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Developing Framework Analysis Model for Science Learning Interactive Multimedia in Educational Field: A Usability Testing Approach

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Abstract:- Visual learning media is a type of technology that can help students retain more information by looking at interactive visuals. Thus, we attempted to analyze an effective learning media model in this study using a case study of system development in a Singaporean high school. In this study, we use prototyping to create a visual media system that is quick and easy to analyze. We use the QUIS framework to evaluate the created media to ensure that usability requirements are met in the system. Thus, we attempt to quantify usability by gauging user acceptance and validation with the goal of developing an analysis framework that explains the level of learnability, error-free aspect, memorability, satisfaction, and efficiency associated with the proposed design. Our design results show that some aspects of development successfully achieve the high rate for all requirements of an ideal usable interactive multimedia.

Keywords:- *Science Learning; Media Tools; Usability Testing; QUIS Method.*

I. INTRODUCTION

The advancement of science and technology in the digital age has an impact on many fields, one of which is in the education field. This is consistent with Tan et al. (2020), who state that using technology in teaching and learning activities can help teachers explain theories and encourage students to learn. To keep up with technological developments in the world of education, the learning process in the age of globalization is becoming a pivotal requirement (Budiman, 2017). According to Pane and Dasopang (2017), the learning process is a two-way street in which teachers and students collaborate to achieve results that are in line with their objectives.

Educational progress can be seen in teaching and learning activities that are now more student-centered, with teachers no longer serving as the focal point of learning. The teacher acts as a learning facilitator in this process, allowing students to learn comfortably and guiding students to find sources of information to expand their knowledge (Nurhamidah, 2018). Learning activities have evolved from face-to-face learning to online learning as technology has advanced (Lin et al., 2017). Learning activities that foster this development can help students become more self-sufficient in their learning. Research of Budiman (2017) also shows that the advancement of science and technology in teaching activities has an impact on teaching and learning activities. Furthermore, the rapid advancement of technology can assist teachers in improving their teaching abilities (Delialiolu and Alioon, 2014).

As part of a teaching team, the teacher must employ the appropriate media, eventually the student learning outcomes will improve. This is in line with research by Widiasih et al. (2018) which shows that using a variety of media can increase students' enthusiasm for learning and affect their academic performance. Learning media will be more interesting when combined with technology, such as a smartphone. Communication technology can also be used as an information medium, allowing students to learn from anywhere and at any time (Kularbphettong et al., 2015). Furthermore, According to Naik et al. (2020), technology can be used as a learning tool to improve student learning outcomes and quality, in addition to facilitating communication.

The use of information technology in learning media is a method of delivering messages and learning information that is well designed to assist students in achieving their learning goals, facilitating the learning process, and optimizing learning outcomes (Nurseto, 2012). According to De Porter's research, humans can only absorb 70 percent of what they do, 50 percent of what they hear and see (audiovisual), 30 percent of what they see, 20 percent of what they hear, and 10 percent of what they read. According to this study, experiential learning is always a priority, but Teaching and Learning Activities (KBM) are sometimes confronted with material that cannot be experimented with. For instance, a science experiment on the topic of electric circuits that take too long or materials that are

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too expensive. It is at this point that the appropriate learning media, namely learning media with interactive applications, is required as a tool for learning.

Based on the explanation above, educators must use engaging teaching materials and learning media in the classroom learning process to overcome these issues. In high school science learning, researchers provide learning solutions by using teaching materials in the form of interactive applications (SMA). This interactive application is a type of educational material that can help or support educators in the delivery of learning materials. This application assists students in better understanding the subject matter. According to Munir (2015), interactive multimedia will greatly assist students in understanding abstract concepts or material because the material can be represented by visual, textual, and visual elements such as images, text, audio, animation, and video that facilitate the learning process. become more interactive (Deliany et al., 2019).

While working on this study, the researcher will answer the following questions: How can the development of interactive media tools aid science student learning? How should the interactiveness and usability of media be defined?. Our study will conduct media development by deploying user interface development for three specific science topics for a senior high school level, and build the framework analysis using QUIS Method.

