Journal of Information System and Technology Management
EISSN: 0128-1666
JISTM
Volume 10 Issue 39 (June 2025) PP. 252-264
DOI: 10.35631/JISTM.1039017

JOURNAL OF INFORMATION SYSTEM AND TECHNOLOGY MANAGEMENT (JISTM)
www.jistm.com

DEVELOPMENT OF AN INTERACTIVE LEARNING APPLICATION FOR BASIC 2D ANIMATION WITH ADOBE ANIMATE

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Article Info:

Article history:
Received date: 26.02.2025
Revised date: 12.03.2025
Accepted date: 30.05.2025
Published date: 30.06.2025

To cite this document:

Kamaruzaman, N. N. N., & Husain, W. S. W. (2025). Development Of An Interactive Learning Application For Basic 2D Animation With Adobe Animate. *Journal of Information System and Technology Management, 10* (39), 252-264.

DOI: 10.35631/JISTM.1039017

Abstract:

Digital learning has witnessed the growing demand for the animation element embedded through the education spaces. Learning animation can be enjoyable for novice users, however, the novice could portray the 2D animation as strenuous and demanding. To address this issue, the study aimed to design a user-friendly platform for beginners, integrating step-by-step tutorials tailored to the Adobe Animate interface and tools. This study focuses on the development of an interactive application to enhance the learning experience for basic 2D animation using Adobe Animate. The project employs the Multimedia Development Life Cycle (MDLC) model to draft the concept, design the storyboard, and assemble the materials into an interactive application. Key features of the application comprise understanding animation, scripting, and drawing basic object techniques that allow users to practice and refine them within the tool's environment. The study also involves testing the application among novice learners to ensure its relevance and effectiveness. The results from the System Usability Scale (SUS) assessment indicated that the use of an interactive 'Fun with Shapes' application is a marginally usable platform, achieving an 'Ok' rating with a score of 68. Future enhancements could include tutorials on motion tweening and scripting for interactive buttons, expanding the application's instructional capabilities.

Keywords:

2D Animation, Adobe Animate, Interactive Application, Learning Tool

Journal of Information System and Technology Management
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Introduction

Digital learning has seen an increasing demand for incorporating animation elements into educational spaces, as educators recognize the benefits of visual engagement and dynamic content to capture learners' view within the educational environment. Animation brings life to learning by adding movement, color, and interactivity, making constructive concepts easier to understand and remember. Learning animation; which results from still images creating the illusion of motion (Krklec et al., 2022) can be a highly enjoyable experience, as it allows learners to explore their creativity through various shapes, colors, and visual effects.

The demand for digital learning tools with animation elements is rising, making animation education both engaging and challenging for beginners. The integration of computer tools into the teaching and learning process has been extensively implemented, to enhance the quality of education in line with technological advancements, helping novice learners acquire skills effectively (Wiana, 2017). Moreover, advancements in tools simplify educators' roles and through the use of learning media, it could enhance students' classroom experiences (Baihaki et al., 2022).

Introducing interactive applications for creating 2D animations can be time-consuming for beginners to master. A clear plan is essential for producing high-quality animation, and this plan is commonly known in the animation world as a storyboard or blueprint design. Storyboarding, a critical step in animation, helps developers organize ideas and resources before final production (Husain et al., 2020).

From the perspective of a novice, 2D animation can often seem strenuous and demanding, posing challenges that conventional learning methods may not adequately address (Farahani et al., 2020; Aziz, 2023). The intricacies of frame-by-frame drawing and the requirements for applying smooth motion can overwhelm beginners. Without prior experience or familiarity with the necessary tools and techniques, the process may feel time-intensive and complex, contributing to the perception that 2D animation is difficult to master.

To address these challenges and reshape novice learners' perspectives, this study aims to develop a user-friendly platform specifically designed for students at Universiti Teknologi MARA (UiTM). The platform integrates comprehensive, step-by-step tutorials tailored to align with the Adobe Animate interface and its suite of tools. By breaking down complex tasks into manageable lessons, the platform seeks to simplify the animation process and guide users progressively.

This study focuses on developing an interactive application that enhances the learning experience for students exploring the fundamentals of 2D animation. By incorporating visual aids and guided workflows, the application simplifies key animation principles, making them more accessible and engaging for users with limited prior experience. Utilizing the capabilities of Adobe Animate, the platform ensures that students gain hands-on experience with the software, thus ensuring both technical skills and creative expression at the early stages of their animation journey.

