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Virtual Laboratory of Andaliman Tissue Culture Integrated with Islamic Values

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A B S T R A C T

Nowadays, the world is being hit by a Corona virus outbreak which has an impact on every line of life including the field of Education which encourages students to take online learning. This study aims to develop a Virtual Laboratory of Andaliman Network Culture integrated with Islamic values as an interactive learning media to overcome problem obstructions in practicum activities as well as to strengthen the internalization of Islamic values and insights into the local potential of students in The State Senior High School 11 Medan, North Sumatera, Indonesia. This research was conducted using Research and Development (R & D) with the ADDIE approach (Analysis, Design, Development, Implementation, Evaluation). The results showed that the percentage of media validity by Material Expert validators was 98.61%, Islamic Values Material Expert validators were 90.62%, Virtual Laboratory Expert validators were 93.96%, and Field Practitioner Expert validators (Biology Teachers) were 93.75% with the category of evaluation of all validators as very good. Meanwhile, the percentage of student responses to the media reached 63.88% in the good category. Thus, it is highly recommended to use the Virtual Laboratory which was developed because it has tested validly to increase understanding about mechanism Plant Tissue Culture with Islamic Values and Local Potential.

INTRODUCTION

Biology is a field of science that provides various learning experiences such as understanding scientific concepts and processes. The process of science in biology can include observation, experimentation, and rational analysis so that facts and concepts are produced (Adi, 2016; Perez, 2018; Zitnik, 2019). The importance of the science process in learning biology is also reflected in the demands of the 2013 curriculum, namely in several basic competencies that require observation, experimentation, and simulation activities. the demands of these activities must be carried out to achieve the learning objectives expected in the 2013 curriculum (Kemendikbud, 2013). The purpose of learning Biology which is expected in the 2013 Curriculum is for students to be able to construct concepts and principles of Biology subject matter which are procedurally built through science process skills (Sudarisman, 2015; Rakhmawati, 2016; Sultoni, 2016).

The science process can be internalized in students through practicum activities . Through practicum activities, students are directed to be able to develop scientific skills and attitudes through the characteristics of the scientific approach (scientific approach) by applying the principles of the scientific method according to the 2013 Curriculum (Darmayanti, 2020). The Biology practicum is closely related to the laboratory which is the place to manufacture the use of tools and materials in the mechanism of practicum activities (Aydin et al., 2015; Ruchiat, 2019).

Meanwhile, the 21st century is marked by the rapid development of digital information and communication technology. This has implications for the world of education in Indonesia, which emphasizes the improvement of technological literacy competencies to support learning mechanisms. Thus, the emphasis is placed on improving 21st century skills as a global education reality that accommodates the needs of educational output in the digital era. To support success in the digital era, a skill base in the digital era that is embedded in learning is needed, among others, critical thinking skills, problem solving, communication, and collaboration (Urbani et al., 2017; Chalkiadaki, 2018; Anagun, 2018; Prayogi, 2019).

On the other side, it is undeniable that currently all countries in the world including Indonesia are being hit by the Corona virus outbreak which has an impact on the spread of Covid 19. This condition affects every aspect of human life, including the field of education (Taufik, 2020; Wang et al., 2020; Kaye et al., 2020; He & Lioyd, 2020). The government has taken a policy to require everyone to carry out isolation, social and physical distancing, to Large-Scale Social Restrictions (LSRR). This condition obliges all people to stay at home, work, worship, and learn from home. Educational institutions must also comply with these government regulations by implementing an online learning system (Widiyono, 2020; Porzio et al,, 2020; Foddai & Ellis, 2020; Zgueb et., 2020).

In addition, one of the typical plants of North Sumatra that has become local wisdom is Andaliman (Zanthoxylum acanthopodium) (Silalahi, 2018). This plant has the potential to be used as a producer of aromatic substances because it contains essential oils, antimicrobials, antioxidants, and immunodemulators. For the people of North Sumatra, Andaliman is often used as a cooking spice, preservatives, and herbal medicine (Meutia, 2015; Suharta, 2020; Pangastuti, 2020; Situmorang, 2021). However, the existence of the existence of Andaliman is under threat because the Andaliman farmers are still propagating the Andaliman using the conventional method of seed germination. In fact, the generative reproduction of Andaliman is very low at around 14%. Thus, a proper method of Andaliman propagation is needed to be able to produce Andaliman effectively (Asbur, 2018). One of the appropriate methods for propagating these plants is by utilizing technology in agriculture in the form of in vitro plant propagation techniques or tissue culture. This method resulted from the development process of modern biotechnology to nurture and preserve a plant species, especially Andaliman (Marx, 2017). The Tissue Culture method is very important to be taught in the world of education because the method is included in the realm of applying modern biotechnology which is needed

by science to know the multidisciplinary principles of science in producing products that are beneficial for humans (Al Muhajir, 2015; Fitriyati, 2015; Hartini, 2019; Chandran, 2020; Gulzar et al., 2020).

The State Senior High School 11 Medan, North Sumatera, Indonesia is one of the schools that has difficulties in carrying out Biology practicum activities. According to the results of observations and interviews with the Biology teacher at the school, it was stated that the school had not carried out the Biology practicum routinely, especially on the Biotechnology subject, the subject of Tissue Culture due to limited tools and materials and relatively expensive costs to carry out the practicum directly. The State Senior High School 11 Medan, North Sumatera, Indonesia also finds it difficult to find effective media in delivering the material and subject matter because it requires observation, experimentation, and simulation activities. In addition, the lack of integration between Islamic values into Biology lessons, especially in this material, causes a weakening of the strengthening of religious values in Biology learning. In fact, the internalization of Islamic values into learning can strengthen the achievement of curriculum goals, especially in KI 1 regarding the competence of spiritual attitudes because of the quranic education process that can strengthen the spiritual soul of students (Jumala, 2019). Local potentials that can be linked in learning also receive less attention in learning Biology at The State Senior High School 11 Medan. In fact, Andaliman as one of the plants of local wisdom can be included in the context of Biology learning, especially plant propagation systems using the Tissue Culture method.