The outline of this manuscript is divided into seven chapters and is organized in accordance with the presentation system outlined below. This first chapter introduction, provides an explanation of the background of developing framework analysis for interactive system tools for educational learning in science topics, the purpose of the work, the scope of the work, the approach used. The second chapter, literature review, contains an explanation of the literature review, which includes the relevant theoretical basis and development methods used in conducting research. The third chapter, Research Methodology explains the methods and research procedures used in conducting research. The fourth chapter, Results and Discussion, t contains an explanation of the results and discussion obtained from the analysis. The fifth chapter, Conclusions and Suggestions, contains an explanation of the design and research conclusions, as well as suggestions for future research or development.

II. LITERATURE REVIEW

Learning media plays a critical role in the learning process. Learning materials can be presented in a variety of ways, including graphics, films, slides, photos, and computer-based learning. Computer media play an important role in the distribution, storage, and processing of information in learning media, where the teaching and learning process becomes communicative, effective, and efficient (Mustika et al., 2018).

The success of learning is heavily influenced by two major factors: teaching methods and learning materials. These two components are inextricably linked and cannot be separated. The application and selection of specific teaching methods has implications for the application of appropriate types of learning media. The role of the media in the teaching and learning process is to increase student stimulation in learning activities (Shofwan, 2009). According to Ali, M (2005), the use of computer-based learning media has a significant impact on students' interest in learning the skills being taught. The use of school supplies can reduce student misunderstanding of teacher explanations, save time in teaching preparation, and increase student learning motivation.

Nugroho (2008) defines interaction as a process that allows students to master the learning environment in his research. The learning environment in question in this context is computer-assisted learning. The characteristics of student learning in response to stimuli displayed on a computer screen are what are classified in the context of multimedia learning, not the hardware system. The sophistication of computer programs has a large influence on the quality of student interaction with computers. According to Shofwan (2009) research, there are at least three levels of interaction based on the quality of learning interactions which are active, proactive, and mutual. Furthermore, Miarso (2011) defines learning media as "anything that can stimulate thoughts, emotions, attention, and willingness to learn in order to encourage intentional learning." Learning materials are classified into three types: (1) presentation materials, (2) multimedia objects, and (3) interactive media.

Students must be able to construct and apply information, knowledge, logic, criticism, creativity, and innovation in order to achieve success. They must also be able to analyze and use natural and environmental phenomena as meaningful learning resources and apply them contextually in everyday life (Hasasiyah, et al. 2020). Due to changes in the way students learn who use technology as a source and medium of learning, information technology is also a critical need for learning in the twenty-first century today. The use of interactive learning media is required to improve understanding of scientific topics (Ihsan, et al. 2019).

Interactive multimedia incorporates elements of scientific learning that are comprehensively displayed through audio, animation, video, text, and graphics related to learning materials, allowing users (students) to interact interactively with the features provided (Gunawan et al. 2016). According to Lia and Linda (2015), science learning can be combined with interactive multimedia. This will increase students' interest in and understanding of science. Students can interact with multimedia content and organize their own education. Learning is not restricted to the classroom but can occur anywhere.

Table 1. State of the art of the research

Author (Year)	Science Learning Education	Prototyping	QUIS Method	Usability Testing	Participatory Analysis
Renaningtias & Apriliani (2021)	✓	✓			
Subiyakto & Wijaya (2018)		✓		✓	✓
Sadewa et al. (2020)				✓	✓
Rifaldi et al. (2021)		✓			
Syawaludin & Muhimmah (2021)		✓			✓
Punkastyo and Abisono (2018)			✓	✓	
Ayuningtias & Huda (2019)		✓	✓		
Sasongko et al. (2017)			✓	✓	
Yumarlin, M. Z. (2016)				✓	✓
Suardiasa et al., (2021)				✓	✓
Wijayanti et al., (2018)		✓			
Robbi & Yulianti (2019)		✓			✓
Uliyana et al., (2021)		✓			
Damayanthi et al., (2020)			✓	✓	✓
Safi'i et al., (2020)			✓	✓	✓
Widhiyanti & Atmani (2021)		✓			✓
Aditya et al., (2021)		✓			
Andry & Stefanus (2020)	✓				
Nurul et al., (2020)	✓	✓			
Putra et al., (2020)		✓			
Saleh, 2016		✓			
Zailani et al., (2020)		✓			
Novita & Andiarni (2019)		✓			
Diansyah, A., & Susanto, E. S. (2021)		✓			
Putra & Sujarwanto (2017)	✓				✓
Puji et al., (2014)	✓				
Azmi et al., (2020)					✓
Dewantara et al., (2020)	✓				✓
Tazkia et al., (2019)	✓				
Haka et al., (2020)	✓				✓
Arofah & Rinaningsih (2021)	✓				✓
Ismail & Gumilar (2019)					✓
This study	✓	✓	✓	✓	✓

