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Development of discovery learning-based animation media to improve students' digital literacy on human digestive topic

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ABSTRACT

In high school education, especially in 11th grade, students typically confront obstacles in establishing the legitimacy and authenticity of the material they obtain. These issues arise because students' ability to explore, assess, and handle information remains immature. This study is a form of research and development that utilizes the ADDIE model. Data were collected using a questionnaire to examine the validity and feasibility of the product, while tests were employed to gauge digital literacy skills. The participants of this study were 30 students in the 11th grade of SMA Negeri 1 Wonosegoro, Boyolali Regency. The results indicate that media products are considered valid (87%), practical with a good category (87.5%), and effective with a good category (85%). Thus, the responses of students and teachers to the discovery-learning-based animation media product on the digestive system material are within good requirements. The study advises that students use interactive e-learning resources anytime and anyplace to facilitate their learning process. Therefore, future research can explore other biology topics packaged through the discovery of learning-based animation media at the high school level.

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INTRODUCTION

Technology developing rapidly in the 21st-century influences the development of the digital environment. These technological developments have also contributed to the increase in the use of gadgets such as tablets, computers, and smartphones. The high use of communication tools has changed how everyone communicates, collaborates, creates work, solves problems, makes decisions, and consumes information (Haleem et al., 2022). Even in the context of education, technology has changed the perspective of students to learn to use digital technology to deepen understanding and knowledge.

Based on the demands of learning in the 21st-century, schools must be able to adapt to world changes that continue to experience acceleration, and classroom teaching needs to shift to digital formats (Shohel, 2022). Expanding the array of learning resources available on the

internet can present students with enhanced opportunities for education (Huang et al., 2022; White & Selwyn, 2012). The high use of technology today, especially in gaining access to information, must also be anticipated. Access to information from the internet, which is very diverse, cannot guarantee that the information obtained is valid and can be trusted (Musi et al., 2022). As a result, getting information assigns responsibility for finding, checking, and integrating information sources for each user. This condition requires that students who use information technology as a learning tool must have digital literacy skills in distinguishing valuable sources of information or vice versa (Tsaniyah & Juliana, 2019).

Digital literacy is a set of abilities needed for success as a citizen in the 21st-century, and it extends beyond merely using tools or technology (Gündüzalp, 2021). These skills help students to think critically, solve complicated problems, and accomplish duties in the digital age (Erwin & Mohammed, 2022). Elements of digital literacy should encompass aspects such as smart reading, attitudes like self-directed learning and social literacy, and smart user competencies (Blau et al., 2020), including understanding digital and non-digital formats, creating and communicating digital knowledge (Churchill, 2020), evaluating information, generating knowledge, and possessing information and media literacy (Gomez et al., 2017).

Enhancing digital literacy skills is paramount in today's digitally driven world, as it empowers individuals to navigate the digital landscape and actively engage in learning. Equipping students with the necessary strategies to evaluate and consume digital texts critically is a fundamental aspect of this skill development (Kasperski et al., 2022). By teaching students how to critically assess and interact with digital content, students will get the challenges of the digital age and foster their growth as informed and responsible citizens (Tinmaz et al., 2022). Incorporating digital literacy into education involves providing students with the tools and knowledge needed to discern digital information's credibility, accuracy, and relevance. This skill set allows them to make informed decisions, differentiate between reliable and questionable sources, and effectively utilize digital resources for their educational and personal needs.

Even though students often access technology in their daily activities, they still need to get used to using learning technology (Chesire et al., 2022). Some students face challenges in digital literacy skills, especially in effectively utilizing learning technology. The issue of lacking digital literacy skills in this context is related to the ability to find, evaluate, use, share, and create content using information technology and the internet. However, there is a need for stimulating efforts to support learning and enhance student engagement, hence building the ideal adaptive e-learning environment (El-Sabagh, 2021). Teachers can play a role in accompanying students in accessing digital resources based on learning needs. The mentoring process aims to facilitate students in training their ability to adapt socially, collaborate and access various media (McGrew & Breakstone, 2023). Hence, educators should be able to motivate students by modifying learning materials to incorporate technology, thereby fulfilling the requirements of 21st-century learning skills.

