

The Development of An Interactive Biology E-Module Based on Articulate Storyline for Class XI Digestive System Concepts

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Abstract

This research aims to develop interactive learning media based on Articulate Storyline for the digestive system concept in class XI and to determine students' responses to the media development outcomes. The research method used is Research and Development (RnD) with the ADDIE development model, namely Analyze, Design, Development, Implementation, and Evaluate, but it was only carried out up to the development stage. The media development stage underwent a validation process by media and material experts, resulting in an average material validation percentage of 84.33% with excellent criteria. Meanwhile, the media validators reported an average percentage of 89%, also with excellent criteria. The media was tested on students of class XI at SMA Negeri 95 Jakarta Barat, with the trial showing positive results. The percentage of response results averaged 90.90% with excellent criteria. Based on these results, the use of interactive e-modules based on Articulate Storyline can meet the needs of students as supplementary learning media for the digestive system concept.

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Learning Media; ADDIE; Articulate Storyline; Digestive System.

Introduction

The curriculum plays a crucial role in determining appropriate learning targets for students (Filgona et al., 2020). In February 2022, the Ministry of Education, Culture, Research, and Technology (Kemendikbudristek) officially launched the independent curriculum. This curriculum employs methods that are based on students' interests and talents (Baruta, 2021). In the implementation of the independent curriculum, there are minimum competencies to be achieved by students as learning reinforcement. In the 2013 curriculum, these competency standards are referred to as core competencies (KI) and basic competencies (KD). In the independent curriculum, they are termed as learning outcomes (CP), which include differences in terms of reduced material coverage from the previous curriculum, as well as changes in the arrangement of achievements that emphasize learning flexibility (Anggraena, 2022).

The process to achieve these outcomes involves two supporting elements: the subject understanding element and the process skills element. The process skills comprise several stages, namely: 1) observing; 2) questioning and predicting; 3) planning and conducting investigations; 4) processing, analyzing data, and information; 5) evaluating and reflecting; and 6) communicating results (Head of the Education Standards, Curriculum, and Assessment Agency, 2022).

In line with the issuance of a statement by the Department of Education and Sports regarding the prohibition of students purchasing Student Worksheets (LKS) from the school (Diskominfo, 2019), concerns have arisen that this statement may impose a burden on students in acquiring them. Additionally, the Ministry of Education, Culture, Research, and Technology has also stated the disallowance of using School Operational Assistance (BOS) funds, provided to schools, for the purchase of LKS (Kemendikbudristek, 2022). In other words, if a school wishes to provide additional learning resources in the form of LKS to students, the school must make them available for free, but of course, this can pose a personal budgetary burden for the school.

The independent curriculum has the fundamental concept of creating an enjoyable learning atmosphere in its implementation (Saleh, 2019). In its execution, the use of learning resources and media is essential as tools to facilitate effective communication between teachers and students. Learning resources and media are needed as a means to convey instructional messages (Mahmudah, 2022). The lack of learning resources and media received by students in the learning process will undoubtedly affect the teaching and learning process in the classroom, thus influencing the outcomes that students are expected to achieve in their learning.

According to the learning outcomes published by the Ministry of Education, Culture, Research, and Technology (Kemendikbudristek), concerning the biology subject's learning outcomes from phase E to phase F, students are expected to analyze the interrelation of organ structures within the organ system and their functions in the digestion system. Additionally, they should understand abnormalities or disorders that may arise in these organs, comprehend enzyme functions, and be familiar with the metabolic processes occurring in the body (Kemendikburistek, 2022).

Teachers, who act as facilitators for students in organizing the class, play a crucial role in the learning process by creating and designing learning media (Monica, 2023). In this era of Industry 4.0, teachers must optimize technology, especially in the field of information technology or IT (Fauzi, 2022). The innovation expected by the government regarding the quality of education, particularly in the learning process, should be implemented in the field. Teachers

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need to keep up with the dynamic developments in the use of electronic devices connected to the internet. This can be utilized to create teaching materials that encourage students to be more actively explorative (Novibriawan, 2023).

The use of multimedia programs as learning media can be tailored to the needs and capabilities of users, often employed as interactive learning media. This interactivity fosters a "dialogic" learning process for students due to the interaction between users and the content of the media (Pribadi, 2017). Interactive learning media based on Articulate Storyline comes with additional features that enhance interactivity, aiming to increase students' activity, interaction, and consequently, improve their understanding in the learning process. Students are also expected to gain a self-directed and flexible learning experience (Fatihaturahmi, 2023). Sundari and Silitonga (2022) found in their research that there is a comparison of student learning outcomes between the use of PowerPoint and Articulate Storyline as learning media. The interactive learning media based on Articulate Storyline yielded better results compared to PowerPoint-based learning media.