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In developing interactive applications, this study employs the SDLC (Software Development Life Cycle) particularly the Prototyping Model. In research by Rifaldi et al. (2021) the study uses the prototyping method because the application developed is an initial concept for combining several pre-existing features, while the researcher chose the prototyping model for this study since that enables the user to see and interact with the prototype, allowing for feedback and more precise and comprehensive specifications. In this study, user involvement occurs at the requirements gathering (communication) and evaluation stages of prototyping in code (construction of prototype), in contrast to Syawaludin & Muhimmah (2021) research, which employs the Participatory Design (PD) method and involves active user involvement throughout the system development stage, from the initial to the critical design stage.

Furthermore, a high level of usability of a media or system application indicates that the opportunity to consult and use the application will be high, as the user is truly interested in obtaining information quickly and accurately. If a user desires access to an application but the application does not meet the user's requirements, the user is likely to abandon the application. Thus, in order to satisfy user needs, the application must adhere to several usability criteria proposed by (Luh et al., 2016) such as Learnability, Efficiency, Memorability, Free of Errors, and Satisfaction.

Thus, the usability evaluation for this study will be conducted by sending a questionnaire to the educational institution, which will then distribute the questionnaire to the respondents while in Subiyakto and Wijaya's (2018) research evaluated usability using QUIS via direct observation and user satisfaction tests with several predetermined respondents. In filling out the interactive application's usability evaluation questionnaire, five aspects of usability will be considered, namely ease of learning (Learnability), efficiency (Efficiency), memorability (Memorability), errors and security (Errors), and satisfaction with filling out QUIS (Questionnaire for User Interaction Satisfaction), while Sadewa et al. (2020) conducted usability testing of the Buleleng E-SAKIP application (Satisfaction).

III. METHODOLOGY

This chapter presents the research design such as the research procedures, approach of analysis, and the materials required for the research. Figure 1 illustrates the research methodology. The methodology of this research consists of a) Study Literature, b) Defining three science topics to be developed, c) development of prototype, d) analyzing media using QUIS, e) Framework Analysis, f) Result and Conclusion.