Amid the challenges presented by the Covid-19 pandemic, teachers are compelled to seek solutions by leveraging technology to overcome obstacles and ensure seamless learning experiences effectively (Herliandry et al., 2020). Tang & Chaw (2015) integrating learning media can maximize the improvement of digital literacy, as implementing multimodal approaches can enhance student communication. Using animated learning media with Adobe

Animate can provide an innovative learning process. Zubaidillah et al (2016) explained that enthusiastic media could help interact with teachers and students so that students can be actively involved in learning. Adobe animate can enhance static images into motion pictures to create animations with a two-dimensional appearance that is stronger and lighter (Samsudin et al., 2019).

The discovery learning model was chosen to facilitate the development of animated media, aiming to enhance students' digital literacy skills in biology. Acquiring a strong literacy level is crucial for learning biology, as it involves accurately linking information based on scientific phenomena. Discovery Learning has principles of mastering knowledge by searching, processing, and exploring through investigation (Alfieri et al., 2011; Bahtia & Dukomalamo, 2019). The discovery learning model can facilitate students to conclude or analyze an event precisely and accurately based on factual information. Animation media based on the discovery learning model will be very appropriate because it can make it easier for students to find information through their smartphones. Students will search for information using a combination of book and internet references based on discovery learning steps.

Previous research on the effectiveness of discovery learning shows that this model can be used to train students' ability to search for information (Alfieri et al., 2011). This research explains the importance of feedback and giving examples to students to strengthen students understanding based on scientific activity (Asrizal et al., 2018). Subsequent research explains that scientific models can train students' digital literacy skills (Basuki et al., 2020). Using the internet to support learning is important for student adjustment to technological and information developments. Moreover, research on the utilization of animation media applications has explored their impact on students' engagement and interest in learning and their accessibility (Harahap et al., 2015). The study aims to assist students in learning the concept of human digestive system material in Biology subjects to make it easier to understand. Subsequent research has designed guided discovery learning-based game media showing increased collaboration and problem-solving *(*Previtali et al., 2016).

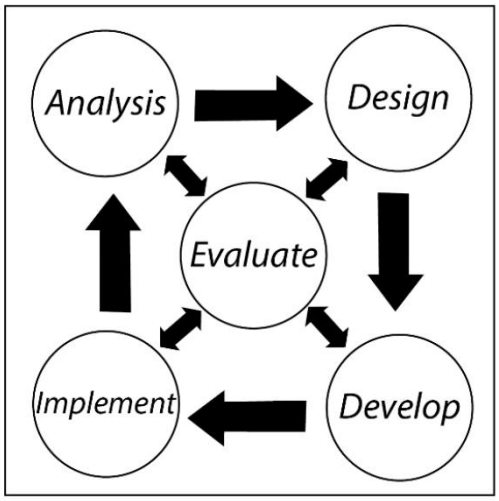
Based on the research mentioned above, one type of research that has emerged is exploring the discovery of learning-based animation media developed in the form of android applications. However, there remains to be more studies specifically addressing the development of discovery learning-based animation media focused on the human digestive system. This subject significantly enhances students' digital literacy skills, enabling them to analyze and acquire information through scientific learning (Arifin et al., 2022; Juniarti et al., 2021). Therefore, researching the development of discovery learning-based animation media at SMA Negeri 1 Wonosegoro, Boyolali Regency, concerning the human digestive system, holds considerable importance in fostering students' digital literacy.

METHOD

Research design

The type of research used is Research and Development (R&D). The research and development method is a type of method that focuses on the feasibility of the product

produced to test the product. The development animation media products Animate CC is the ADDIE Design, Development or Implementation or Evaluations) (Branch,



effectiveness of the model used in creating based on Adobe model (Analysis, Production, Delivery, and 2009).

Participant

For this study, the purposive sampling to the population of students A purposive sampling researchers employed select the sample from in class XI Science[1]. approach allows researchers to deliberately choose participants with specific characteristics or qualities that align with the study's objectives. In this case, the researchers aimed to gather data from students in the above mentioned class, totaling 30 students. The product trial was conducted at SMA Negeri 1 Wonosegoro, Boyolali Regency, in class XI Science[1], with 30 students from September to November for the 2020/2021 school year. Data collection was conducted during four sessions following the pre-determined learning implementation plan.

Research procedure

The research project encompasses six stages, covering the entire process from the problem and needs analysis to the final evaluation stage. The development of animation media, which is based on the Discovery Learning model and follows the ADDIE model, encompasses a series of sequential steps, as illustrated in Figure 1. These stages ensure a systematic and comprehensive approach to the development process, allowing for effective animation media design and evaluation. The steps include analysis, design, development, implementation, and evaluation. Each stage significantly contributes to refining the animation media, addressing specific learning needs, and continuously improving its effectiveness. Figure 1 provides a visual representation of the sequential process involved in developing motion system animation media, highlighting the interconnectedness and interdependence of each stage.