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Literature Review

Teaching and learning can be significantly enhanced by creating interactive experiences that actively engage students and foster a deeper understanding. The study by Untari et al. (2020) found that the use of interactive and flash-based media can enhance learning outcomes and the learning process. In their study, lecturers use a variety of examples and exercises within interactive multimedia to teach 2D animation. This allows students to view examples and allows them to practice the techniques themselves.

Educational Technology in Teaching and Learning Practices

The digital age is changing how we learn, and this shift is becoming increasingly noticeable in education. With new technology rapidly advancing, schools and educators are urged to adapt quickly, incorporating these tools into their teaching methods to stay current. Educational technology is essential for improving teaching and learning experiences. Incorporating innovative tools and techniques helps achieve better educational outcomes. Teaching-learning materials (TLMs) are well known as tools to support instructors in teaching lessons to students. With today's student-centered learning approach, learning materials must also help students focus and develop their independent comprehension skills (Cervera, 2024).

Walters (2022) explained that digital learning offers countless benefits for education in terms of accessibility and flexibility, allowing learners to access information on different devices at their convenience. This flexibility enhances engagement and accommodates diverse learning preferences (Cervera, 2024). In this context, interactive applications align perfectly with the goals of modern educational technology. By incorporating necessary elements, these interactive tools become an invaluable component in the digital learning landscape, helping educators create dynamic and effective learning environments.

Interactive Application for Teaching and Learning Practices

Interactive applications are programs designed to be controlled by users. The concept of interactive applications originates from the term "interactive multimedia" within the multimedia field. To develop a multimedia project, animators must combine various multimedia elements, including text, images, sound, animation, and video. Interactive multimedia is the combination of many media, such as mixing audio and visual elements in a presentation that encourages user interaction (Mantik et al., 2022).

For instance, interactive learning modules may include clickable diagrams, video tutorials, audio explanations, or animated simulations, all of which work together to create an environment that promotes deeper understanding and retention. In essence, interactive applications represent the evolving nature of digital media, where users shift from passive consumption to active engagement. This shift not only enhances user satisfaction but also opens new possibilities for innovation in the education environment, making interactive applications a foundation of modern multimedia development.

2D Animation for Beginners

Animation occurs when a static image is transformed into a moving image. It is the result of a sequence of still images that together create the illusion of motion in the real world (Krklec et al., 2022). When generating the animation of a moving object, animators must plan and consider the space used to draft the idea. The basic space suggested for beginner animators is two-dimensional animation (2D animation).

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For beginners, 2D animation is often the recommended starting point. As a foundational form of animation, 2D provides a simplified yet versatile platform for learning essential techniques. However, becoming proficient in 2D animation requires more than just technical skill. According to Aziz (2023), mastering effective instructional techniques is key to fostering growth and enhancing student engagement. Educational approaches that incorporate hands-on practice and interactive feedback can significantly improve the learning experience. Moreover, the use of animation software and digital tools introduces students to industry-standard practices, preparing them for real-world applications.

Learning 2D animation is a valuable skill that should be introduced and thoroughly explored from an early stage in education. By incorporating it, students can become more familiar with digital tools and technologies that are essential for creating animations. This foundational knowledge not only enhances their technical proficiency but also nurtures their creativity and adaptability to modern digital platforms.

Adobe Animate as a Learning Tool

Adobe Animate is part of the Adobe software suite and is well-known for creating simple animations, making it an excellent choice for beginners to learn the basics of multimedia editing. The software uses a system of layers and symbols to simplify the animation process. Symbols can be arranged in individual layers, with each layer potentially containing multiple other symbols. To create well-organized animations, it's recommended to manage each symbol with its own timeline for drafting scenes effectively. This extensive system allows you to work in detail with each element and with the complete object (Petrushevska, 2024).

Interactive media created with Adobe Animate can be accessed on laptops and smartphones. The software's runtime system enables the production of engaging multimedia that is easily accessible (Aini and Mufit 2022). Rahayu & Ratna (2020) stated that interactive multimedia designed with Adobe Animate is effective and valuable for the learning process. The features in Adobe Animate make the content more engaging and easier for students to understand, encouraging active participation and enhancing their responsiveness during lessons.