Therefore, to optimize the science process abilities and technological skills of students according to the demands of the 2013 Curriculum and 21st century competence, at the same time hone religious character and add insight into efforts to conserve the potential of local plants in North Sumatra, Indonesia during the Covid 19 Pandemic and the new normal era in SMA. Negeri 11 Medan, Indoensia needs an interactive learning media that can overcome the obstacles of face-to-face Biology practicum activities. Virtual Laboratory is an interactive learning media that is able to overcome these problems because this media can simulate activities in the laboratory as if the user were in an actual laboratory (Inayah et al., 2020; Estriegana; Hartini, 2019; Makransky, 2021). Research on the development of a Virtual Laboratory has been conducted by previous researchers, such as that conducted by Rokhim (2020); Hartini (2019); Chairani (2019) with research results showed that the development of a Virtual Laboratory is very useful to support practicum activities. However, the development of a Virtual Laboratory about Biotechnology with the subject of Network Culture integrated with Islamic values and local potential has never been done by any researcher. Therefore, the originality of this research lies in the substance of the material, the place of research, the object, and the subject to be studied.

Based on the problems described, this research aims to develop an Andaliman Virtual Laboratory which is integrated with Islamic values. This Virtual Laboratory is expected to be an interactive media to overcome obstructions in practicum activities as well as to strengthen students 'religiosity values and increase students' insights about local potential in North Sumatra. So, it will encourage the character of students who master technological literacy based on Islamic values and local potential. The development of a Virtual Laboratory for Plant Tissue Culture has been carried out by Hartini et al. (2019). However, the Virtual Laboratory does not integrate the concept of local potential and Islamic values. Therefore, the element of novelty in the development of the Virtual Laboratory by researchers lies in the aspect of the content of the concept of local potential which specifically raises Andaliman as a cultured plant and integrates it with Islamic values. In addition, this study is also intended to improve students' ethnoscience skills based on applicable technology mechanisms which are expected to develop inculturation learning through the process of assimilation and accommodation of student learning effectively and efficiently (Arfianawaty, 2016; Khoiri, 2018; Pertiwi, 2019)Thus, it is expected to be able

to facilitate students' scientific workspace and have a positive influence in increasing critical thinking power in applying indigenous science through the preservation of local potential plant species combined with Islamic values

METHODS
Research Design

This research is classified into a Research and Development (R & D) type of research with the ADDIE model approach (Analysis, Design, Development, Implementation, Evaluation). According to Rayanto (2020), at the Analysis stage, an analysis of potential problems is carried out regarding the need for the use of an Integrated Virtual Laboratory of Local Potential and Islamic Values at The State Senior High School 11 Medan, North Sumatera, Indonesia. At the Design stage, the Virtual Laboratory media content design is carried out by considering aspects of Core Competencies and Basic Competencies in Plant Tissue Culture Materials. Furthermore, at the Development stage, the Virtual Laboratory is developed by creating animations and coding so that the images can be operated according to practical procedures. At this stage, media validation was also carried out by material expert validators, Islamic values material expert validators, Virtual Laboratory expert validators, and field practitioner expert validators (Biology teachers). After the media is declared valid, then the next step is carried out, namely Implementation. At the Implementation stage, the Virtual Laboratory implementation process is carried out on students. At the Evaluation stage, the Virtual Laboratory evaluation process is carried out based on the assessment and input from the validators and student responses as a basis for making revisions.

Population and Samples

The place to introduce the Virtual Laboratory as a multimedia-based interactive learning media for students was held at The State Senior High School 11 Medan, North Sumatera, Indonesia. Meanwhile, validation by expert validators was carried out at campus II of UIN North Sumatra and The State Senior High School 11 Medan. This research was conducted in March 2021. The study population was 209 students with a total sample of 72 students. According to Syaukani (2018) the research sample was selected based on a random sampling technique which was carried out by taking randomly from the total population. In sampling, the teacher plays a role in accommodating the research management, so that the activities play a good role.

Instrument

The research instruments used in this study were validation sheets and questionnaires. The indicators applied refer to the development of the Virtual Laboratory with coverage of media content aspects, integration of materials with Islamic values, development of teaching materials, response to the needs of teachers and students. These indicators are obtained through a review of previous research articles that are relevant in that context. The validation sheet is addressed to expert validators to determine the feasibility level of the Virtual Laboratory being developed. The selected validators meet the following criteria: master's degree graduates, pursuing areas of expertise related to plant tissue culture, integration of Al-Qur'an verses in science, utilization of ethnobotany and local potential, and development of digital learning media. Meanwhile, the questionnaire was aimed at students to find out students' responses to the Virtual Laboratory.