Figure 1. Diagram of the implementation of research and development of the ADDIE model (Branch, 2009)

Analyzing refers to activities evaluating and understanding the needs and characteristics of class XI students in biology subjects. In addition, a situation analysis is conducted that is relevant to students' digital literacy indicators, which will be used as content in the animated media. This analysis ensures that the learning materials' content can effectively enhance students' digital literacy skills (Angadi & Ganihar, 2015).

At the design stage, the researcher compiled an animation media framework based on Discovery learning based on a storyboard design that refers to predetermined product specifications—furthermore, the design of discovery learning-based animation media. The development stage is the stage of completing the prototype into a product. The animation depicting the digestive process in humans incorporates motion tweening, which involves animating objects by utilizing frame-to-frame techniques to determine the initial and final positions of the moving, rotating, and resizing elements.

Expert validators in material content, media specialists, and Biology teachers will validate the designed animations. The designed products will undergo validation by expert validators specializing in material content, media experts, and Biology teachers. The validators will assess the animations quantitatively and descriptively, providing feedback to improve the media (Zieschank et al., 2021).

Implementation refers to the product testing phase, where a limited group of class XI students is involved in an experimental setting. The trial results will be analysed thoroughly and carefully considered during the subsequent evaluation phase (Suniasih, 2021). Evaluating refers to evaluation activities carried out at each stage of development, considering input from various sources to make improvements and enhancements to discovery learning-based animated media designs.

Data, instruments and data collection

Material experts, media specialists, and Biology teachers assessed and provided several suggestions for the questionnaire sheets used to test validity and practicality. Discovery learning-based animation media products produced will be subject to material and media validation processes. Material experts carry out the material validation process, which is done by learning media experts. Any suggestions each validator gives will be considered and used to make improvements (Adisti et al., 2023). Aspects of media validation include design or

appearance, which provides for presentation techniques, display design, and media attractiveness. The elements used to validate the material include the suitability of the material with competence, the accuracy of the material, and the supporting material on the media, and the aspects used to validate the media by the teacher include aspects of content or material and media. Digital literacy is smart user, sharing, critical reading, and socialization abilities (Liu Jing, 2016). The digital literacy instrument uses a performance appraisal sheet. Two experts in education validated the performance appraisal sheet, declaring it feasible with a reliability coefficient of 0.76.

Data analysis

Data analysis from the validator assessment results aims to obtain the validity value of animated media. The score data from the validation results of the product assessment obtained is tabulated and calculated based on the average and then categorized according to the media validity criteria. Categorization of product feasibility levels based on categories, namely: (1) very valid, does not need revision (84% -100%), (2) valid, does not need revision (71% - 83%), (3) quite valid, needs a little revision (61%-70%), (4) less valid (41%-60%), (5) invalid (<41%), need total revision (Azwar, 2012). Meanwhile, the practicality criteria for the development product use the following criteria: very good practical (85%-100%), good practical (70%-84%), reasonably practical (55%-69%), less practical (50%-69%), not practical (<49%) (Riduwan, 2009).

The analysis of digital literacy was conducted using the questionnaire instrument, and the scores were converted into a five-point scale based on the recapitulation of student response questionnaire data. The student's achievement in digital literacy skills was categorized based on each achievement indicator specifically related to digital literacy., namely: (1) very good (90%-100%), (2) good (75%-89%), (3) moderate (65%-74%), (4) not good (55%-64%), (5) very not good (0%-54%) (Tegeh et al., 2014).

The product trial was conducted using a one-group pretest and post-test design, and the data were analyzed using the SPSS 21 software. This design involved administering a pretest to the group before the intervention, implementing the product or intervention, and then conducting a post-test to assess the participants' performance or understanding of changes. The data obtained from both the pretest and post-test were then analyzed using the statistical software SPSS 21 to examine the effectiveness or impact of the product on the desired outcomes (O'Connell et al., 2017).

RESULT AND DISCUSSION

The existing research on developing the discovery learning-based animation media for the human digestive system has shed light on the crucial stage of analyzing student needs (Khairani et al., 2023; Purba et al., 2017). Through interviews conducted with teachers, it was revealed that the current teaching materials predominantly rely on conventional aids like posters, charts, and torso models. However, these traditional teaching tools have limitations, particularly in engaging students and effectively delivering the content. As a result, there is an apparent demand for an alternative medium to facilitate independent learning and provide opportunities for students to enhance their digital literacy skills.