Methodology

In line with the purpose of creating an engaging application, this study adopts the Multimedia Development Life Cycle (MDLC) method. This method has unique characteristics related to the development and use of multimedia elements, which can be applied to design both interactive and non-interactive applications (Roedavan et al.,2022). The MDLC was chosen because it allows for iteration or repetition at certain stages, if necessary (Aryani et al., 2024). The design of the interactive *'Fun with Shapes'* application was built using the MDLC stages: initialization, blueprint design, asset preparation, product development, testing, and validation, as summarized in Figure 1.

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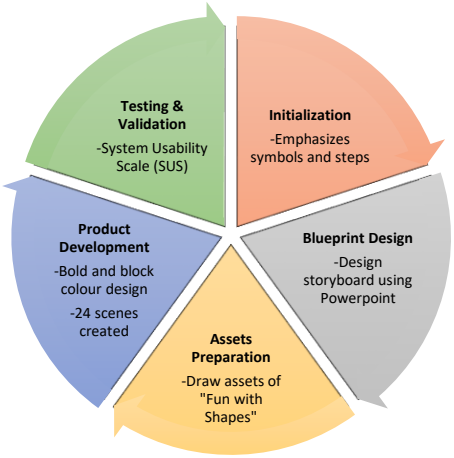

Figure 1: Multimedia Development Life Cycle for Interactive Application

Concept Initialization

As digital methods started to take over the learning environment, they changed how lessons were generally viewed. Nonetheless, novices with little knowledge of 2D animation may require clear guidance in creating such animations. This idea serves as the foundation for directing and guiding users in developing simple 2D animations through interactive media. In presenting learning materials for interactive media at Universiti Teknologi MARA (UiTM), the fundamental principles of interactive media design emphasize simplicity, symbols, and clearly defined steps. This project focuses on drawing 2D objects rather than animating them. It provides step-by-step tutorials on drawing, assembling, and animating these objects. The concept of simplicity is also applied to the content, ensuring it is not overly complicated but remains brief, straightforward, instructive, and engaging to capture students' interest.

Blueprint Design

The design process involves developing an application through a storyboard. Microsoft PowerPoint was used to create the storyboard, with each slide representing a scene. Initially, the authors explored various background options for drawing specific object elements to ensure they aligned with a novice skill level. After reviewing captivating and easy-to-draw objects to sketch, the authors selected *"Butterfly Garden"* as the background theme. Figure 2 illustrates the storyboard design used in this study.

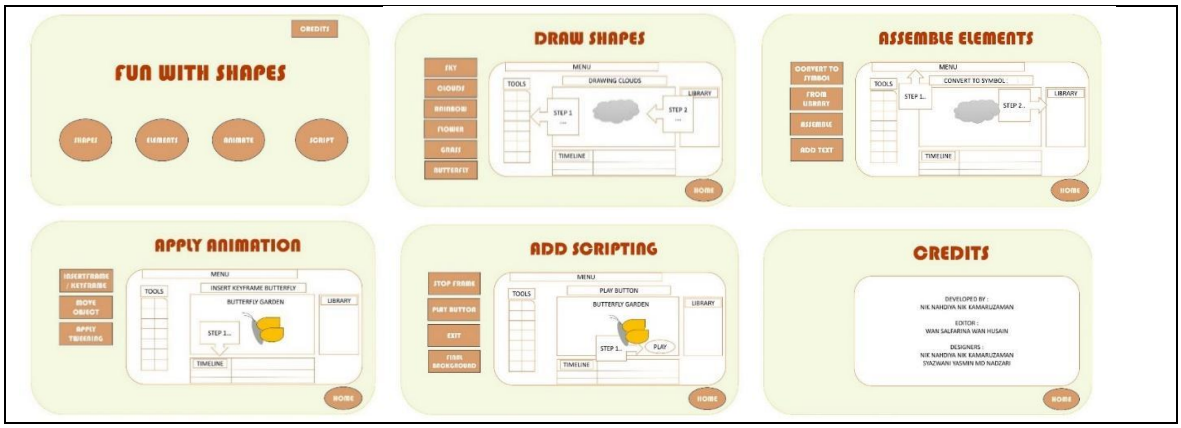

Figure 2: Storyboard Design of Application

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The scene is organized around four main topics: *'Draw Shapes,' 'Assemble Elements,' 'Apply Animation,'* and *'Add Scripting.'* The first scene introduces these topics through four primary buttons and a side button labeled *'Credits.'* Each drawing element is categorized under the *'Draw Shapes'* topic, with detailed steps demonstrating how to create objects within the Adobe Animate environment. Additionally, the *'Assemble Elements'* topic focuses on converting objects into specific types and adding text elements. The *'Apply Animation'* section provides detailed instructions for setting the object's path. Lastly, the *'Add Scripting'* topic outlines the steps for incorporating ActionScript to create interactive applications.

