

Evaluating the Usability of Interactive Infographics for Raising Tuberculosis Awareness Among UiTMCK Students

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Abstract: One of the sustainable development goals (SDGs) is related to good health and well-being. By 2039, one of the issues that wants to be solved is tuberculosis. Due to the ease of tuberculosis infection, anyone can be exposed to this disease. Lack of knowledge and low awareness about this disease can bring more critical consequences. Therefore, interactive infographics were used since they have the power to visualize content and they became popular on digital and social media platforms. Yet, only a few studies investigated the impact of design on target users. This paper presents the design and development of an infographic-based ADDIE model instructional design on health education that focuses on tuberculosis awareness. Creating an interactive awareness platform is a great idea which is suitable for the educational environment in conveying the idea through media social. The purpose of this study was to evaluate the usability of interactive infographic awareness on tuberculosis among 90 UiTM students. The results from the System Usability Scale (SUS) assessment indicated that the use of an interactive infographic for tuberculosis awareness is a successful platform, achieving a 'Good' rating with a score of 78.

Keywords: Interactive infographic, Tuberculosis, Usability evaluation

1 Introduction

Tuberculosis (TB) in Malaysia has an estimated incidence and mortality rate of 81 cases per 100,000 people-year and 4.9 per 100,000 populations [1]. TB, a communicable disease, significantly contributes to poor health and stands as one of the foremost global causes of mortality. Prior to the coronavirus (COVID-19) pandemic, TB held a grim distinction of being the primary cause of death from a single infectious agent, surpassing even HIV/AIDS [2]. TB disease is one of the communicable diseases caused by a bacteria called mycobacterium tuberculosis. Lack of knowledge about TB disease causes an underutilization of health services, delays in seeking a diagnosis, and poor treatment adherence among TB patients [3]. Enhancing the dissemination of public awareness and health promotion campaigns for TB is crucial to boost understanding of the disease. Furthermore, the importance of early TB detection is essential in preventing fatalities among the public. Early detection enables patients to recover with the right treatment and follow a proper schedule for prevention.

Research conducted in Malaysia by [3] revealed a limited awareness and understanding of TB among the population. Therefore, the study was conducted at UiTM, the university with the highest student enrollment in Malaysia where a potential diffusion from human to human is high. Findings by [4] suggest that more efforts should be made to improve knowledge, awareness, and perception of students regarding TB disease for university students. Technology-assisted education has been the platform used for sharing knowledge and educating people and is suitable to use in a university environment. Utilizing digital platforms, like infographics medium, to raise awareness is an applicable approach to curb the rising number of TB cases. Infographics are used to tell stories, convey ideas, or



explore issues through a range of different graphics [5]. Regarding these functions, poster representation and static infographics can be part of the assessment tool. However, these types of tools bring some challenges for users in understanding and delivering clear information. Utilizing interactive infographics is a suitable approach to enhance the dissemination of TB awareness.

The study employed the ADDIE model because it aids in organizing TB content in a streamlined manner. The model consists of five stages of the development process: Analysis, Design, Development, Implementation, and Evaluation. Further discussion on the detailed implementation of each stage can be found in Section 3. At the end of the stage, SUS was used to test the usability of interactive infographics among UiTM students. The results of this study are expected to become a benchmark and recommendation in future development for interactive infographics to raise awareness.

2 Literature Review

Infographics refers to information graphics that can convey knowledge about a topic efficiently, hinges on their quality and presentation, allowing them to transmit information more swiftly and effectively compared to plain text [6]. Infographics can present information in an organized and attractive way and, therefore, be smoothly captured in individuals' minds [7]. Interactive infographics is one of the implementations of multimedia that incorporate the elements of interactivity in the design. There are many types of infographics, including static and interactive [7]. In the case of static infographics, they employ a combination of images and text to elucidate complex concepts through visual elements like maps, charts, and graphics. Static infographics do not require any interaction from users, meanwhile animated infographics depend on animation, and it catches viewers' attention with more spectacular and eye-catching visuals [8]. Infographics have evolved from static to more immersive experiences in interactive infographics that allow humans to engage using scrolling, clicking, or hovering the elements. Infographics consist of three primary components: content elements (such as texts, facts, references, statistics, etc.), visual elements (including graphics, maps, colors, icons, signs, etc.), and knowledge elements (encompassing messages, conclusions, etc.) [9].