Based on that, the presence of media can assist students in understanding abstract concepts, such as the digestive organ forms and processes involved in digestive enzymes. The use of media aids, such as images or videos, which students can see, is expected to enhance their understanding of the sub-topic of the digestive system. Therefore, the researcher will address this issue to examine students' responses to the development of an interactive biology E-module based on Articulate Storyline for the concept of the digestive system in grade XI.

Research Method

The research design for developing this media employs the ADDIE model, encompassing the stages of analyze, design, development, implement, and evaluate (Stapa and Muhammad, 2019). The research focuses specifically on the development stage because its aim is to assess the media's feasibility based on expert validation and respondent trials. The detailed stages include:

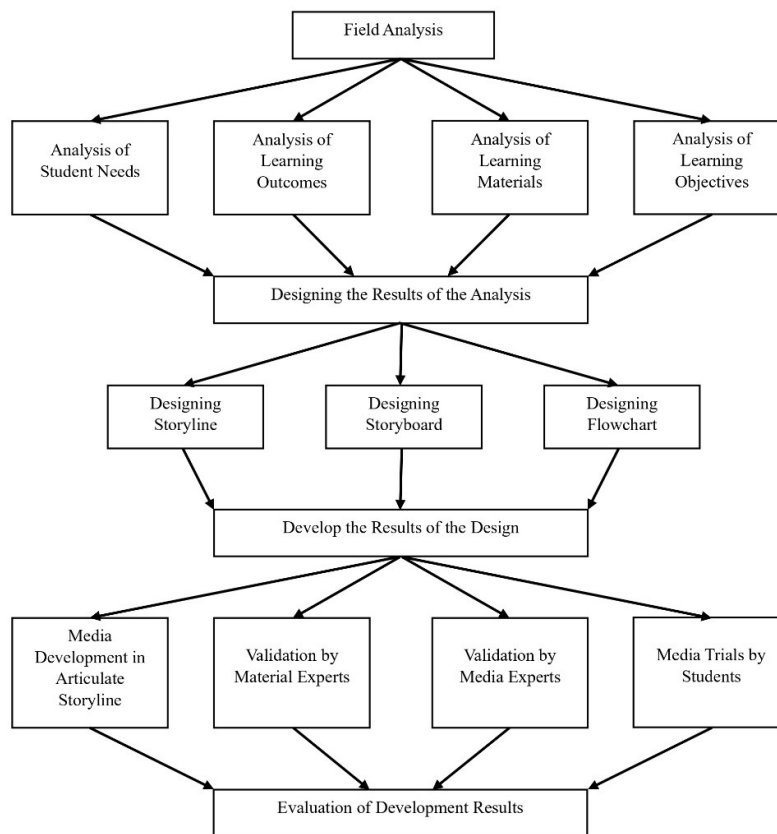


Figure 1. Implementation of the ADD stages in research.

The research was conducted in the second semester of the academic year 2023/2024, from September to December 2023. The analysis to development stages took place in October to November 2023, including the validation process by media experts and subject matter experts. The study concluded with the implementation and evaluation stages in December 2023. This research was carried out at West Jakarta 95 High School, focusing on the biology major for eleventh-grade students. The sample consisted of 11 individuals for a small-scale trial and 35 individuals for a large-

scale trial in different classes between the small-scale and large-scale trials.

The instruments used in this research included validation sheets by subject matter experts and media experts, as well as student response questionnaires. The validation sheet aimed to obtain assessments and suggestions from experts regarding the created media. Meanwhile, the student response questionnaire aimed to collect various responses or evaluations from students regarding the developed media.

The data in the validation questionnaire are in the form of Likert scale responses, and these variables are measured and elaborated into variable indicators. Subsequently, the variables are transformed into reference points for the formulation of instrument items in the form of questions or statements. The Likert scale consists of scores ranging from 1 to 5 (Sugiyono, 2013).

The questionnaire is then analyzed and presented after being filled out by the validator and student. The percentage is calculated using the formula:

$$\text{Percentage} = \frac{\sum \text{score}}{\text{max score}} \times 100\%$$

Then, the results of the calculation are annotated according to the predetermined intervals, as shown in Table 1 below:

Table 1. Media validation intervals by experts (Saputra, 2021)

No	Score (%) - Categories
1	81% – 100% - Excellent
2	61% – 80% - Good
3	41% – 60% - Sufficient
4	21% – 40% - Poor
5	<20% – Very Poor

Results and discussions

The research conducted in this thesis resulted in an interactive learning media in the form of an e-module on the concept of the human digestive system. This interactive learning media is designed as an additional learning resource to provide additional information for students and as a supplement to the curriculum, specifically on the concept of the human digestive system for 11th-grade students in the independent curriculum.