Procedure

The design of this research is development research by creating an interactive virtual laboratory learning media on Plant Tissue Culture Materials Based on Local Potential and Islamic Values. The population in this study were all students of class XII science at The State Senior High School 11 Medan, North Sumatera, Indonesia, totaling 209 students. The sample

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was selected through random sampling technique from the total population, where the sample amounted to 72 students. The research instrument used was a validation sheet by the validator and a questionnaire sheet by students. The research procedure was carried out by applying the ADDIE steps as the main approach in this development research. These steps consist of Analysis, Design, Development, Implementation, and Evaluation. Data analysis was carried out using the percentage of media validity, which was then interpreted according to predetermined criteria. Systematically, the research procedure can be seen Figure 1.
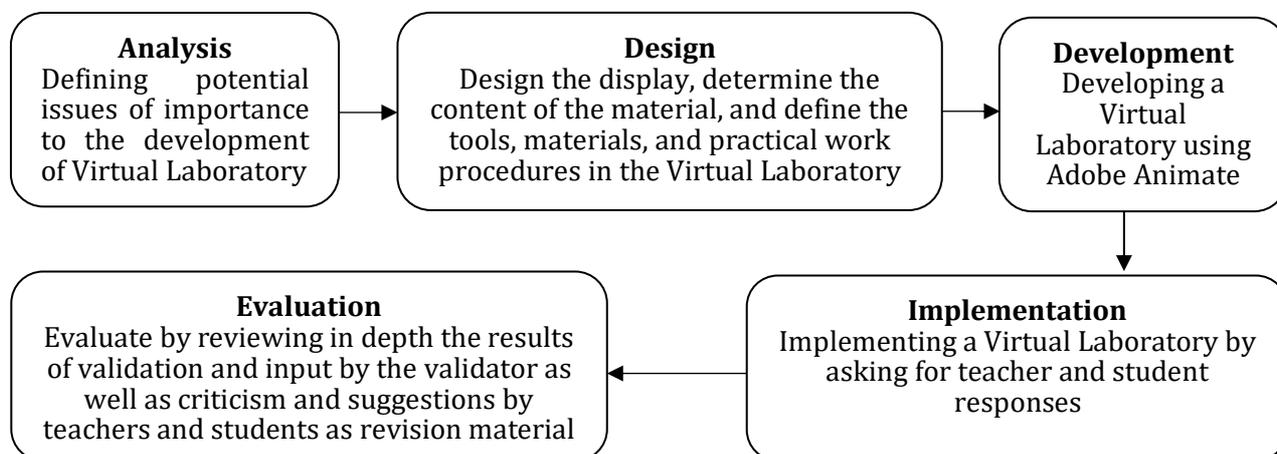
Analysis Defining potential issues of importance to the development of Virtual Laboratory	→	**Design** Design the display, determine the content of the material, and define the tools, materials, and practical work procedures in the Virtual Laboratory	→	**Development** Developing a Virtual Laboratory using Adobe Animate

Evaluation Evaluate by reviewing in depth the results of validation and input by the validator as well as criticism and suggestions by teachers and students as revision material	←	**Implementation** Implementing a Virtual Laboratory by asking for teacher and student responses

Figure 1. Procedure

Data Analysis Techniques

The results of the Virtual Laboratory validation by expert validators were analyzed using formula I.

$$P = \frac{\sum X}{\sum Xi} \times 100\% \dots\dots\dots\dots\dots\dots \text{ (I)}$$

Formula Description:
P   = Percentage of validity
$\sum X$ = Total score of validators
$\sum Xi$ = Total ideal score (Munawwaroh, 2019; Giannopoulos et al., 2021; Gulati et al., 2021)

Furthermore, the results of the Virtual Laboratory Validation are interpreted according to the Table 1.

Table 1.
Interpretation of the Value of Virtual Laboratory Validation Results

Percentage (%)	Information	Follow-up
90<N≤100	Nailing	New products are ready to be used for learning activities
80<G≤90	Good	Products can be continued by adding something that is missing, making certain considerations, revisions that are not too big, and not basic
60<E≤80	Enough	Make revisions by looking back carefully and looking for product weaknesses to be fixed
D≤60	Deficient	Make major and basic revisions to the contents of the product

(source: Hidayah, 2017)

Meanwhile, the results of student responses to the Virtual Laboratory were analyzed using the following formula:

$$P = \frac{f}{N}X \ 100 \ \% \ .... \ (II)$$

Formula Description:

P = percentage number

f = frequency of students who answered

N = total students   (Sudijono, 2009; Deepika & Kumar, 2021).

Then, the calculated data obtained are interpreted through the Table 2.

Table 2.

Student Response Interpretation Criteria

Percentage (%)	Response Criteria
81 - 100	Nailing
61 – 80	Good
41 – 60	Passable
21 – 40	Not good
0 - 20	Not very good

(Source: Tania, 2017; Rahayu, 2021)

RESULTS AND DISCUSSION

This research can be described based on the ADDIE approach (Analysis, Design, Development, Implementation, Evaluation). In the Analysis stage, analysis and problem identification of the students' Biology learning needs is carried out which is the background for the development of an integrated Virtual Laboratory of Islamic Values and Local Potentials. According to student responses through distributed questionnaires it can be understood that all students who were the research samples agreed that learning media was needed to study Plant Tissue Culture material with the percentage of respondents reaching 100%. The same thing was also expressed by the biology teacher in class XII IPA that students' Biology learning on Plant Tissue Culture material became less qualified due to the lack of interactive learning media in the school and also not carrying out the Plant Tissue Culture practicum due to limitations. tools and materials to carry out this practicum and the application of online learning during the Covid 19 Pandemic.