One challenge with the use of infographics in education is that it requires accurate designs based on scientific standards. Otherwise, audiences may not get the best information out of the tools [7]. What is particularly noteworthy using infographics is having significant commonalities which rely on visual representations to communicate information to their audiences. Several scholars investigated the use of interactive visualizations, including both data visualization and infographics. Some of the scholars implemented interactive infographics for awareness purposes that focuses on environmental [10], cancer [11] and TB [12]. While infographics are undeniably popular, there remains a lack of research verifying their effectiveness as learning materials. In this context, [13] investigated how learning and information retention are affected by infographics as educational material has been studied in detail which focused on implementing text and graphics. According to [14], infographics can be equipped with a voice over that will explain the content of the infographics with a musical background so that people will not be bored.

The director of Kelantan Health Department reported, as of June this year, the number of reported TB cases in Kelantan had shown a slight increase, with an incidence rate of 32.1 per 100,000 residents, compared to the previous year when the incidence rate was 52 per 100,000 residents. Health education has a significant role to play in both health and healthcare, but there are various forms of community education available. Traditionally, methods such as health education brochures, posters, and interactive sessions have been employed to educate the general public [15]. One of the health education concerns by Malaysian government is TB. Stressing the early detection of TB is crucial in preventing death cases among the public and early detection allows the patients to recover with correct treatment schedule and prevention. One of the suitable ways to prevent the increasing number of TB cases is through awareness using digital platforms such as interactive infographics. Based on research [12], infographic messages for TB can be conveyed to users using six dimensions which are basic knowledge, symptoms, risk factors, modes of transmission, treatment and care and support. UiTMCK, which deals

with many students who come from various cities in Malaysia need to know about TB to reduce the increasing number of cases. The study by [13] found that infographics improves students' understanding due to robust learning. However, tests were not conducted to verify students' learning performance.

In reality, not all interactive infographics match the environment of users. Hence, to ensure the validity of usability of pilot experiments, the SUS has been used as an evaluation tool for evaluating software interfaces that consist of the infographics focusing on TB awareness in order to have the correct measurements and see the structure accurately. SUS is a set of questionnaires that can be used to measure the usability of a computer system from the subjective point of view of users [16].

3 Methodology

The design of the interactive infographics was built using the ADDIE model which is analysis, design, development, implementation, and evaluation as summarized in Figure 1 below.