Assets Preparation

Before developing the interactive application, the author prepares the assets based on 2D drawing tutorial steps. Objects are initially drawn using Adobe Animate, with screenshots captured at each stage. These screenshots are then inserted into Microsoft PowerPoint, where arrows and annotations are added to clearly outline each step, offering better insight into the tools and features.

The tutorial begins with steps for drawing the sky, followed by grass and clouds, as shown in Figure 3, then progresses to a rainbow, flowers, and a butterfly. Some steps, however, serve as guidelines, encouraging users to experiment with tools such as the Rectangle, Oval, Pencil, and Paint Bucket. Users can explore different properties and color combinations as long as they creatively represent the object they want to depict.

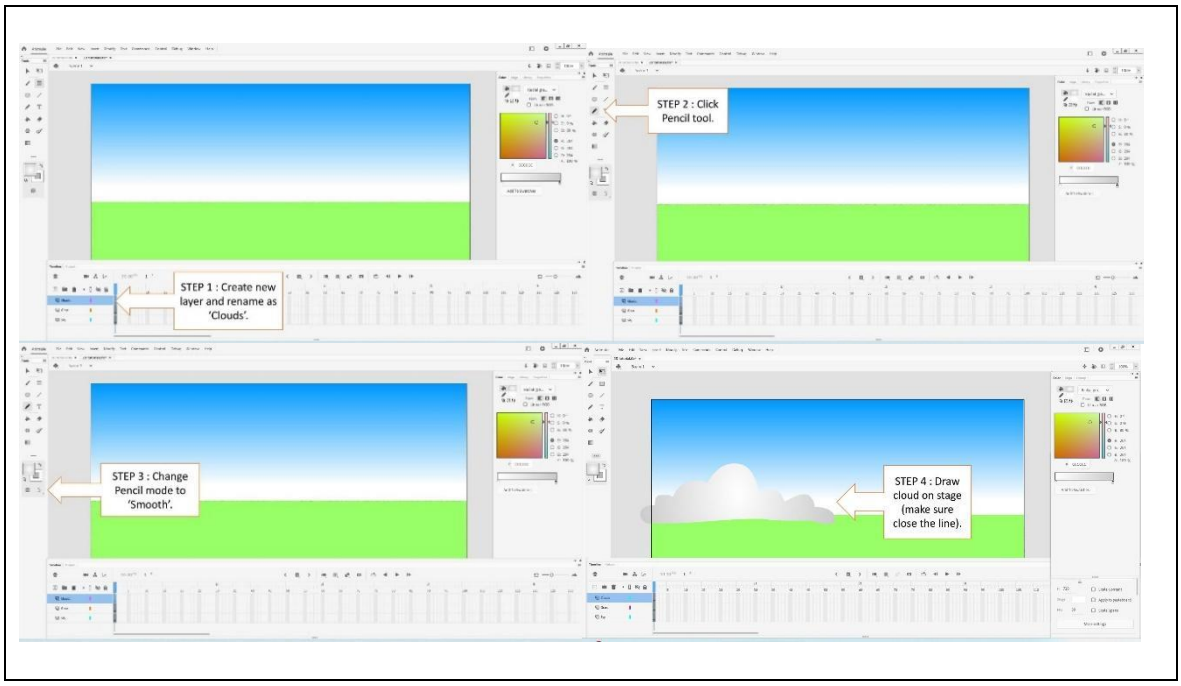

Figure 3: Screenshots of Drawing Objects Tutorial

After learning to draw objects, the tutorials progress to assembling elements by converting them into symbols. In the Animate environment, objects are classified as *'Graphic'*, *'Movie Clip'*, or *'Button'* and each object must be defined before serving its purpose. To classify an object as static, *'Graphic'* mode is selected, whereas animation objects are designated as *'Movie Clips'*. Additionally, the tutorials include a segment on creating simple text elements. The focus then shifts to the primary goal of 2D animation, introducing tweening techniques

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that start with inserting frames or keyframes. Finally, users learn to apply ActionScript, specifically for creating a play button which ActionScript is a scripting language for Adobe Animate used by developers to create animations and applications. The tutorials also emphasize the use of the *stop* script before guiding users through the design process for the play button.