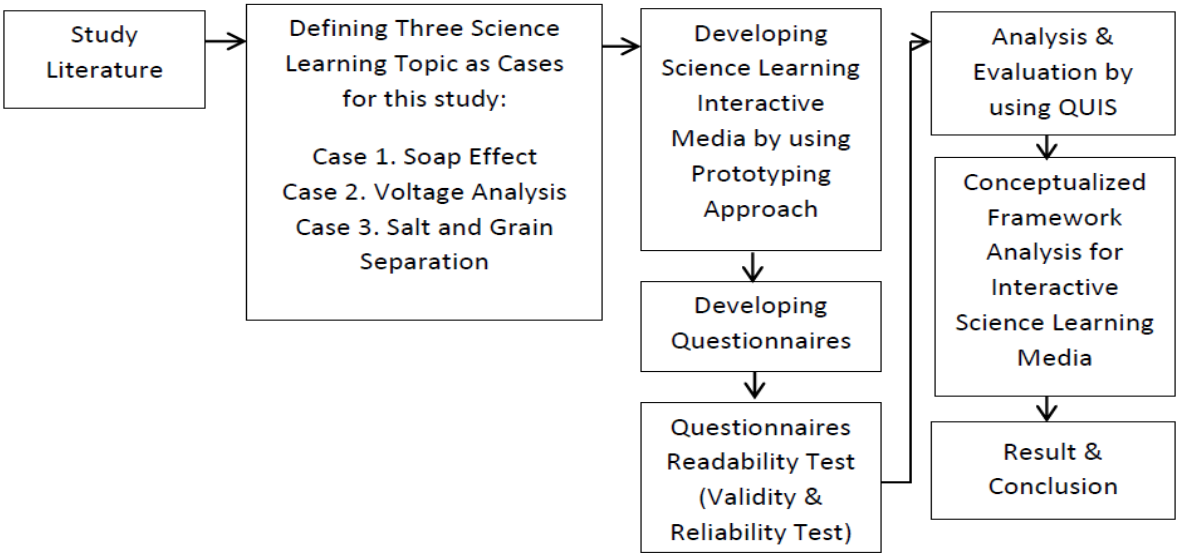

Fig 1. Research Methodology

The literature review in this study was done by evaluating the literature or library sources that are pertinent to the study's research theme. The literature can take the form of reviews and/or books on software or applications to be developed, in this case in relation to such applications. The literature review for this study was conducted using Google Scholar Search, PROQUEST Database, and Emerald Database with the keywords ``Interactive Application Development with Prototyping Method.'' Additionally, the researcher created a special range for the literature search, which is between 2017 and 2022, in order to improve the journal's up-to-dateness. However, in some literature, researchers were unable to locate information in the range of 2017 to 2018, and thus relied on pre-2017 literature.

Furthermore, in this study, the science-learning component of this study will be evaluated using three high school-level science process examples. Case number one, Voltage in Parallel Circuit, which can be used to make measurements and infer the relationship between voltages across separate branches of parallel circuits; and Voltage in Parallel Circuit, which can be used to manipulate interactively in order to make measurements and infer the relationship between voltages across separate branches of parallel circuits.

Case number two, Keeping Healthy - Effect of Different Soaps on Bacterial Growth, which is used to determine the process of hand washing using various methods and durations, both of which can affect the results of hand washing performed. Case number three, Separating Mixture - Salt and Rice Grains, which is used to demonstrate how different separation techniques performed in different sequences can affect the separation of salt and rice grains.

In this research, the prototype method is used because it provides an accurate representation of the currently running application. Prototyping is a method of software engineering that demonstrates how software components can function directly. The prototype is created to define the mechanisms requirements in the application/software (Suryn, 2014).

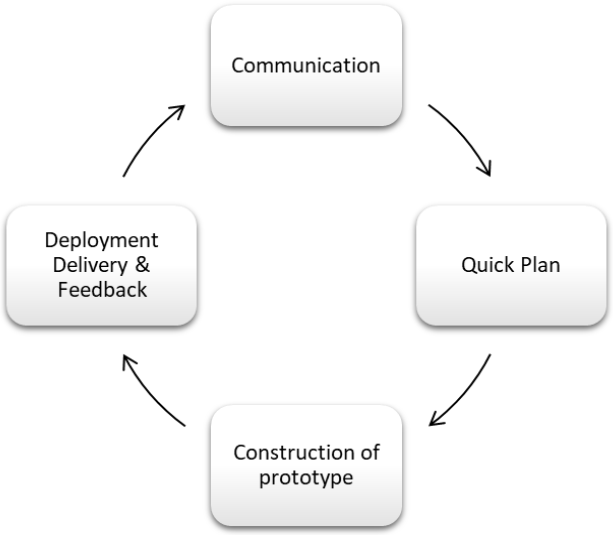

Fig 2. Prototyping Approach Method (Suryin, 2014)

Phase of Prototyping approach is shown as in Figure 2. The communication phase is the first phase of this method. In this case, communication is accomplished through meetings with customers, the purpose of which is to gather critical requirements for software development. The second phase is Rapid Plan, which involves the rapid development of a plan to implement the requirements gathered in the previous phase. Following this phase, a prototype is created in the form of code prototyping. Furthermore, the third phase is Prototype construction.

After analyzing and gathering requirements for problem analysis, we can proceed to the prototyping phase by building web applications in the form of interactive applications using React JS using the IDE (Integrated Development Environment) Visual Studio Code. React is a framework that is widely used by developers to efficiently and fluently create SPAs (Single Page Applications). This is because the framework's component sets are reusable. According to MDN Web Docs, a single page application (SPA) is a web application implementation that contains only one web document. When different content is displayed, this document updates the body content of that single document using JavaScript APIs such as XMLHttpRequest and Fetch. The author chose React JS as the framework for this interactive application in order to demonstrate how it simplifies the creation of interactive user interfaces, as well as the efficient updating and rendering of components when data or content changes.