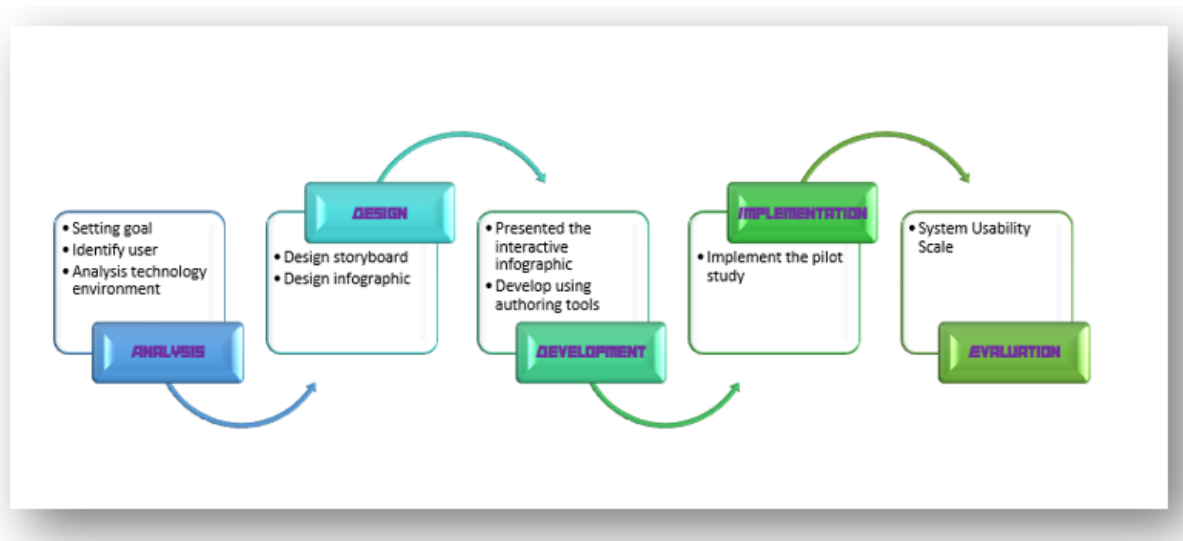


Figure 1: The development phases of interactive infographics

A Analysis

Initially, the general goals of interactive infographics covering TB awareness were identified. An online survey was conducted using Google Form, and characteristics of the participants were studied in detail in choosing suitable infographic elements to be implemented in the interactive infographics. Participants selected were UiTMCK students in Machang and Kota Bharu who come from various states in Malaysia.

Based on the findings, six dimensions were suggested by [12], but the study basically used three dimensions in conveying awareness to students which include basic knowledge, symptoms, and treatment which is more suitable for university students. In converting these dimensions to interactive infographics, the technological environment also needs to be studied, such as the software and hardware needed in constructing interactive infographics. For the interactive infographics, three main software were used which were Adobe Photoshop CC, Adobe Animate CC and Adobe Premiere CC.

B Design

In designing the interactive infographics, the types of images and drawings suitable for the study have been identified. The nonlinear design concepts were used since it is an interactive infographic in which the users can navigate freely through the content that is unbound by predetermined routes. In the interactive infographics, the storyboard was sketched to describe how to deliver the instructions to meet

the objectives identified during the analysis phase. Storyboarding can be a significant segment in the innovative cycle by permitting the developer to compose pictures and text in an outline style before the development starts [17].

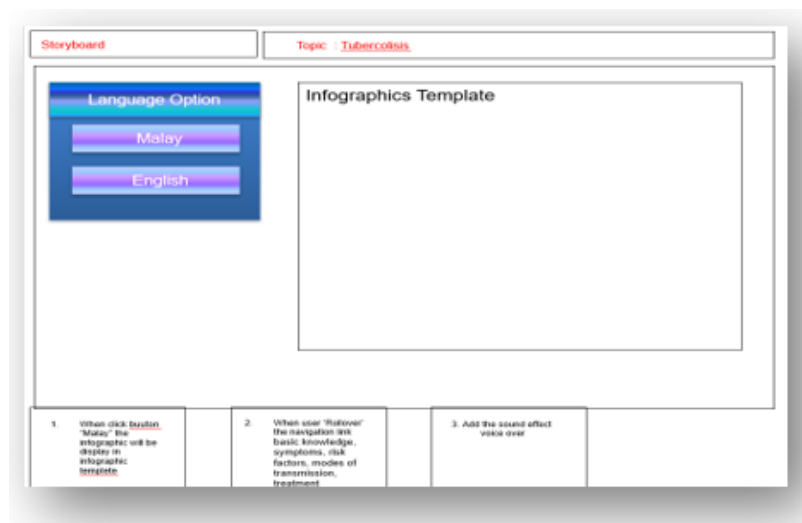


Figure 2: Sample of storyboard

Figure 2 is the interactive infographic to disseminate awareness, users can navigate through two main languages which are Malay and English. Rollover navigation that can be controlled by users for certain terms has been assigned as navigation links which are basic knowledge, symptoms, and treatment.

C Development

The instructional materials are presented as interactive infographics using a combination of graphics, text, and videos and the contents can be controlled freely by users. Several software applications were implemented for combining the elements of infographics such as Adobe Photoshop to edit graphics and text, Adobe Animate to transfer the contents to interactive infographics and Adobe Premiere to edit the footage of video in infographics.

