6].

Digital native is very superior in using technology. So that elementary school age children in the current era tend to like computer-based learning materials [7]. Currently, it is very important to introduce the ability of schools to build a conducive environment for the application of new technologies [8]. When compared with static illustration, animation can increase learning persistence much more [9]. Besides, 3D object projection can display interactive and immersive 360-degree content. Student learning improved 86% with 3D learning content, compared to 2D content which only increased by 52% [10]. So it can be concluded that with the support of interactive 3D animated and digital learning content, it can provide solutions in the development of learning materials.

The previous research relevant to this research, namely "Designing and Making 3D Interactive Visualization Applications for the Great Mosque of Central Java Using Unity3D" [11] and "Designing Animation 360o Relief Jataka Borobudur Temple for Youth 16-18 Years" [6]. The lack of interest of the younger generation in local cultural arts, accompanied by a lack of learning media and the delivery of interesting information for the younger generation, so the researchers designed a cloud-based digital learning material with 3D visualization and animation content about traditional Indonesian fabrics: Palembang songket for young generations, especially elementary school students.

In this study, researchers used blender software and Adobe Photoshop to create 3D visualization and animation assets, as well as the Canva and Sketchfab platforms to publish cloud-based learning materials. In this study, researchers used blender software and adobe photoshop to create 3D visualization and animation assets, as well as the Canva and sketchfab platforms to publish cloud-based learning materials. The methods used in making assets in this study are Subdivision Surface, UV-Mapping, 3d Painting, and Walkcycle animation.

2. Methods

The first This research focuses on discussing the process of making 3D visualizations, animation, to the publication stage of cloud-based digital learning materials. In the manufacturing process, researchers refer to the general standard stages of 3D animation production (Pipeline 3D Animation), which consists of Pre-Production, Production, and Post-Production. The technique of collecting data and visual reference was carried out by studying documents on the Palembang songket decoration data from several books and previous research. The researcher reduced the data obtained by focusing on the old Palembang songket motif. Based on research by Xia San-ao states that the 3D animation design process consists of five main stages, namely modeling, materials, map design, light and camera, and animation [12]. The research method for creating 3D visualization and animation assets is as follows.

Development of teaching materials for elementary school students can be done in four phases, namely, define, design, develop, and justify [13]. Based on Figure 1, there are 3 main stages in making 3D visualization and animation that the researcher applies, namely (1) Pre-Production; (2) Production; and (3) Post Production;
3. Results and discussion
The final result of this research is 3D visualization and animation as content development of digital learning materials for traditional Indonesian fabrics: Songket Palembang based on cloud. The results of this study, the researchers describe based on the 3D animated pipeline as follows.

3.1. Pre-production
The pre-production stage consists of finding ideas and preliminary research, defining concepts, and designing sketches: character rotation, property, and environment. Psychologically, humans are attracted to cute and cute things, because living things (especially mammals) have the basic nature to love their offspring, shapes, colors, and funny elements make a person happy and have positive thoughts [14]. In this study, 3D visualization was made with traditional concepts and adapted to the design tastes of the younger generation. So that the educational media created can motivate students in learning cultural arts with the support of 3D animated visualization that is interesting, informative, and entertaining.

3.2. Production
The production stage is the production process of 3D asset modeling, Subdivision Surface, texturing with UV-Mapping techniques and 3D painting, rigging, and walk cycle animation using a blender application. After that, at the digital motif texturing stage using the Photoshop application. The 3D modeling process is adapted from a rough sketch (character rotation sheet) that has been made in the pre-production stage. The overall asset modeling process uses box modeling techniques and edges modeling techniques.

Figure 2 shows the texturing process using the UV-Mapping technique on the songket cloth object. After that, the texturing process uses 3D painting techniques on the faces of the characters. And Figure 3 shows the process of character rigging and animation movement, which is the stage of making bones so that 3D objects can be moved in the animating process. In this study, the animation movement is limited by the movement of the walk cycle characters by applying 12 animation principles. After that, the last step is the process of exporting to .fbx files and rendering.
The design results of the 3D animated visualization from this study are as follows.

3.2.1. Character design

a) Ipah character: Ipah is a cheerful and curious 13-year-old girl. All he did with determination and high enthusiasm. Ipah has loved and admired Palembang songket fabrics since she was a child and aspires to be good at weaving songket fabrics.

b) The clothes used in the Ipah character (figure 4) are a modification of the traditional Palembang brackets combined with the Bungo Pacik motif Palembang songket cloth. The Bungo Pacik motif during the Sultanate was worn by women of Arab descent. The Bungo Pacik motif is a type of cloth with flowers and studs. In the middle part of the motif, there is a white star flower image. The motif structure is arranged in an orderly and scattered manner. The yellow gold shirt color and the red heart cloth are the traditional colors typical of the city of Palembang.

c) Mang Kemas character: Mang Kemas is a 23-year-old handsome and friendly manager of the Palembang Songket gallery. Mang Cek has extensive knowledge about Palembang songket cloth.
The clothes used in the Mang Kemas character (Figure 5) are a combination of casual clothes with Tanjak and rumpak songket with the dominant nago besaung motif in green. Tanjak and Rumpak songket are traditional Palembang accessories for men. The songket with the nago besaung motif depicts a pair of dragons facing each other and fighting over a ball made of gold.

d) Cek Eka character: Cek eka is a kind songket weaver, she is 40-years-old. She is one of the best weavers in Palembang. In his daily life, he spends time just weaving. According to Cek eka weaving is a very noble and fun activity. Clothing used at check character Eka (Figure 6) is a modern bracket red clothes with berakam songket motifs. Berakam motive is the motive small flowers, usually resembling star jasmine or distributed in the expanse of songket. The characters use gold-colored glasses and red lipstick to portray the figures of mothers.

![Figure 6. Cek Eka 3D character design.](image)

3.2.2. Environment and property design

In figure 7, the 3D visualization environment of the Palembang songket gallery serves as a place to display the Palembang songket motifs. So that users can explore and rotate the environment 360 degrees, and interact with the information therein.

![Figure 7. Environment gallery songket.](image)

3.3. Post-production

Post-Production is the final stage in this research. After the 3d assets are exported all in .fbx format, then the 3D asset upload process continues. At this stage, it consists of the process of providing sound effects, color tones, and publishing 3D assets. All 3D visualization assets are uploaded to the Sketchfab repository. It is continued by providing sound effects, annotations, and lighting on 3D objects to clarify information. Next, is the process of compiling cloud-based digital learning materials on the Canva platform. All materials and animated 3D visualizations are uploaded to the canva platform. So that animated 3D visualization content can be used interactively in the form of cloud-based digital learning materials.

4. Conclusion

Animated 3D visualization on cloud-based digital learning materials that the researchers developed has been successfully built. This research resulted in the 3D Visualization and Animation as Digital Content Development Learning Materials Traditional Cloth Indonesia: Songket cloud-based. Researchers designed 3D visualization assets based on the characteristics of elementary school students as the main
target of this study. Digital learning materials are also designed with an attractive and consistent combination display of text, images, colors, language, and layout. It is hoped that the development of digital learning materials is expected that the younger generation can be motivated and quickly understand the information contained in learning materials. So that later the younger generation can maintain and maintain cultural arts as the preservation of Indonesia's cultural wealth.

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