After the prototype is constructed, it is distributed and sent to the user for evaluation, with the prototype focusing on the representation of the software's features that will be visible to the end user (for example, human interface layout or output display format). The fourth phase is Delivery & Feedback on Deployments. In this case after the user has used and evaluated the prototype, the developer receives feedback for future software development changes. System evaluation is performed to ensure that users' needs are met and to gain a better understanding of the tasks required of software developers (Madhukar et al., 2018).

Furthermore, The Questionnaire for User Interaction Satisfaction is a questionnaire that is used to assess user satisfaction with a human computer interface (HCI) (Satriajaya et al., 2021). The QUIS questionnaire is intended to ascertain users' subjective satisfaction with various aspects of human interaction (H.N et al., 2015). QUIS is a questionnaire that collects self-reported metrics about the user's perception of the system, subjective reaction to it, and interactions with it (Damayanthi et al., 2020). According to Tullis and Albert in (Joanna, 2010), this questionnaire measures five different aspects of usability.

To validate the questionnaire, the Questionnaire Readability Test is a procedure used to determine the validity of the questionnaire that will be used to collect data from the results of usability tests. At this point, the researcher used expert judgment to conduct a readability test. Experts in judgment, that is, individuals with expertise in a particular field, can be consulted to ascertain the instrument's accuracy (Irfan, 2021). Handayani et al. (2019) stated that measuring and reporting the readability of instrument content is critical because it can help ensure the construct's readability and instill confidence in readers and researchers about the instrument by involving experts in assessing the instrument's conceptual and operational feasibility. According to Latifah's (2017) research, expert judgment is a technique for examining data in the form of opinions or statements by subject matter experts.

The readability test results from the experts can be accepted as-is or modified slightly or even completely. To assess the questionnaire readability, the researchers chose the Technical Product Manager of PT. Technology Education Stadium (Studycle), who has experience developing interactive applications. Additionally, the researcher consulted several experts in the fields of English and grammatical analysis. Data collection will be conducted using questionnaires that have been determined to be valid by experts.

Furthermore, a validity test is used to determine the validity or invalidity of a measuring instrument. The measuring instrument in this case is the questionnaire questions. A questionnaire is said to be valid if the questions on it can reveal information about the variable being measured (Janna, 2020). According to Sugiyono (2014:24), the validity test is conducted using data from the questionnaire results and the Product

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Moment correlation. The validity test is used to determine the relationship between two variables (symptoms) on an interval scale using the Product Moment correlation formula (a scale that uses real numbers). According to Sugiyono in (Hendri, M., 2017), the Product Moment correlation formula is as follows.

The researcher calculates the validity test using SPSS 22.0 (Statistical Program of Social Science) software with a significance level of () = 0.05, indicating that the level of confidence in obtaining the truth during the validity test calculation is 95%. (Zahra & Rina, 2018). When compared to the level of significance () = 0.01, which indicates that the data analysis results should be as detailed and sensitive as possible. Whereas a significance level of 0.01 is typically used in research requiring a low error rate, such as testing a drug in the medical field that involves human life (Payadnya & Atmaja, 2020). As a result, the researcher chose a significance level of () = 0.05, which is considered to be quite representative and is a widely used significance level (Zahra & Rina, 2018).

Internal consistency reliability testing was conducted by attempting the instrument only once and then analyzing the results using specific techniques. The analysis results can be used to forecast the instrument's reliability. According to Riduwan in (Zahra & Rina, 2018), the Cronbach's Alpha formula can be used to determine the reliability of research instruments. Cronbach's Alpha is a mathematical formula used to determine the measure level of reliability, with a reliability coefficient or alpha of 0.60 or greater indicating that the instrument is reliable.

At the stage of Analysis of Prototype using QUIS, the researcher developed the Questionnaire for User Interaction Satisfaction (QUIS) to assist users in expressing their feelings, impressions, and attitudes toward the upcoming interactive application interface. In order to evaluate this prototyping, the user will be asked to provide feedback on the implemented prototyping code, which will also serve as a reference for improving the User Interface in the subsequent iteration. This questionnaire was created using the five usability dimensions described in sub-chapter 2.6 and the feedback provided by the user while running the application. Additionally, the questionnaire is designed using the Likert Scale method, which is a technique for determining the level of user satisfaction using a Likert Scale.