Virtual Laboratory as an interactive learning media can be used as a solution to this problem because this media can simulate a practicum activity, especially Plant Tissue Culture. So that the practitioner does not experience problems in providing tools and materials that are quite expensive and require complex maintenance to run the practicum. This is in line with Sumargo (2014) which states that a Virtual Laboratory is very effective at explaining the concept of matter through experiments that cannot be done in conventional laboratories. Furthermore, Mrs. Ika also emphasized that The State Senior High School 11 Medan, North Sumatera, Indonesia already has several Information Technology (IT) -based learning tools, such as a computer laboratory with complete media devices, projectors, and speakers. Student responses also show that almost all students have a Personal Computer (PC) of 73.6 %. Thus, the application of the Virtual Laboratory at The State Senior High School 11 Medan, North Sumatera, Indonesia is not an obstacle in the aspect of technological equipment availability.

Furthermore, the student's ability to operate an Information Technology (IT) based learning media was classified as high with the number of responses reaching 72.5%. In addition, the ability of Biology teachers to master learning technology is also classified as good because Biology teachers at The State Senior High School 11 Medan, North Sumatera, Indonesia often hold and participate in online learning trainings that require the application of technology in learning. However, the role of Biology teachers in improving students' technological literacy is still low, with total respondents reaching 9,7 %. This is due to the lack of availability of applicable learning media that can cover the needs of learning Biology directly. Therefore, a Virtual Laboratory can be a solution to improve students' technological literacy competencies.

This is in accordance with Hasse (2017) that digital-based learning media including Virtual Laboratory can project and manage active learning activities into an analytical ability that is in line with technological developments. Thus, students are given access to hone technology skills through the absorption of complex power information.

Furthermore, according to student responses through questionnaires to the integration of Islamic values in Biology learning, it can be seen that students agree to integrate Islamic values in Plant Tissue Culture material is an important thing with a total of respondents reaching 93.1 %. This is because linking Islamic values in these materials can increase faith and piety to Allah SWT by living His greatness through the application of the principles of Plant Tissue Culture. However, according to the students' responses, the internalization of Islamic values in the material still needs to be improved with a total of 29.2 % of respondents. This is in accordance with the results of an interview with Mrs. Ika who stated that Biology teachers rarely internalize Islamic values in the Plant Tissue Culture material. Therefore, the development of a Plant Tissue Culture Virtual Laboratory integrated with Islamic values in this research can be a solution to the lack of strengthening Islamic values in studying Plant Tissue Culture practicum. The same thing is emphasized by Solihin (2020) that integrating Islamic values in learning can hone the achievement of the character of religiosity and character of students because Islamic values contain elements of deepening and living the greatness of Allah SWT and strengthening noble morals. This concept is in accordance with the demands of the 2013 Curriculum to achieve KI 1 regarding the competence of spiritual attitudes. In addition, Winoto also reported that the use of learning technology whose substance is associated with religious values can increase the effectiveness of students' understanding of tolerance as a form of religious teachings that students must have in multicultural life.

In addition, according to students' responses to the utilization of Local Potential, it can be understood that most students agree that linking the concept of Local Potential to Biology learning is very important with a total of 98.6% respondents. Most students also know that Andaliman is included in the category of Local Potential Plants typical of North Sumatra which has many benefits with a total of 56.9 % of respondents. However, only some students know that Andaliman's generative propagation is currently experiencing obstacles as stated by Asbur (2018) that the power of Andaliman's generative germination is very low and at certain times is strongly influenced by pollinators and other external environmental factors.So, it is hoped that an Andaliman propagation method can be found that can overcome these production problems, namely by applying the concept of Plant Tissue Culture practicum.

The students' low understanding of the method of Andaliman propagation through Plant Tissue Culture was triggered by the lack of role of Biology teachers in integrating Biology concepts in the utilization of Local Potential. This is in accordance with the results of the interview with Mrs. Ika that the concept of local potential is not related to biology learning. Therefore, the development of an integrated Virtual Laboratory with Local Potential in this research can be a solution to the lack of strengthening the concept of Local Potential in Biology learning. This is intended to provide students with knowledge intensively about the importance of preserving endemic species through the application of the concept of Biology. This is in accordance with Mumpuni (2013) which states that the integration of the concept of Local Potential in Biology learning can develop the potential advantages of natural resources in order to preserve the environment and biodiversity that characterizes a region. The implementation of these activities is the realization of deep ecology actions, where each individual can take part in maintaining the stability of nature. This also has implications for the development of student character education because students are directed to understand and live up to the various problems and challenges that arise from their region.

At the Design stage, a Virtual Laboratory design was carried out which was divided into three processes, namely the work on the storyboard design, determining the presentation of

material content, and determining the animation design for practicum tools and materials as well as the tools for the command menu for practicum activities. There are three main menus presented in the Virtual Laboratory. The menus are material menu, procedure menu, quiz menu, and bibliography menu. The material menu serves to present material content about Plant Tissue Culture. The quiz menu serves to present the question display as an evaluation tool to measure the achievement of learning outcomes in the cognitive domain. The procedure menu serves to present tools and materials that can be operated to carry out the Andaliman Tissue Culture practicum. The bibliography menu presents the identity of the literature in constructing the Virtual Laboratory. Each of these menus is presented with sub menu commands that can be selected by the practitioner to operate the Virtual Laboratory. These commands can be seen in detail through the table above.