Product Development

Since all the tutorial steps have been prepared, the development of the application can now begin. This application emphasizes on learning over visuals and various elements appeal, focusing on a simplified interface. To engage young learners, bold and block colors are used in the design, combining yellow, red, and green, each representing a different topic.

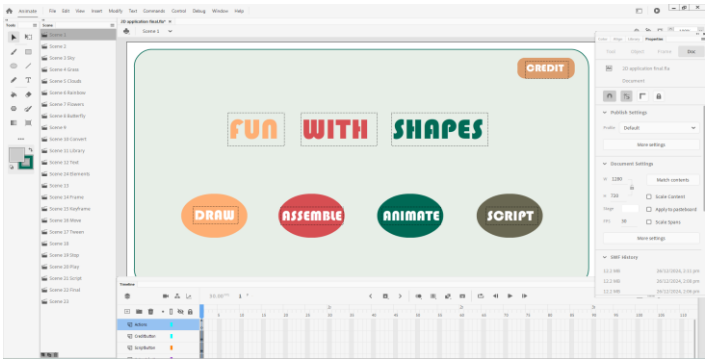

Figure 4: Product Development of Interactive Application

A total of 24 scenes were created, with the first scene, as shown in Figure 4, featuring four main buttons representing the four main topics. The first topic, *'Draw Shapes,'* includes seven scenes that guide users through drawing the sky, grass, clouds, rainbow, flowers, and a butterfly. Each drawing scene contains multiple layers, including a title, six distinct sidebar buttons, and a steps layer with pre-prepared screenshot images. Similarly, the *'Assemble Elements,' 'Apply Animation,'* and *'Add Scripting'* topics also contain multiple layers, including a title, sidebar buttons, and a steps layer with tutorial images. The *'Insert Keyframe'* function is applied to each step's image, enabling users to progress through the steps by clicking the play button. This play button is programmed with the command *'Click to Go to Next Frame and Stop'* to allow users to navigate step-by-step tutorials at their own pace.

Testing & Validation

The interactive applications that have been built are tested modularly to avoid errors and problems from happening. Testing was carried out using the System Usability Scale (SUS) method among UiTM Machang students, targeting novice students who had minimal prior experience in animation. The SUS method was adopted because it is highly effective at distinguishing between easy and difficult applications, even in relatively small-sample experiments (Lewis, 2018).

This approach aimed to evaluate the product's accessibility, ease of use, and effectiveness in conveying key concepts to individuals with limited technical knowledge. By selecting participants with little background in animation, the testing process provided valuable insights into how intuitive and user-friendly the application was. This ensured that it could cater to beginners without requiring extensive guidance. Feedback from these students was instrumental in identifying areas for improvement and enhancing the overall learning experience.

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Result and Discussion

The development of this interactive application involves creating it with Adobe Animate, followed by testing during a 2D animation educational setting with novice students. This testing takes place during 2D animation lessons, where novice students interact with the application as part of their learning experience. The goal of this testing phase is to evaluate the application's usability and effectiveness in enhancing students' understanding of animation principles.

Application Implementation

This interactive application named *'Fun with Shapes'* prioritizes the learning experience, placing greater emphasis on educational content and user comprehension rather than relying heavily on complex visual designs. The focus is on maintaining a clean, straightforward, and simplified interface that minimizes distractions, ensuring that users can easily navigate the application and concentrate on the material being presented.

The design incorporates vibrant colors, which are visually stimulating and engaging, helping to capture and maintain the attention of young learners. This strategic use of color not only enhances the aesthetic appeal but also serves a functional purpose by aiding in the differentiation of content. The color system helps create a sense of structure and consistency, allowing learners to intuitively associate specific colors with particular topics. The bright palette also fosters an inviting learning environment and encourages interaction.

Figure 5: Main Interface of 'Fun with Shapes' Interactive Application

The initial scene, shown in Figure 5, presents a title displayed as text along with four main buttons representing different topics, as well as a *'Credit'* button. Users can begin by selecting the *'Draw'* button, which leads to the first section focused on learning how to draw 2D objects. Within the *'Draw Shapes'* interface, as depicted in Figure 5, users can follow instructions to draw various objects by clicking the sidebar buttons. Each button provides a tutorial for drawing specific elements, including the sky, grass, clouds, rainbow, flowers, and butterfly.