The response to each instrument item on a Likert Scale ranges from extremely positive to extremely negative in terms of words and numerical values. The Likert Scale is used in this study by presenting the user with a question or statement and then requiring the user to choose one of five available response options, each of which has a different value. As in the study by Maryuliana (2015), the Likert Scale used in her study has an answer scale consisting of the following: Strongly disagree or very difficult to rate (STS) = 1, Disagree, difficult (TS) = 2, Neutral (N) = 3, Agree, easy (S) = 4, Strongly agree, very easy (SS) = 5.

IV. RESULT AND DISCUSSION

This section presents usability evaluation based on the user interface using QUIS (Questionnaire for User Interaction Satisfaction). The results of the prototype evaluation will be obtained by processing the questionnaire data by calculating the Grand Mean value. The result of data processing is to determine the level of usability based on the user's assessment of the user interface of the Interactive Application.

The results of the application evaluation, namely the QUIS calculation, are shown in Table 2. The QUIS calculation considers five aspects of usability, namely ease of learning (Learnability), efficiency, memorability, errors and security, and satisfaction.

User	Learnability	Efficiency	Memorability	Errors	Satisfaction
1	4.25	4.57	4.50	4.00	4.67
2	5.00	5.00	4.75	4.33	5.00
3	4.25	4.14	4.25	4.33	4.33
4	4.25	3.71	3.50	4.00	3.67
5	4.25	4.14	4.50	4.33	5.00
ΣX	22.00	21.57	21.50	21.00	22.67
Grand Mean	4.40	4.31	4.30	4.20	4.53

The purpose of the questionnaire statistical analysis is to determine the Grand Mean value. After obtaining the Grand Mean, the value will be compared to the interval distance calculated using the Likert scale as described in the methodology section. The results as shown in Table 2, can be represented as follows.

Our framework analysis shows that the design we provide is simple to master (Learnability), as The Grand Mean value for the learnability aspect of the questionnaire calculated is 4.40. On the basis of the value obtained, it can be concluded that the interactive application's learnability is highly regarded. This indicates that the user strongly agrees that the application is easily learned. Furthermore, the grand mean value for efficiency in the questionnaire calculation is 4.31. On the basis of the value obtained, one can conclude that the interactive application's efficiency is quite acceptable. This indicates that the user is adamant about the application's efficiency.

Based on the results of the questionnaire, the Grand Mean value for the memorability aspect is 4.30. It shows that the interactive application's memorability aspect is strongly agreed upon. This indicates that the user strongly agrees that the application is easily remembered. Moreover, The Grand Mean value obtained from the errors aspect of the questionnaire calculation is 4.20, indicating that the errors aspect of the interactive application is agreed upon. This indicates that the user is adamant about the application's low error rate.

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The last aspect of analysis is, The Grand Mean value for the satisfaction component of the questionnaire is 4.53. Based on the value obtained, it can be concluded that the interactive application's satisfaction aspect is strongly agreed upon. This indicates that the user is adamant that the application provides a high level of satisfaction.

The purpose of the prototyping in this study is to build an interactive web-based application to serve as a learning medium for one of the high schools located in Singapore. In this case, researchers successfully collected data from users at an education consultant company via a document containing a series of sketches (storyboards) that serve as an introduction to the application's implementation.

The research conducted employs the Questionnaire for User Interaction Satisfaction (QUIS) to assess user satisfaction with a web-based interactive application's user interface using five respondents as user representatives. The distributed questionnaires included readability tests that were used to determine the validity of the questionnaires based on the opinions of experts or judgment experts. Additionally, a feasibility test will be conducted on the questionnaire to ensure that it is suitable for use as a data collection instrument. This feasibility test is composed of two components: a validity and a reliability component. When the number of respondents is N = 30, the df is 28, and the significance level is 5%, the r table value is 0.361; then, a comparison with r arithmetic is made, and the results are valid. Cronbach's Alpha () coefficient value obtained during the reliability test is greater than 0.60, namely 0.906. It is said to be trustworthy.