By adding animation into the learning process, students may delve into the complexity of the human digestive system in an interactive and aesthetically appealing manner (Teplá et al., 2022). Unlike static posters or charts, animated media may actively demonstrate complex processes, making it easier for pupils to comprehend and retain the knowledge. Moreover, such media may be accessible online, enabling students to study at their own pace and convenience, thus boosting independent learning.

Improving content retention and independent study, utilizing animation-based learning media also allows students to practice and enhance their digital literacy skills. Interacting with digital media requires students to navigate various interfaces, utilize multimedia features, and critically analyze the information presented (Werdistira et al., 2022). Students can develop vital digital literacy competencies such as information retrieval, media evaluation, and effective communication by engaging with animated learning media. Integrating discovery learning-based animation media into studying the human digestive system addresses the limitations of conventional teaching aids and provides an interactive, independent, and digitally immersive learning experience.

Analyse: Needs Analysis Stage

As a component of the analysis stage focusing on student characteristics, interviews were carried out to assess students' digital literacy skills, particularly in the domain of biology. Overall, the findings highlighted that students in the XI Science class would greatly benefit from enhancing their capacity to analyze and verify information, enabling them to harness it as a valuable source of knowledge effectively. A common occurrence is that students hastily conclude from reading texts without fully grasping the main concepts presented in the information source. Therefore, students need to enhance their critical thinking and information processing skills to ensure a deeper understanding of the subject matter and improve their digital literacy proficiency in biology.

Researchers create product development guidelines in the early stages of product design before proceeding to the development stage. The product's initial development is conducted subsequent to a needs analysis. Based on the need assessment from respondents, this research will focus on developing animation media for digestive system material using the Discovery Learning model, which refers to the curriculum implemented in schools. The animated media will encompass text, images, videos, and audio that delve into the structure and function of the digestive organs. This interactive content will be accessible through electronic devices.

As suggested by the respondents, materials that form the basis of suggestions for animation media were obtained from indicators which include increasing knowledge skills, involvement, social-emotional aspects, and visual aspects that help in understanding the concept. In addition, the challenge of finding the truth of information from a concept is the most needed element, which the media can support as a tool to improve digital literacy skills. Teacher respondents wanted animated biology material in Indonesian, complemented by audio and video, which could help teachers learn biology, especially digestive system material. Thus, biology teachers can play an essential role in the teaching and learning process and integrate the field of biology into digital technology (Widiyana et al., 2021; Zanin, 2015).

Design Stage

During the initial stage of product design, the researcher creates a comprehensive product development formula that serves as a blueprint and guidance before commencing the actual development of the product. This critical step ensures a structured and well-thought-out approach to the product's creation. Subsequently, the initial product development follows an in-depth needs analysis, which helps identify the specific requirements and preferences of the target users.

Considering the valuable product recommendations provided by the respondents, this research project aims to develop animation media for biology learning, specifically focusing on the digestive system material. The chosen approach for this media development is the Discovery Learning method, which emphasizes an interactive and experiential learning experience. By integrating Discovery Learning principles into the animated media, students will be actively immersed in exploring and comprehending the complex concepts related to the digestive system. The animated media will be meticulously crafted, skillfully integrating diverse multimedia elements, including text, images, videos, and audio. These interactive components will provide an immersive learning experience for students (Astuti & Nurcahyo, 2019; Rahayu et al., 2021). Accessing the media will be convenient through modern gadgets, enabling students to explore the content at their own pace and convenience.

The process of designing animated media using Adobe Animate takes the following steps: (1) Determining the animation's desired resolution, frame rate, and duration in the newly created document, (2) Set the settings for animation elements based on the layers used, which include backgrounds, objects, and sound effects; (3) The objects used in this animation media adapt the images available on Google and then edit and adjust the object description based on the concept of the digestive system in humans; (4) It provides object animation using the timeline panel in Adobe Animate CC through the first frame on the latter that corresponds to the object to be animated. Furthermore, we can modify object properties like size, position, rotation, or colour. These modifications are made by transitioning to the next frame. This sequential process is performed for each frame that requires animation. For instance, when designing a product, the concept of food digestion can be animated by illustrating the entry of food into the mouth and its subsequent processing in the digestive organs, showcasing the enzymes involved in digesting food.