As shown in Figure 3, the interactive infographics above focuses on basic knowledge of TB, symptoms, and treatment. Moreover, the design implements the voiceover in order to increase the understanding of the contents to users.

D Implementation

A pilot study was conducted among 90 undergraduate students in UiTMCK using a survey method. The pilot study sample was retrieved according to the content that was developed and based on real problems. The pilot study instruments are used to confirm the usability of interactive infographics.

E Evaluation

The SUS was employed as an evaluation tool for assessing software interfaces. The data from the survey was entered into Microsoft Excel to be processed. The data was then calculated using a weighted SUS score. The results of the calculation are divided into 5 Letter Grades from A, B, C, D, and F with a choice of ratings of Excellent, Good, OK, Poor, and Awful. The details of 10 SUS questionnaires can be seen clearly in Figure 5.

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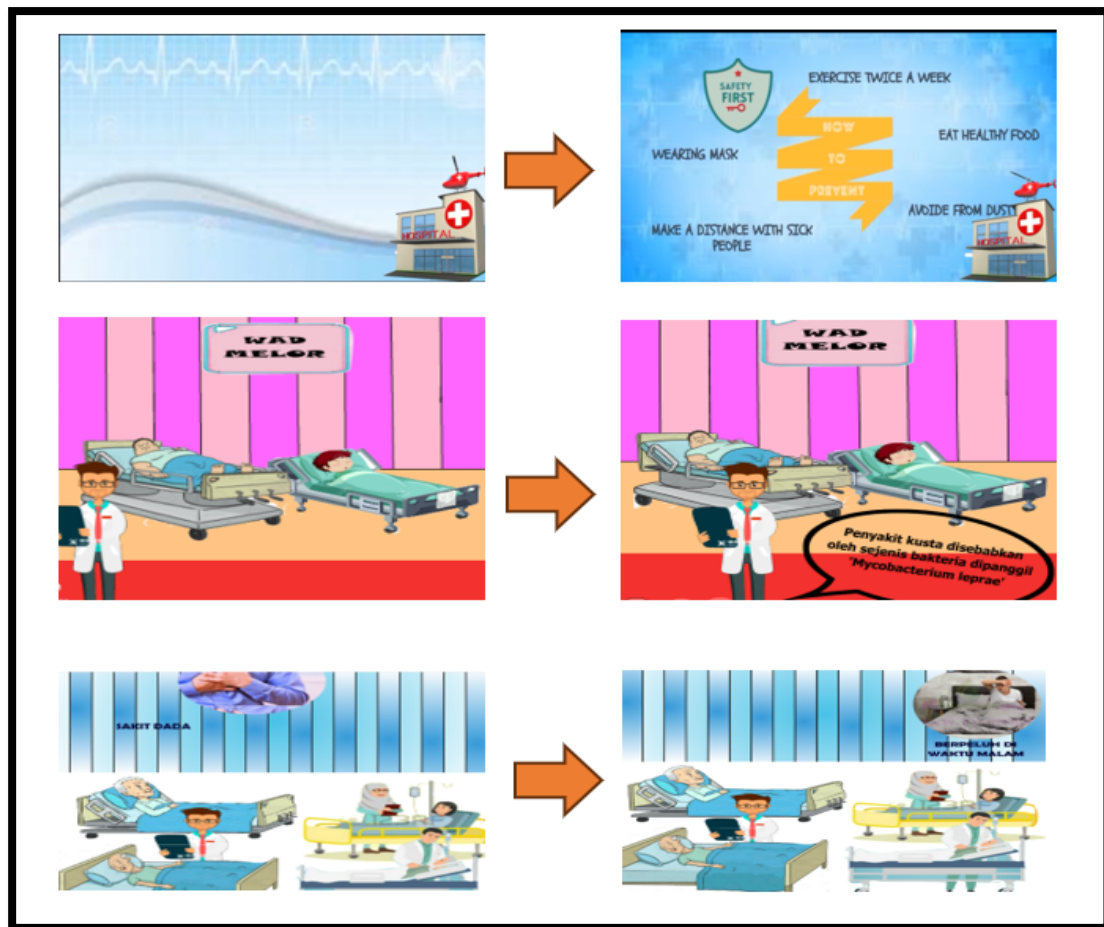