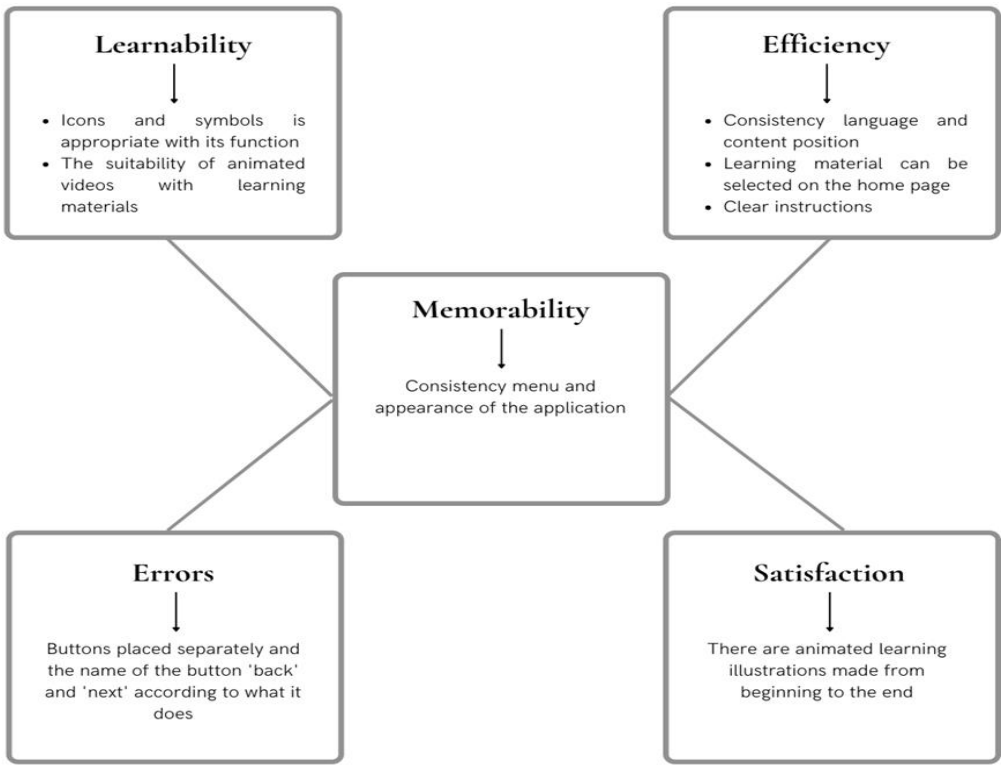

Fig 3. Visualization of the Aspects in the Science Learning Media

The calculated Grand Mean value for the learnability aspect of the questionnaire is 4.40. On the basis of the value obtained, it can be concluded that the interactive application's learnability is highly regarded. This indicates that the user strongly agrees that the application facilitates the user's task completion when the user interacts with it. The learnability aspect of the interactive application can be seen in the compatibility of the application's components and functions. Additionally, the animations displayed are customized for each learning material to aid users in comprehending the material being accessed.

Furthermore, the Grand Mean value for efficiency is 4.31 in the questionnaire's calculation. On the basis of the value obtained, one can conclude that the interactive application's efficiency is quite acceptable. This indicates that the user strongly agrees that they are extremely efficient at completing application tasks. The efficiency of this interactive application can be seen in the consistency of the content placement and the language used. Additionally, users can select learning materials from the home page, which simplifies the process of accessing desired learning materials. Instructions used to access learning materials can assist users in taking quick and precise actions.

The Grand Mean value for memorability is 4.30 in the questionnaire calculation. On the basis of the value obtained, it can be concluded that the interactive application's memorability is highly regarded. This indicates that the user strongly agrees that the application is easy to use after a period of inactivity. The consistency of the menu and display in this interactive application contributes to its memorability. The application's button components are also organized according

to their functions, so that the user can quickly determine which steps will be taken based on the user's requirements, and so that even if the user does not open the application for an extended period of time, the user can still easily access the application.