By incorporating discovery learning-based animation media, students can engage with dynamic visuals, informative text, educational videos, and audio enhancements. This multimedia approach aims to enhance students' comprehension and retention of the biology concepts related to the digestive system. Moreover, it promotes an active and independent learning environment, fostering students' curiosity and critical thinking skills. The development of this animated media aligns to create a compelling and engaging learning resource for biology education. It underscores the importance of leveraging technology to facilitate immersive and interactive learning experiences. By providing an accessible and engaging medium, students can better understand the digestive system and strengthen their overall biology knowledge.

Develop Stage

Throughout the product development stage, the researcher meticulously crafted animation media to ensure alignment with the fundamental principles of the Discovery Learning model. This design was based on the previously established product development formula. Animation media incorporates six syntaxes derived from the Discovery Learning model. These syntaxes serve as the foundational framework for animation, ensuring an immersive and engaging learning experience for students.

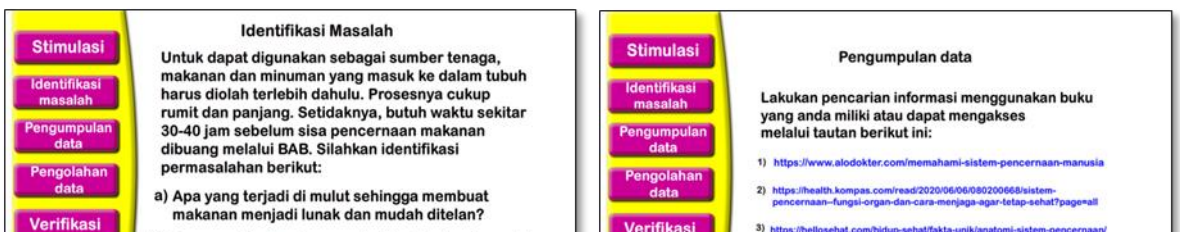
The animation media focuses on the human digestive system, presenting a comprehensive and interactive learning presentation. Through the integration of captivating visuals, informative text, and engaging audio, students are immersed in a digital learning experience that fosters their understanding of the intricate processes involved in digestion. Animation media has been developed specifically for Android devices to provide easy access and convenience. This tailored approach allows students to interact with the content at their preferred pace, promoting flexibility in learning and encouraging independent exploration.

The animation media showcases the culmination of meticulous design, incorporating the Discovery Learning model to enhance students' understanding of the human digestive system. The image illustrates the visual representation of the animation media and highlights its engaging features, inviting students to embark on an interactive learning journey. Using this innovative animation media, students can grasp the complexities of the human digestive system in an immersive and interactive manner, ultimately fostering a deeper understanding of the subject matter. The results of the product development are evident in the Figure 2 presented below.

(a) (b)

Figure 2. The presentation of human digestive system materials using animated media

The design of discovery learning-based animation media incorporates a combination of static images and dynamic visuals. The display of discovery learning-based animation media is designed with a choice of five main menus that lead to the discovery learning model: stimulation, problem identification, data collection, data processing, verification, and conclusions. Figure 2(a) is the initial menu for learning media titles. This figure stimulates the material to start learning. Figure 2(b) is material for the human digestive system presented material for the organs of the digestive system equipped with supporting pictures. This figure illustrates the presentation of material that focuses on the organs of the human digestive system and the characteristics of these organs.



(a) (b)

Figure 3. Discovery Learning model syntax for Media Presentation

Discovery learning-based animation interactive multimedia is designed to facilitate students' digital literacy skills. In Figure (3a), the steps of discovery learning are presented. After introducing the material, students will identify problems based on the provided stimulus. This process allows each student to gain a preliminary understanding of the learning objectives and the direction of the upcoming learning activities. Figure (3b) represents the data processing stage after students receive the necessary materials. During this stage, students are exposed to a range of resources to process the information available and apply it to solve presented problems. This figure facilitated students into the data processing stage, where students will fill out a Google form with solutions from the information obtained.

Upon the completion of product development, the initial phase of product validation testing is conducted, involving two experts specializing in learning media and biology education. During this process, the experts assign scores by placing a check mark (V) on each item based on the predetermined assessment indicators for validating the media. The learning media experts bring their extensive knowledge and experience in instructional design, educational technology, and pedagogy to evaluate the developed media's effectiveness, usability, and overall quality (Festiyed et al., 2019; Hardiyansyah et al., 2019). Their expertise enables them to assess various aspects, such as the clarity of instructional content, the engagement level of the media, and its alignment with instructional objectives.