Figure 3: Interactive Infographics

4 Results and Discussion

SUS were tested among 90 respondents in UiTMCK. The questionnaire used a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Based on the results of the usability evaluation using the SUS (Table 1), the interactive infographics gets a score of 78 with a “Good” rating whose acceptability range was ‘acceptable’. The scale result is supported by a study by [18] based on the mean SUS scale purpose and the statement mentions that the products which are at least passable have SUS scores above 70s to 80s are good products. From the results gathered from the respondents, it can be concluded that the interactive infographic software in health fulfils the usability element test, although there are some weaknesses reported from the responses.

Table 1: Sample of SUS calculation

Respondent	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	X	SUM Y	Y	SUS	GRADE
Respondent 1	3	2	4	2	3	2	3	4	3	4	17	14	11	70	B
Respondent 2	4	2	4	2	4	3	4	5	4	4	21	16	9	75	B
Respondent 3	5	1	5	1	5	1	5	5	5	5	25	13	12	92.5	A
Respondent 4	5	2	5	1	5	1	5	5	5	5	25	14	11	90	A
Respondent 5	5	1	5	1	5	1	5	5	5	5	25	13	12	92.5	A

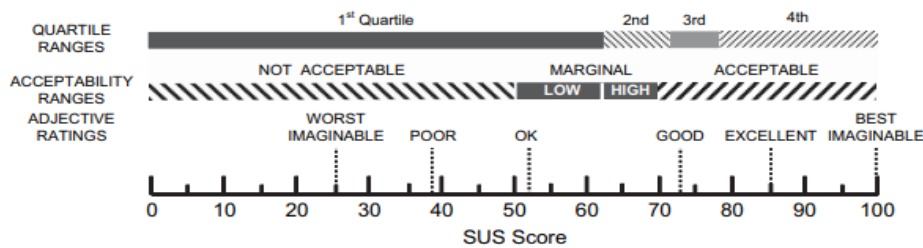
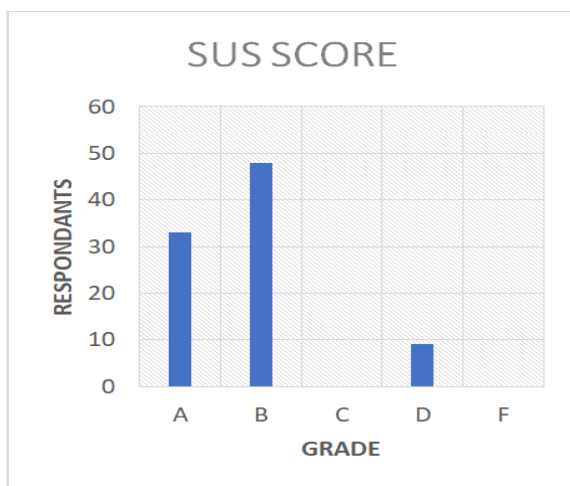


Figure 4: Mean System Usability Scale (SUS) score by quartile, adjective ratings and acceptability of overall SUS score [18].

In this research, we found that the respondents described the interactive infographic contents improve their understanding better compared to reading static infographics that they commonly see on social media platforms. Based on [19], the rule for percentile ranks and letter grades are as follows:

1. Grade A: score ≥ 80.3 , percentile $\geq 90\%$
2. Grade B: $74 \leq \text{score} < 80.3$, $70\% \leq \text{percentile} < 90\%$
3. Grade C: $68 \leq \text{score} < 74$, $40\% \leq \text{percentile} < 70\%$
4. Grade D: $51 \leq \text{score} < 68$, $20\% \leq \text{percentile} < 40\%$
5. Grade F: score < 51 , percentile $< 20\%$



SUS Questionnaires

I think that I would like to use this interactive infographic frequently

I found this interactive infographic unnecessarily complex

I though this interactive infographic was easy to use

I think I would need assistance to be able to use this website

I found the various functions in this interactive infographic were well integrated

I thought there was too much inconsistency in this interactive infographic.