When the user clicks the *'Sky'* button, the screen displays the first step, allowing the user to click the play button to proceed. Each step is highlighted with arrows, starting from Step 1, to indicate specific tools. This continues sequentially through Step 2, Step 3, and so on, until the final step for each element. The object arrangement begins with the simplest element, *'Sky,'* and gradually progresses to more complex objects, culminating in the drawing of a *'Butterfly.'*

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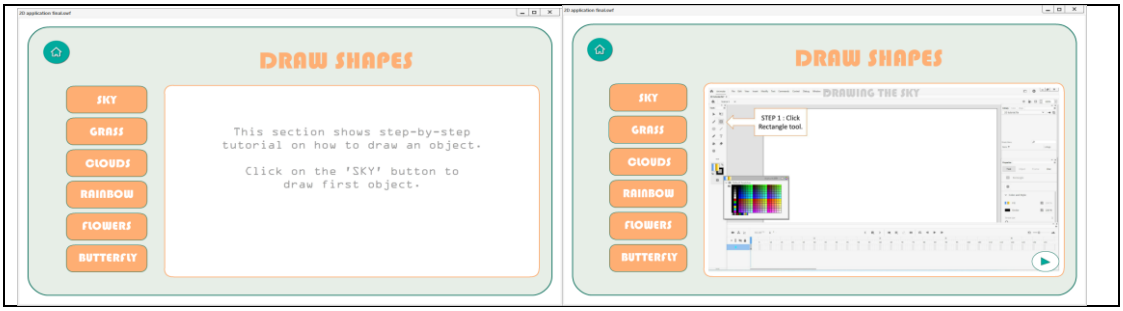

Figure 6: Draw Shapes Interfaces

Another key aspect of the application is that each scene features left sidebar buttons to enhance navigation, along with a *'Home'* button that allows users to move easily throughout the application. These sidebar buttons serve as shortcuts, enabling users to switch between scenes or features effortlessly. At the center of the screen, the tutorial steps are prominently displayed, guiding users through the application's functionalities. Each tutorial step is clearly labeled with a title, providing context and ensuring users can easily follow along.

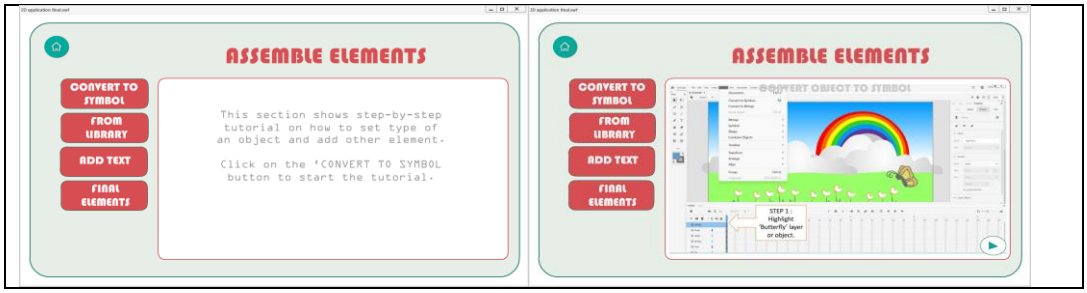

Figure 7: Assemble Elements Interfaces

Figure 7 illustrates the interfaces of the tutorials as they expand into the next section, *'Assemble Elements,'* where users defining the object as either a *'Graphic'* or *'Movie Clip.'* Simultaneously, this section demonstrates how to add a title text element, detailing character properties through the *'Add Text'* button. Following this, the *'Apply Animation'* section, shown in Figure 8, guides users in setting the object's path using *'Insert Frame'* or *'Insert Keyframe.'* Step-by-step tutorials, accessible through sidebar buttons, help users create a 2D animation of the butterfly object by applying tweening actions.

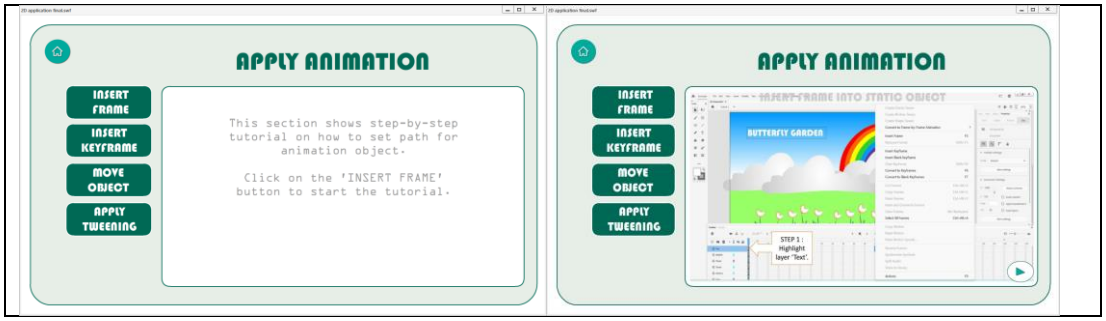

Figure 8: Apply Animation Interfaces

The final section of the application, as shown in Figure 9, focuses on *'Add Scripting'* tutorials, transitioning from applying animations to inserting scripts for the play button. The process begins with adding the *'Stop Frame'* command, demonstrated through sidebar buttons.