On the other hand, biology education experts contribute their expertise in biology education to evaluate the accuracy, relevance, and educational value of the media, specifically within the context of biology learning. They assess the content's alignment with curriculum standards, the appropriateness of the language used, and the portrayal of scientific concepts. Both experts meticulously review and assess the media based on the predetermined assessment indicators. They carefully analyze each item and provide scores to indicate the level of alignment, effectiveness, and suitability of the media. Using a check mark allows for a transparent and standardized scoring system, ensuring consistency and ease of interpretation during the validation process.

Through the collaborative efforts of the learning media and biology education experts, the product undergoes a thorough validation process that ensures its quality, accuracy, and instructional value. Their valuable insights and feedback serve as a valuable resource for further refinement and improvement of the media. The outcomes of the initial product validation testing conducted by these experts provide valuable insights into the strengths, weaknesses, and areas of improvement for the media. This feedback informs subsequent iterations and enhancements to ensure that the final product meets the highest quality standards and effectively supports biology education with engaging and informative content.

The following Table 1. presents the validation results of two experts on the assessment of animated media.

Table 1. Material expert validation summary

Validation aspect	Percentage	Criteria
Compatibility of Material with Basic Competency	90%	Valid
Material Accuracy	85%	Valid
Supporting material in the media	85%	Valid
Average	87%	Valid, does not need revision

Based on Table 1, the average value of the validity of the discovery learning-based animation media is obtained, namely the valid category. Assessment of the suitability aspect of the material scope consists of five indicators, namely suitability with basic competencies, accuracy of material with learning objectives, completeness of material, depth of material, and balance of material with examples. Material accuracy consists of indicators of material suitability with scientific developments, actual pictures, diagrams and illustrations, material attractiveness, accuracy of facts and data, and accuracy of concepts and definitions. The material expert's suggestion for improvement in the media is in the section on the balance of the material with examples. Media needs to be added to material substances related to application in everyday life.

Table 2. Media expert validation summary

Validation aspect	Percentage	Criteria
Presentation method	92%	Valid
Display design	85%	Valid
Media fascination	85%	Valid
Average	87%	Valid, does not need revision

One Biology teacher conducted the practicality test on animation media based on the Discovery Learning model. The teacher's response related to the feasibility of discovery learning-based animation media is needed so that the animation media fits the needs of students when implemented in learning. The following Table 3 is a summary of the practicality test results of animation media based on the Discovery Learning model:

Table 3. Summary of biology teacher responses

Validation aspect	Percentage	Criteria
Content/ material	85%	Good Pratical
ICT aspect	90%	Very Good Practical
Average	87.5%	Good Practical

Comments and input from each validator are used to improve the developed animation media. Comments and suggestions from each validator have been completed to improve the

animation media. Comments from each validator and teacher responses are presented in Table 4 as follows.

Table 4. Summary of suggestions for improvement from experts and teachers

Validator	Indicator	Improvement suggestions
Content expert	Material scope	The material on the mouth organ needs to be deepened.
ICT Expert	Figure illustration	Information on the image needs to be completed
Biology teacher	Material scope	Presentation of the material needs to be systematic

Two experts and a practitioner who validated animated media agreed that discovery learning-based animation interactive multimedia can significantly contribute to meaningful and sustainable learning for several reasons. In terms of content, this animated medium includes various materials according to student's interests and elements that facilitate the development of digital literacy skills when studying digestive system material. In addition, this media balances knowledge about critical thinking skills and elaborates information to create solutions.

Furthermore, this animated media has proven relevant to Indonesia's curriculum content. In terms of practice, this animated media involves all the material presented to strengthen students' digital literacy. Students are encouraged to seek and validate information through the sources provided in this animated medium. Additionally, students are encouraged to communicate their findings by referencing the relevant and valid information provided within this media.

In terms of design, this animated media is well-designed, well-structured, and easy to use by high school students. The design pays attention to effective layout, attractive visuals, and the use of technology that students easily understand (Previtali et al., 2016). Finally, this animated media is recommended and suitable for use by biology teachers in teaching material on the human digestive system. This animated media has been specially designed to enhance biology learning by incorporating the principles of Discovery Learning. The validation from experts and practitioners provides reassurance that this media is an effective and relevant learning tool, enabling students to deepen their understanding of the human digestive system while fostering digital literacy skills.