At the stage of working on the storyboard design, an overview of the activity scheme or concept map is carried out which becomes the storyline in the Plant Tissue Culture practicum activity. The scheme consists of determining the menu commands and instructions that are displayed on each sub menu command. This is in accordance with Simamora (2019), which states that the storyboard in a simulation media contains a storyline that becomes a track record around the instructions for carrying out experiments. In this case, the storyboard of the Virtual Laboratory that was developed consists of four main menus which are presented on the dashboard page. The main menu is the Material menu, the Practical Work Procedure menu, the Quiz menu, and the Bibliography menu. The Material menu contains Basic Competencies and Learning Objectives, literature presentation relating to the definition and scope of Biotechnology, the Concept of Plant Tissue Culture, Description of Andaliman, and Overview of Biotechnology and Plant Tissue Culture from an Islamic perspective. The Practicum Work Procedure menu contains a series of work steps to apply the plant induction process using tissue culture by using an explant in the form of Andaliman. The Quiz menu contains ten multiple choice questions made based on the achievement of the Competency Achievement Indicators (GPA) of Plant Tissue Culture material. Meanwhile, the Bibliography menu contains all sources of literature review presented in the Virtual Laboratory being developed.

Meanwhile, the determination of the material content is carried out based on the literature design that is relevant to the practicum topic. In this case, the Plant Tissue Culture practicum seeks to integrate Islamic values and local potential. Thus, the main points of study that are relevant to this context are the Concept of Biotechnology and Plant Tissue Culture, the description of Andaliman as the Local Potential of North Sumatra and the concept of Biotechnology and Plant Tissue Culture which is reviewed based on an Islamic perspective. The process of determining the material content is in line according to Mutawakkilah (2018) which states that the material content presented in a teaching material should adjust to the needs of students 'understanding of the material which can be formulated based on students' self-actualization indicators after studying the material. In this case, the expected indicators of student self-actualization are being able to apply the Plant Tissue Culture practicum, recognize the Andaliman propagation method as a local potential of North Sumatra through in vitro induction techniques, and understand the concept of Plant Tissue Culture in an Islamic perspective to hone the character of student religiosity.

Furthermore, the determination of the design for the number of practicum tools and materials as well as the tools menu for practicum orders is carried out based on the actual Plant Tissue Culture procedure. So, students can understand the real concept of the practicum through this Virtual Laboratory. This is in accordance with Hakim (2020) that the Virtual Laboratory has a role to overcome the limitations of providing real laboratory facilities. So, whatever tools and materials used must be in accordance with the context of the practicum in the laboratory. The same thing was also expressed by Muhajarah (2020) that the laboratory acts as a place or place to carry out the scientific process through the realization of scientific

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research and experiments. Therefore, the rapid development of technology in the world of education, such as the application of a Virtual Laboratory, must be able to represent operational procedures and present technological tools and materials like actual practicums in conventional laboratories. So, this does not reduce the achievement of students' science process competence.

The difference from this Virtual Laboratory compared to other media, this media integrates the concept of local potential, in the form of Andaliman species cultured in this media. In addition, information is also presented on the substantial correlation between the basic concepts of Network Culture and the essence of Islamic values. To support this concept, the researchers designed a Virtual Laboratory which is divided into three main components, namely the mechanism of the Network Culture practicum, the subject matter, and a quiz to measure students' understanding after participating in learning using Virtual Laboratory media. The presentation of the practicum mechanism is also animated according to the actual pictures and facts. For example, Andaliman animation, tools, and practicum materials are conceptualized in such a way that they have a concrete form.

At the Development stage, the necessary media component design development process is carried out based on the predetermined storyboard. The development of the design consists of making animation designs for practical tools and materials using Adobe Illustrator and creating media by integrating the animation of these tools and materials using Adobe Animate. Animation development can be seen in the following image.
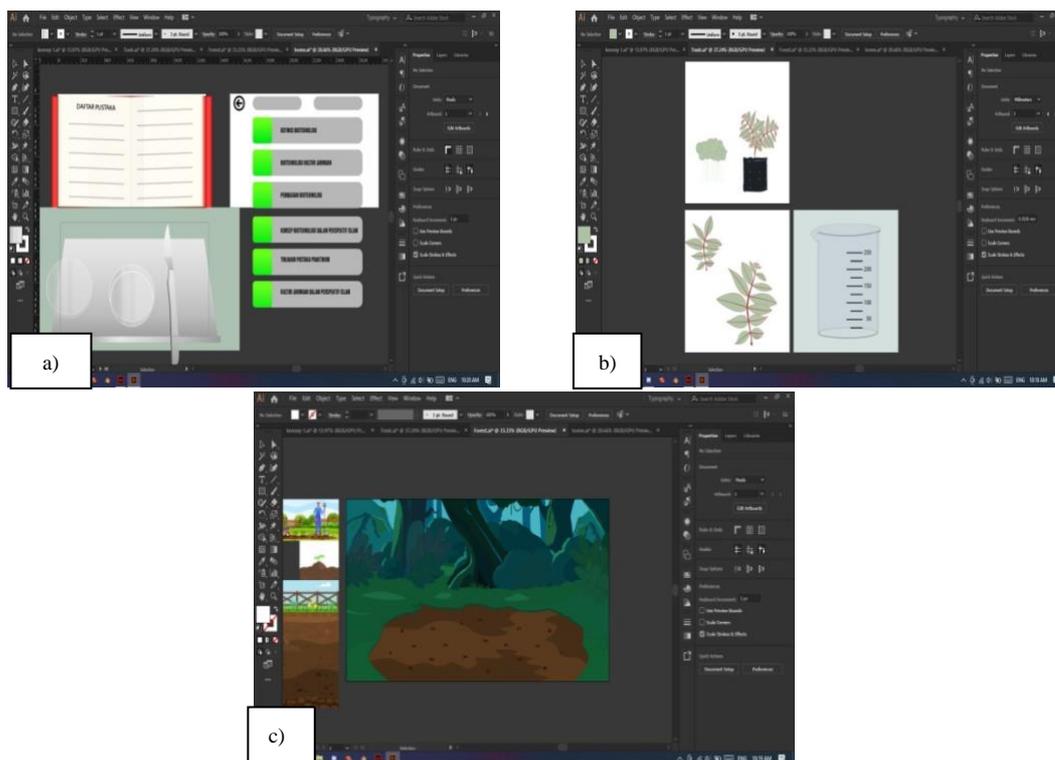