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Additionally, the tutorials cover importing an image to use as a play button, rather than creating one from scratch, through the *'Create Play Button'* feature. Toward the end, the *'Script Play'* tutorial guides users' step by step in adding ActionScript to animate the butterfly object.

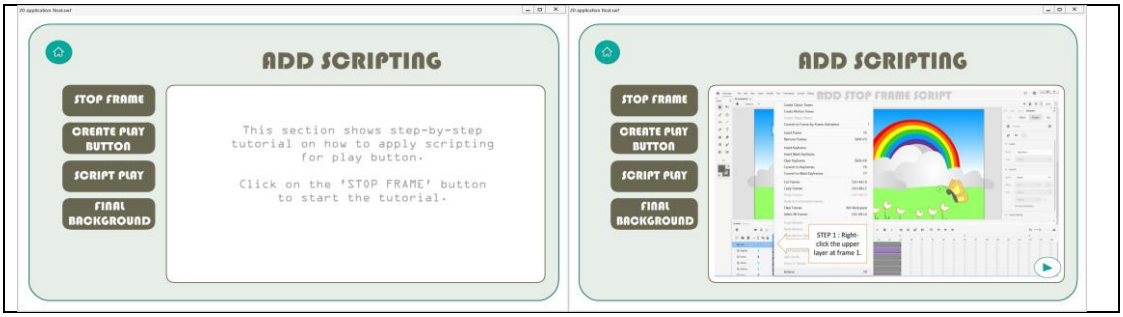

Figure 9: Add Scripting Interfaces

The *'Final Background'* button displays the completed animation screen, showcasing all elements – including the sky, grass, clouds, rainbow, flowers, butterfly, and play button. This gives users a clear preview of the final product and helps them visualize the overall composition. Notably, the application is specifically designed to assist students in developing simple 2D animations by providing an intuitive, step-by-step learning experience. It offers interactive tutorials and guided instructions that cover the entire basic 2D animation process.

Testing & Validation

To assess usability and efficiency, an evaluation was conducted involving students from UiTM who were enrolled in the Interactive Multimedia course in Machang, Kelantan. The pie chart in Figure 10 shows a survey with 36 responses, evenly split between two semesters (blue and purple), each representing 50% of participants who used the initial prototype. The blue color represents Semester 1 students, while the purple color represents Semester 5 students. These two groups were selected for testing because the Interactive Multimedia course in UiTM Machang only involves students from Semester 1 and Semester 5.

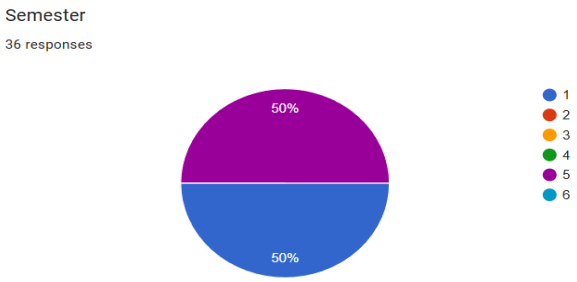

Figure 10: Respondents for 'Fun with Shapes' Interactive Application Testing

This evaluation aimed to gather insights into the effectiveness and practicality of the *'Fun with Shapes'* Interactive Application being studied, leveraging the perspectives of students actively engaged in multimedia learning. The SUS analysis for this testing provides a clear picture of how students feel about the application's usability, based on their feedback using a 1 to 5 scale. Table 1 presents the findings from testing the *'Fun with Shapes'* Interactive Application.