Implement Stage

A brief trial was conducted online using the Google Meeting platform. The learning implementation was carried out in 8 hours of sessions (1 meeting hour = 30 minutes). Limited experiments were carried out to test the readability level of discovery learning-based animation media and the effectiveness of using the media to increase students' digital literacy skills. The effectiveness of the media in fostering digital literacy was evaluated using multiple tests, including a prerequisite test, hypothesis testing, assessment of student digital literacy achievement, and the N-gain score test. These assessments were conducted to measure the influence and effectiveness of the media in developing pupils' digital literacy skills. These tests provided vital information on the influence and usefulness of animated media in

enhancing pupils' digital literacy abilities. A summary of the prerequisite examinations is shown in Table 5.

Table 5. Prerequisite Test

Prerequisite Test	Test Criteria	α	Conclusion
Normality	Shapiro-Wilk: 0.070	0.05	Data Normal
Homogeneity	Levene test: 0.130	0.05	Data Homogen

The results from Table 5 reveal that the precondition test was completed using the Shapiro-Wilk normality test criteria. The findings reveal that the significant value for students' digital literacy skills was more than α (Sig. > α), indicating a normal data distribution. This data shows that the data obtained from the population follows a normal distribution, which is vital for correct analysis and interpretation of the results. The data is also homogenous based on the Levene test criteria with a value of 0.013> 0.05. This information shows that the data has a homogenous distribution.

Table 6. Evaluate the hypothesis regarding the proficiency in digital literacy

Test type	Independent sample test		α	Conclusion
	Variable	Sig.		
Hypothesis testing	Digital literacy	0,000	0,05	Ho was rejected

Based on the hypothesis testing table, the result is 0.000, less than 0.05. Therefore, we reject the null hypothesis (Ho). This indicates that Discovery Learning-based animation media effectively enhances students' digital literacy skills.

Table 7. Results of student responses to the use of animated media.

Aspect	Percetage	Criteria
Study ability	76.9 %	Valid
Attractiveness	74.3 %	Valid
Memory	73,2 %	Valid
Practicality	74.8 %	Valid
Average	74.8 %	Valid

Table 7 indicates a favorable response from students towards the usage of discovery learning-based animation media in the context of this research. The positive student reaction demonstrates a favorable reception of this media in several critical respects. Firstly, students exhibit practical skills in using this animation media. They can readily interact with the animation media, obtain its material, and learn how to use it. This reaction shows that the user interface and navigation in the animation media are well-designed, enabling students to operate it without encountering issues. Secondly, students' capacity to effortlessly use this media demonstrates the effective development of discovery learning-based animation media. This media appears to be designed to be accessible quickly and intuitively by students without requiring extensive supervision or a significant learning curve.

Lastly, the positive response from students regarding this animation media as a tool to enhance their understanding indicates the effectiveness of this media in supporting the learning process. Students feel that this media helps them better comprehend the taught material, which is the primary goal of using this media in the context of education. Overall, Table 7 illustrates that the use of discovery learning-based animation media is highly beneficial for students in terms of user-friendliness, effectiveness in enhancing understanding, and overall positive response. This condition provides strong support for using this media in the context of high school education and suggests potential for further development in education.

Table 8. Results of Digital Literacy Ability

Indicator	Score	Category
Smart user	85 %	Good
Sharing	95 %	Very Good
Critical reading	82.5 %	Good
Socialization	78 %	Good
Average	85 %	Good

Based on Table 8, the ability to communicate has the highest acquisition, which is 95%. The technology utilized for animation-based learning can also influence the sharing process. Platforms that allow students to readily communicate ideas, assignments, or comments can boost interaction. Encouraging connection and collaboration among students is a critical aspect in the sharing process. Group discussions and interactive question-and-answer activities give students with opportunity to share their understanding. At the same time, the ability to collaborate is the lowest acquisition of all indicators, namely 78%. However, the findings in this study reveal an oddity because the students' socialization process is lower than their sharing process (78%). During the learning process, students are genuinely directed to present their ideas and opinions in groups and as a full class. However, the limitations of characteristics that promote intensive student engagement in the learning process seem to be restraints in the application of the developed technology, thereby becoming a limiting factor in enhancing students' sociability abilities.

Overall, the average achievement of digital literacy skills is 85% in the excellent category. Various factors influence the magnitude of the influence of discovery learning-based animation media in implementing limited field trials. The utilization of discovery learning-based animation interactive multimedia accessible through Android devices offers students a convenient means to comprehend the material on the human digestive system effortlessly. Moreover, using Android as a digital learning resource contributes to enhancing students' digital literacy skills (Balya et al., 2018). The use of digital-based devices via Android allows students to gain broad access, requiring them to be critical in reading various sources (Sukarno & Widdah, 2020).