Figure 2. Virtual Laboratory Animation Design Using Adobe Illustrator: a) Animation of Tools and Materials and Main Menu, b) Explanation Animation, c) Acclimatization Animation

Figure 2 shows the creation of an animation design using Adobe Illustrator. The animation obtained acts as an object representation that can represent the operational mechanism of the practicum. The first step is to determine the media graphic, then followed by giving a color that contrasts with the actual object. Each animation that has been designed, then neatly arranged to be used as a tool in the media. In addition, a background animation design was also carried out at each stage of the Plant Tissue Culture work. Making the design can be grouped based on

the practical steps of Plant Tissue Culture, which starts from sterilizing tools and materials, cutting explants, to acclimatization. The mechanism can be seen in the Figure 3.
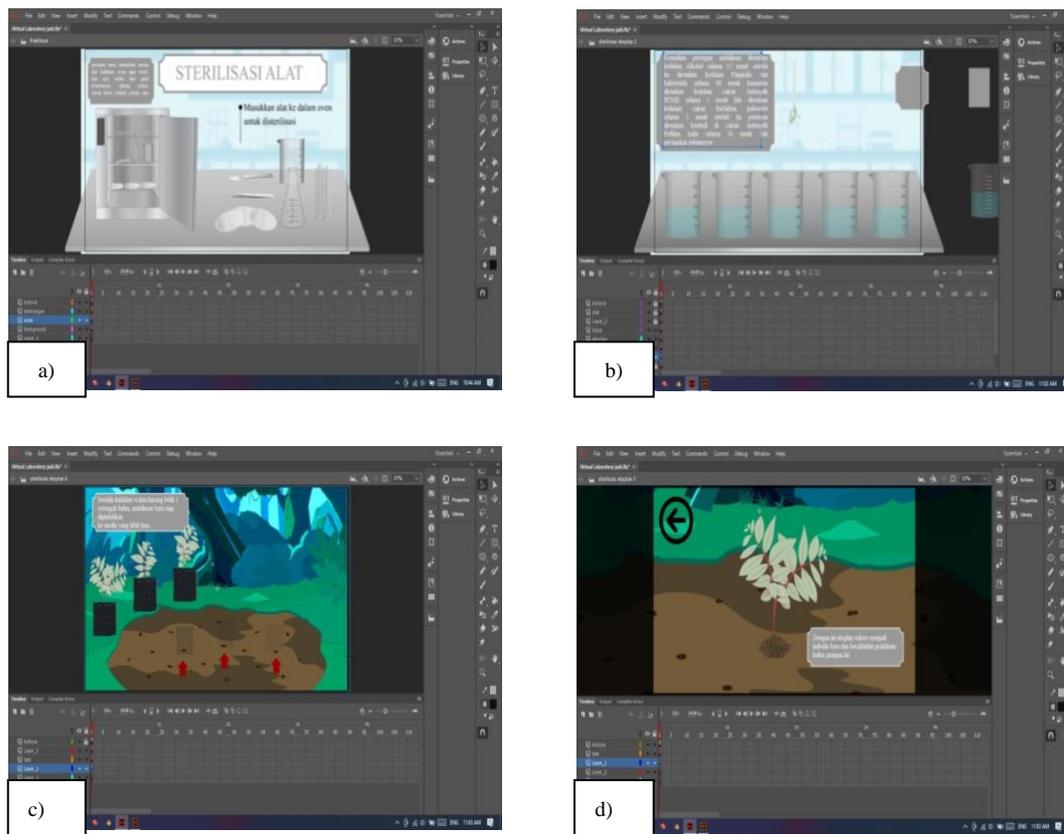

Figure 3. Virtual Laboratory Animation Integration Design Using Adobe Animate: a) Mechanism for Tool Sterilization, b) Mechanism for Explanation Sterilization, c) Mechanism for Planting Plantlets into the In Vivo Environment, d) Mechanism for the Final Stage of Practicum

Meanwhile, Figure 3 explains the development of animation so that it can be operated in the form of a visual display. The main step in this work is to integrate the results of the animation design into Adobe Animate. The choice of reaction color that appears when the material is operated is also adjusted to the conditions and facts in the laboratory when the practicum is carried out. Then, the animation is coded so that it can be operated following the steps of the Plant Tissue Culture practicum. To perform the coding, it is very necessary to have accurate accuracy, so that errors do not occur when the media is used. The most important thing that must be considered in the development of this Virtual Laboratory is that there is no menu element in the operation aspect of the procedure menu because according to the facts in the laboratory, practicum work steps cannot be returned to their original form after step by step is done. Therefore, the basic thing that needs to be understood is that everything that is integrated and developed in this Virtual Laboratory can represent facts in real practicums.