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Table 1: User feedback for 'Fun with Shapes' Interactive Application

No.	Questions	1	2	3	4	5
1.	I think that I would like to use this application frequently.	2.8		11.1	55.6	30.6
2.	I found the application unnecessarily complex.	13.9	16.7	44.4	16.7	8.3
3.	I thought the application was easy to use.		2.8	30.6	30.6	36.1
4.	I think that I would need the support of a technical person to be able to use this application.	8.3	16.7	38.9	25	11.1
5.	I found the various functions in the application were well integrated.	2.8		19.4	52.8	25
6.	I thought there was too much inconsistency in this application.	11.1	33.3	41.7	13.9	
7.	I would imagine that most people would learn to use this application very quickly.	2.8	2.8	27.8	30.6	36.1
8.	I found the application very cumbersome to use.	30.6	38.9	25	5.6	
9.	I felt very confident using the application.		5.6	16.7	44.4	33.3
10.	I needed to learn a lot of things before I could get going with this application.	8.3	22.2	33.3	16.7	19.4

According to Table 1, positive aspects of the experience, such as ease of use and functionality, were highlighted in questions like Q1 and Q5. Notably, 55.6% of respondents said they would use the application frequently, and 52.8% felt its functions were well-integrated. On the other hand, negative feedback pointed to challenges such as complexity, inconsistency, and cumbersome design, with many users giving moderate ratings. Questions like Q8 indirectly measure the aspect of effectiveness, with 44.4% of respondents stating that the app has well-designed workflows and provides recovery mechanisms by implementing a button to be chosen. By applying the SUS scoring method, which adjusts scores for positive and negative items and multiplies the total by 2.5, the application received a score of 65.0.

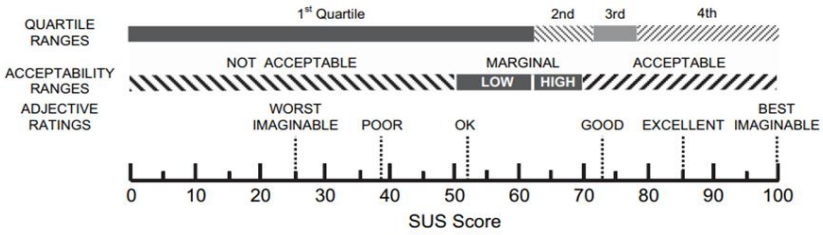

Figure 11: Mean System Usability Scale (SUS) score by quartile, adjective ratings and acceptability of overall SUS score (Bangor et al., 2008)

Comparing the findings with the mean SUS score from Bangor et al. (2008), this score is slightly below the average benchmark of 68, suggesting that the application is 'marginally' usable. Strengths such as ease of learning and integrated functions stand out, but the *'Fun with Shapes'* Interactive Application can be improved, especially by simplifying the interface to better suit novice users, ensuring consistent design, and reducing the need for technical support. Since the SUS does not specifically address functionality-related questions, future improvements could involve incorporating additional questions in usability testing to better explore detailed functional requirements.

Conclusion

Learning 2D animation has come a long way, with manuals evolving into digital methods. The digital approach shifts the mode of learning toward more accessible materials. This application leverages digital methods to offer an interactive and comprehensive view of the animation process, helping learners better understand and retain key concepts. The interactive application

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EISSN: 0128-1666
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for learning basic 2D animation with Adobe Animate provides a dynamic and engaging platform for learners to acquire foundational animation skills. By integrating interactive tutorials, this project demonstrates the potential of digital methods to simplify complex concepts and promote active learning. The application not only supports independent learning but also serves as a valuable resource for educators to supplement traditional teaching methods. Moving forward, incorporating user feedback will ensure continuous improvement, making it an essential tool for aspiring novice learners.

Key areas for enhancement include expanding the tutorials in a more structured and comprehensive manner. This could involve breaking down complex tasks into smaller, easy-to-follow steps, accompanied by visual aids or video demonstrations. A particular focus should be placed on covering additional topics, such as applying motion tweening and scripting for interactive buttons, to ensure users gain insights into advanced functionalities. Beyond tutorials, incorporating additional forms of animation can enhance the overall user experience and engagement; while integrating sound elements such as voice-over instructions can make the application more immersive and appealing. These enhancements not only improve usability but also cater to diverse learning styles, ensuring users stay engaged and motivated throughout their experience with the application.

Acknowledgment
Appreciation goes to Universiti Teknologi MARA, UiTM Machang students for their time and effort to participate in the exploration and evaluation of the 'Fun with Shapes' interactive application. Their valuable feedback has played a crucial role in identifying strengths and areas for improvement within the application.

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Journal of Information System and Technology Management
EISSN: 0128-1666
JISTM
Volume 10 Issue 39 (June 2025) PP. 252-264
DOI: 10.35631/JISTM.1039017
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