The Grand Mean value from the errors aspect of the questionnaire calculation is 4.20. On the basis of the value obtained, it can be concluded that the interactive application's errors are acceptable. This means that the user acknowledges that by utilizing the application, the user can minimize the occurrence of errors made while performing the application's tasks. The location and naming of the 'next' and 'back' buttons are both aspects of the errors contained in this interactive application. For instance, on the page separating mixtures of salt and rice grains, the 'next' and 'back' buttons are placed separately, with the 'next' button in the lower right corner and the 'back' button in the lower left corner. The separation of these buttons will assist users in avoiding errors when selecting the action they wish to take.

The Grand Mean value for the satisfaction component of the questionnaire is 4.53. On the basis of the value obtained, it can be concluded that the interactive application's satisfaction aspect is strongly agreed upon. This indicates that the user is adamant that the application he or she is using provides a high level of satisfaction for the user as a result of the benefits received while using the application. The interactive application's satisfaction factor is based on animation to illustrate learning. The animated illustration is created from the initial process to the final result of the process carried out. For example, if the user selects a learning material with a healthy-effect soap, the hand washing process will be displayed on the application from the beginning to the end, so that the user can feel satisfied with the material displayed because the user can easily understand the learning flow.

V. CONLUSION

The researchers used one of Singapore's senior high schools (SMA) as the object of study for this research into developing interactive web-based applications as learning media. Researchers collect data from users at PT. Technology Education Stadium via a document containing a series of sketches (storyboard) that serves as an introduction to the application's implementation. The researchers chose the prototype method because it enables users to interact with applications that are built in the form of a code prototype.

Furthermore, QUIS (Questionnaire for User Interaction Satisfaction) was used to evaluate the interactive web-based application that was developed. This questionnaire is used to assess user satisfaction with the user interface of a web-based interactive application, using five respondents as representative users. The distributed questionnaires included readability tests that were used to determine the validity of the questionnaires based on the opinions of experts or judgment experts. Additionally, a feasibility test will be conducted on the questionnaire to ensure that it is suitable for use as a data collection instrument. This feasibility test consists of two components: a validity test and a reliability test. When the validity test is conducted with the number of respondents or N = 30, df = 28, and a 5% significance level, the r table value is 0.361; this value is then compared to the r arithmetic value, and the results are valid. When the coefficient value of Cronbach's Alpha () obtained during the reliability test exceeds 0.60, namely 0.906, the system is said to be reliable.

The usability evaluation of web-based interactive applications as learning media that used QUIS to assess the five aspects of usability is considered to be satisfactory. It is demonstrated that the scores obtained in the following areas are 4.40 for ease of learning (Learnability), 4.31 for Efficiency, 4.30 for ease of remembering (Memorability), 4.30 for errors and security, and 4.20 for Satisfaction. According to the evaluation results, the interactive application developed can be used effectively by users, specifically one of Singapore's SMA (High School) students, as a science learning medium that can support the teaching and learning processes in schools.

Managerial implication of this research is that the educators can use this design to understand the right application for teaching and learning especially in the domain of science learning through images, sounds, videos, and animations that can attract students and increase student interest in learning. In addition, the use of interactive media provides encouragement and motivation to learn, and provides easy concepts to understand science material. This research is also able to help students to understand a science learning material because students can repeat the lessons presented if the material is still not understood.

In this research, interactive applications in science learning can help students to interact with the media as a learning resource through interesting features such as being able to display interactive learning videos and also accompanied by animations that can help students more understand the material being studied. These interesting features will increase student interest in learning a material, for example in the case of salt and rice separation, educators can show how the process of separating salt and rice grains is using three separation techniques, namely dissolving, evaporation, and filtration which are included in an attractive animated video and displayed according to the chosen technique.

As the scope of prototyping is limited, the application was built using three scientific materials in this study, namely Voltage in a Parallel Circuit, Staying Healthy-Effect of Soap, and Separating Mixture - Salt and Rice Grains. To incorporate more complex analysis, our suggestion for further research is that additional cases should be implemented in the future to obtain more accurate analysis for an ideal educational media framework. Furthermore, the purpose of this study was to assess the usability of an interactive application created using QUIS (Questionnaire of User Interface Satisfaction) in order to improve the application's user interface. However, for further research, when evaluating usability, researchers should give attention to the aspect of weaknesses and suitability based on the evaluation principle specified in this research method which has not been accommodated in this study.

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