Adobe Illustrator was chosen as an animation design application because it displays good quality images when they are enlarged. This is consistent with what Wijaya (2016) states that Adobe Illustrator is a vector-based image processing software. Vector images are formed from a number of lines and curves, so that when this image is enlarged it will not lose its detail and the image quality is still good. Furthermore, Enterprise (2018) also adds that Adobe Illustrator is an image processing application that can be used for several purposes, such as creating graphic designs, painting objects, arranging text (typography), and creating website designs with vector-shaped image views, so as to produce realistic image sharpness.The

animation design consists of two steps, namely making the background and creating the infographic content. Making the contents of the infographic consists of working on animation of practicum tools and materials, working on several animations for practicum command tools, and working on the layout of the practicum instruction writing. This is as stated by Putra (2020) that there are several main things that must be done in designing the components of infographic media such as making artboards, backgrounds, and serving infographic content.

Furthermore, the animation of media components that has been created will be integrated into Adobe Animate so that the animation can be operated like an actual practicum. Adobe Animate was chosen because this multimedia application can express animation in the form of a functional operation presentation in a more intuitive and expressive manner. This multimedia application has also been equipped with various additional features that can support more innovative and interactive media processing. This is in accordance with Amalia (2020) that Adobe Animate is very suitable for use as a multimedia device to develop digital-based learning media because this device has several advantages, such as building innovation and immersive websites, creating applications that can be integrated in various platforms, and also controlling powerful for more intuitive and expressive animation.In summary, the steps that were applied to develop the Virtual Laboratory through Adobe Animate are compiling animations that have been designed into the workplace. Then, convert the animation into a symbol. Then, add coding to each animation so that it can function according to practicum procedures. The same thing was also explained by Rosdiana (2019) who stated that Adobe Animate allows work orders based on the given coding. So, Virtual Laboratory developers can adjust the activities that the animation wants to do based on the commands given. The appearance of the Virtual Laboratory developed can be seen in Figure 4.

Figure 4. Views in the Virtual Laboratory: a) Dashboard page, b) Researcher Profile, c) Sterilization Tool, d) Somatic Embryogenesis

Figure 4, presents the Virtual Laboratory that has been developed and can be operated by the practicum. Specifically for the practicum mechanism steps, it is divided into several main stages that reflect the work steps of the Plant Tissue Culture practicum. Each of these work

steps is accompanied by operational instructions listed in the upper right and upper left corners of the display. This makes it easier for users to know what to do to run a virtual practicum. After the practitioner finishes operating the tool, the reaction results will be displayed continuously, so that the practitioner can easily understand the results of each practicum stage.

In the implementation stage, two treatment processes were carried out, namely the Virtual Laboratory validation by expert validators and the introduction of the Virtual Laboratory to the Biology teacher and students. Media validation consisted of three expert validators, namely material expert validator, material expert validator on Islamic values, and Virtual Laboratory expert validator. The results of the media validation from the three validators can be seen in the following Table 3.

Table 3.
Percentage of Validity Virtual Laboratory Integrated   Network Culture Islamic Values and Local Potential

Validator	Observed Indicators	Percentage
Material Expert	Coverage of material, Accuracy of material, Up-to-date and contextual, Integration of local potential, Authenticity of material, Scientific skills, Functionality of material content in Virtual Laboratory	98,61%
Islamic Values on Material Expert	Correlation of material with verses of the Qur'an, Integration of material content with verses of the Qur'an, Support of verses of the Qur'an with material, Insights of students with Islamic values, Internalization of moral values through integration of material with verses Al-Qur'an, strengthening spiritual attitudes in learning, Developing character learning based on the verses of the Qur'an	90,62%
Virtual Laboratory Expert	Software, Media components, Visual communication, Artistic and aesthetics, Ease of navigation, Overall functionality of Virtual Laboratory	93,96%

The material expert validator plays a role in validating the content of the material contained in the Virtual Laboratory, such as the scope, accuracy, up-to-datedness and function of the material. Based on the validation results from the material expert validator, the final score of validation was 98.61% with the category of very good feasibility level. This is in accordance with Cholifah (2021) who revealed that the feasibility of the material is very good at the Virtual Laboratory, indicating that the substance of the material in the Virtual Laboratory has been adjusted to the material needs of students and the accuracy of the material is very relevant to support strengthening students' understanding of the practicum being learned. So that the Virtual Laboratory is very suitable for use in learning.

In addition, the result of the validation from the material expert validator of Islamic values obtained a score of 90.62% with a very good category of feasibility, so that the media can be implemented in learning. The same thing was also reported by Rizkiah (2018) that the category of feasibility level is very good in integrating material with Islamic values indicating that the content contains elements of emphasis and material correlation with the verses of the Qur'an well, so that it can internalize the values moral value to students. Pratiwi (2019) also emphasizes that Islamic values integrated in learning media can improve students' understanding regarding the relationship between concepts or material with the verses of the Qur'an, so that they can form a good personality and have noble character according to the guidance of the Qur'an. an.

Validation of Virtual Laboratory by Virtual Laboratory Expert validator obtained a score of 93.96% with very good criteria, so that the media can be implemented in learning. However, there is a suggestion from the validator to add a use function button to the information layout and add a description of the color difference to each solution used in explant sterilization. This is intended to make the appearance and presentation of the Virtual Laboratory more attractive. Researchers have done this suggestion so that the media developed is better. Tarmizi (2020) explains that a multimedia-based learning media with very good criteria obtained by a Media Expert validator indicates that the media developed is capable of being applied to students. However, every input given needs to be followed up to improve the quality of the media.

After the Virtual Laboratory developed is validated by the validator, the next step is to introduce the learning media to Field Practitioners (Biology Teachers) and students to find out the level of validity and their responses to the media. The percentage of validity by Field Practitioners (Biology Teachers) and the results of student responses can be seen in the following Table 4.