I would imagine that most people would learn to use this interactive infographic very quickly.

I found this interactive infographic very cumbersome/awkward to use.

I felt very confident using this interactive infographic.

I needed to learn a lot of things before I could get going with this interactive infographic.

Figure 5: SUS scores rating and questionnaires for Interactive Infographic

Figure 5 above shows the highest grade scored by respondents was grade B which represents 33 respondents, and the score means a good adjacent rating. Followed by grade A with 48 respondents

whose adjective rating was excellent and, lastly, grade D with 9 respondents which represents poor adjective rating.

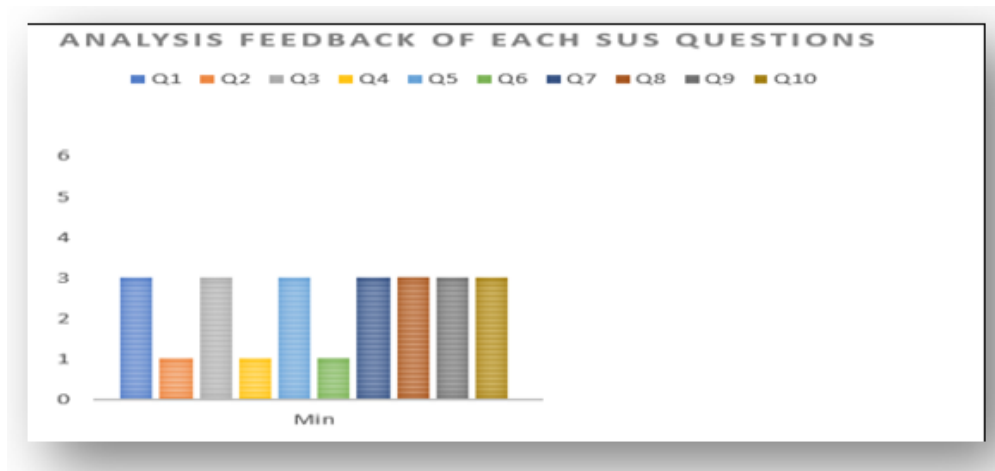


Figure 6: Analysis feedback of each SUS question for Interactive Infographic

Figure 6 represents the analysis viewed on a per-item basis on a minimum for 10 questionnaires. Five positive questionnaires (numbered 1,3,5,7 and 9) and five negatives (numbered 2,4,6,8 and 10). The questionnaires were asked in positive and negative statements to avoid biases. When viewed on a per-item basis, the eighth questionnaire (I found these interactive infographics very cumbersome/awkward to use) and tenth questionnaire (I needed to learn a lot of things before I could get going with these interactive infographics) showed that respondents answering ‘neutral’ making the overall grade to fall under ‘B’.

5 Conclusion

This study demonstrates TB awareness using digital platforms. An interactive infographic was developed based on the ADDIE model which includes design and development and was evaluated using SUS. According to the SUS score, it can be concluded that most of the participants agreed that using an interactive infographics to raise awareness about TB is a good approach as the medium to convey information the score gathered 78 which is categorized as a ‘Good’ result with its acceptability range was ‘acceptable’. A majority of respondents who scored grades A and B also proved that effectiveness, efficiency and satisfaction were strongly achieved by the participants.

In conclusion, using an appropriate representation of interactive infographics can increase the participant's knowledge and understanding of TB. It is hoped that infographics can help users detect TB in its early stage which will enable patients to recover in immediate time. For future works, presenting information in multiple modalities and low-cost implementation, infographic tools might provide a beneficial supplement to participants in handling complex phenomena across all domains. The limitation of the study is in this research also only focuses on using one technique of usability evaluation which SUS is intended to provide an easy and quick subjective measure of usability. For future research, the evaluation can be extended using different techniques and include comparisons in order to get more accurate results for the research including using multi variable analysis with detailed inferential statistical analysis.

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Conflict of Interest Statement

The authors agree that this research was conducted in the absence of any self-benefits, commercial or financial conflicts and declare the absence of conflicting interests with the funders.

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