Animated media can direct students' focus on the central concept of the material to be analyzed systematically (Sastradika et al., 2021). Students are expected to be able to own this animated medium so they can use a variety of digital technologies to make it easier to create, place, and evaluate information (Amalia, 2015; Kahar, 2018). This condition will spur

students' abilities to become intelligent users when finding narrations in texts and being able to process this information into valid information. According to research Tamara *et al* (2019), media can create media forms that combine data processing in text, images and sound, which can complete in interactive animations. Some of the material presented in the media helps students develop social collaboration skills to communicate with their colleagues.

The implementation of discovery learning-based animation interactive multimedia has shown that it can critically process information from various sources (Festiyed et al., 2019). However, some students still need help processing information in the form of data or facts to be linked to the problem-solving process. According to research Yokhebed (2018), the process of critical thinking in digital literacy is closely related to how a person processes information cognitively first so that afterwards, he can provide a critical view of an information text. According to research Febliza & Oktariani (2020), the application of digital literacy media not only involves the ability to use technology, information, and communication devices but also affects the ability to socialize, think critically, and creatively. This research was implemented in a network (online) so that student collaboration could have been more optimal. Students experience difficulties collaborating with friends because they still need to adapt to the online communication process.

The utilization of animation media, employing discovery learning principles, in biology education has the potential to yield numerous benefits for students, particularly enhancing their information literacy skills (Fan et al., 2018; Mashami & Gunawan, 2018). This pedagogical approach, which involves actively engaging students in the learning process and encouraging independent exploration, can foster critical thinking and provide access to a wide range of digital resources. By integrating animation media within biology education, educators can effectively equip students with the necessary tools and competencies to navigate, evaluate, and utilize information in the rapidly evolving digital landscape (Ala et al., 2022).

One of the critical advantages of utilizing animation media in biology education is promoting active and independent learning. Animation media captivates students' attention and curiosity by immersing them in dynamic and visually stimulating content, encouraging them to explore the subject matter actively. As students interact with animated visuals, they become more engaged and motivated to delve deeper into the presented biological concepts (El Hammoumi et al., 2022). This active participation enhances their comprehension and retention of information, enabling them to understand complex biological processes better.

Furthermore, animation media provides students with access to a diverse array of digital resources. Through animations, students can visualize abstract concepts, observe intricate biological phenomena, and comprehend complex processes that may be challenging to grasp through traditional teaching methods alone (Lepito, 2018). Animation media allows students to witness microscopic events, observe physiological processes, and explore biological systems in a captivating and interactive manner (Hwang et al., 2012). This immersive experience expands their knowledge and encourages them to explore additional digital resources such as online databases, scientific journals, and educational websites, enhancing their information literacy skills.

Additionally, using animation media within biology education nurtures critical thinking abilities (Ritonga et al., 2020). Students are prompted to analyze, evaluate, and interpret the

information presented in animations, enabling them to develop a discerning approach to understanding scientific concepts. They learn to assess the accuracy, reliability, and credibility of the information depicted in animations and recognize potential biases or limitations. This critical evaluation of digital resources hones their ability to differentiate between trustworthy sources and misinformation, a vital skill in the era of abundant online information (Stadlinger et al., 2021).

CONCLUSION AND SUGGESTION

Conclusion

Discovery learning-based animation media products developed in this study follow the ADDIE model, which consists of five stages: analysis, design, development, implementation, and evaluation. In this study, two experts and one practitioner were involved: media experts, biology education experts, and biology teachers. All experts agree that Discovery Learning-based animation media for Biology subjects, especially on material on the human digestive system at the high school level, is valid.

Implementing the animation media in a limited group further strengthens its validity and highlights its potential to enhance students' digital literacy through the Discovery Learning approach. It ensures the reliability and suitability of the animation media for facilitating students' digital learning experiences. It promotes digital literacy development by encouraging active engagement in sharing activities, smart users, critical reading, and socialization.

Suggestion

The outcomes of this study can be further enhanced in future research, including a more extensive exploration of other biological areas. Moreover, increasing the number of students engaging in product testing can produce more accurate results. Another topic for future inquiry is the development of features that facilitate students' interaction and social aspects using established digital tools.

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