Table 4.
Percentage of Validity Virtual Laboratory Integrated Network Culture Islamic Values and Local Potential

Respondent	Observed Indicators	Percentage
Practitioner Expert (Biology Teacher)	Conformity of content/materials, presentation of material, overall function of Virtual Laboratory in learning	93,75%
Student	Ease and attractiveness of Virtual Laboratory, Motivation to study Network Culture practicum, Readability of writing in Virtual Laboratory	65,88%

The results of the Virtual Laboratory validation from the field practitioner expert validator (Biology teacher) showed a score of 93.75% with a very good level of feasibility. Based on the results of the validation, it can be understood that the media, including the category, can be implemented in learning. This is in line according to Permana (2016) which states that the results of validation assessments by Virtual Laboratory field practitioners are in the very good category indicating that the media has met the elements of requirements, including the presentation of material and overall functions of the Virtual Laboratory can provide students with practical preparation, there is a tendency to embed positive values in learning, and helping students to improve science process skills which is marked by the development of skills to conduct analytical experiments to improve the ability to provide experimental interpretation, so that it can support practicum activities.

Meanwhile, the results of student responses to the Virtual Laboratory showed a score of 65.88% with a good response criterion interpretation. This shows that the media can facilitate students to learn the integrated Plant Tissue Culture Practicum Islamic Values and Local Potentials in an interesting, informative, visual, and interactive way. This is as explained by Syaifulloh (2014) that the positive response of students to the development of a Virtual Laboratory indicates that the media is developed efficiently to facilitate students' understanding of learning a practical topic. This has positive implications for increasing student focus and conceptual and contextual understanding through positive learning activities.

At the Evaluation stage, an evaluation of the Virtual Laboratory was developed using a formative evaluation approach. According to Rayanto (2020) formative evaluation is carried out by collecting data at stages for improvement. Based on this definition, the evaluation carried out at this stage is based on the validation result data from all validators and the results of student responses. The average validation results by all validators and the results of student responses can be seen in the following Table 5.

Table 5.
The Percentage of Student Response Results and the Mean Percentage of the Virtual Laboratory of Integrated Plant Tissue Culture Islamic Values and Local Potential

Respondent	Average percentage
Expert Validator	94,23%
Student	65,88%

The level of validity of all validators was obtained by looking for the mean percentage of validity with the results obtained of 94.23% with very good assessment criteria. Meanwhile, the results of student responses reached 65.88% with good assessment criteria. Based on this assessment, it indicates that the Virtual Laboratory developed is feasible to be implemented in learning, especially in Plant Tissue Culture practicum activities. The same thing was explained by Elisa (2020) who stated that the results of the Virtual Laboratory assessment were in the very good category indicating that the media was very feasible to be tested in learning to meet the needs of learning media in schools. The same thing was also expressed by Kurniawan (2021) that a Virtual Laboratory with a very valid level can be used and practiced on students to have positive implications for student learning activities.

The difference in the assessment criteria between expert validators and student response results is caused by differences in students' perspectives on the developed Virtual Laboratory. This is in accordance with Triningtyas (2016) which states that differences in a person's perspective and insights can affect their assessment of an object. Meanwhile, the results of the Virtual Laboratory validation were obtained based on the objective assessment of each validator which was measured based on predetermined assessment indicators. The same thing is also emphasized by Hadi (2017) that differences in perspective are strongly influenced by a person's mindset in addressing something, genetic factors, individual background, and emotional level. Thus, this will lead to variations in student responses to the Virtual Laboratory being developed.

The development of the Virtual Laboratory in this research provides an element of novelty to Biology learning, especially practical activities based on information technology literacy. In addition, the Virtual Laboratory is also directed to be more concerned with the preservation of living things. This is evidenced by the Andaliman preservation technique through Tissue Culture which is the application of modern biotechnology-based plant propagation. Through this Virtual Laboratory, it is also designed to be able to increase students' understanding of religiosity, where the Network Culture material in this media is integrated with complex Islamic values.

CONCLUSION

Based on the research that has been done, it can be concluded that the development of the Andaliman Network Culture Virtual Laboratory integrated with Islamic values can be done by identifying the media needs (Analysis), designing the appearance and substance of the media (Design), developing product manufacturing (development), implementing it in learning (Implementation), and evaluate the validation results and respondents' input as revision material (Evaluation). Validation was carried out by material expert validators, Islamic values expert validators, Virtual Laboratory expert validators, and field practitioner expert validators with the percentages being 98.61%, 90.62%, 93.96%, 93.75%, respectively. very good and student responses with a percentage of 65.88% are categorized as good.

In addition to testing the validity and responses of students to the Virtual Laboratory being developed, it is also necessary to test the effectiveness of the media in learning to determine the role of the media in achieving learning objectives. For this reason, it is recommended for other researchers to conduct further research related to the effectiveness of an integrated Virtual Laboratory on Islamic Values and Local Potentials in learning activities.

So, it can be known in a concrete manner the role of the media in optimizing the achievement of learning objectives. In addition, it is also recommended for other researchers to carry out other research in the context of developing digital media in Biology learning that can hone literacy skills and care for the environment. This is intended to produce Biology learning outcomes that are characterized and have broad environmental insight.

This part provides the summary of results and discussion which refers to the research aims. Thus, the new principal ideas, which are essential part of the research findings, are developed. The suggestions, which are arranged based on research discussed-findings, are also written in this part. These should be based on practical activities, new theoretical development, and/or advance research.

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