This learning media is structured according to the insights gathered from interviews with teachers and students regarding the need for supplementary learning media. The interview process is part of the Analyze stage in the ADDIE development model. In this stage, the researcher not only investigates the field conditions based on interviews with teachers and students but also analyzes the learning achievements and objectives in the F phase of the independent curriculum implemented at the school where the research is conducted.

The interview results also indicate that students tend to feel bored with learning resources that are solely textual. Group presentation results in the form of PowerPoint or PPT also tend to be textual. Consequently, students often seek additional information through YouTube videos to obtain visual information and avoid getting easily bored. In addition, textual material is sometimes insufficient to explain a topic and concept, especially in this research on the concept of the human digestive system. Therefore, a more creative learning media is needed, so that students can understand the learning not only through writing or text but also through visual forms.

The process undertaken by the researcher after analyzing the interview results is to analyze several book sources for incorporating material into the learning media. This is done by the researcher to minimize errors in the conveyed material by comparing one source with another. After the analysis is conducted, intersections are determined for each material from the book sources, which will be used as references for the content of the learning media. Certainly, the material selection is in line with the learning achievements and objectives predetermined beforehand.

The analysis results will then be developed in the next stage, which is the design stage. In this stage, the collection of materials from the intersections of various book sources begins to be arranged according to learning achievements. The selected materials in this study include food substance, system material, glands, and digestive enzymes, as well as disturbances in the digestive system. These materials are then divided according to the learning objectives. The intersection results of materials from the comparison of several book sources used by students, namely 2 curriculum 2013 books, 1 independent curriculum book, and 2 additional books, namely a book on the Cambridge curriculum and Campbell's Biology book. The intersection results on the concept of the digestive system can be seen in Table 3.

The material is then organized into a learning flow in the form of a storyboard, with the aim that the researcher can easily divide and arrange the content on each page that will appear in the learning media. After the storyboard is prepared, the researcher begins the next stage of development by using several applications to assist in creating text,

images, animations, and videos to be displayed in the learning media. The results of this design will be turned into a prototype, which will then be programmed with commands for each button according to the storyboard, and a schematic learning flow will be created with the help of a flowchart.

Table 2. Content of material

Book	Material
Intersection of 5 books	<ul style="list-style-type: none"> ● Food Substance <ul style="list-style-type: none"> ○ Macronutrients ○ Micronutrients ● Digestive Process <ul style="list-style-type: none"> ○ Mechanical digestive ○ Chemical digestive ○ Digestive tract, absorption process, and the role of enzymes ● Digestive system disorders

The media design in the design stage is then developed in the development stage. This stage includes the validation process by experts, both in terms of content and media appearance. The validation process not only provides an assessment of the media but also includes feedback from experts regarding the development of the media. The aim is to assess the validity of the media before it is used in the testing process.

The results of material validation by experts show that the prototype of the learning media meets the criteria excellently with scores in each component. The results of material validation can be seen in Table 3:

Table 3. Material validation results from validator

No	Component	Percentage	Criteria
1	Material suitability	87%	Excellent
2	Presentation of material	87%	Excellent
3	Language	79%	Good
Total		84%	Excellent

Despite having excellent criteria, there are some revisions related to typing errors in the material, some information errors, lack of information, and the need to add references to the material. Therefore, the researcher still needs to carry out revisions in accordance with the validator's suggestions.

The validation results of the media by experts have an average component score higher than the material validation results, with an average score of 89%, indicating excellent criteria. The results of material validation can be seen in Table 4.

Table 4. Media validation results from validator

No	Component	Percentage	Criteria
1	Ease of navigation	92%	Excellent
2	Artistic and aesthetic	88%	Excellent
3	Usefull	87%	Excellent
Total		89%	Excellent

A high score does not guarantee the absence of suggestions from the validator. Suggestions from the validator's include the need for clear identification on the learning media, clear instructions on buttons, and proper layout of text and images. Therefore, the revision process is still carried out by the researcher in accordance with the validator's suggestions. The prototype, developed in accordance with expert assessments and suggestions, and having undergone the revision process, can be used for testing with students. Before being tested on a large scale, the learning media is initially tested on a small scale to assess the ratings and responses provided by students.

Small-scale testing was conducted with 11 biology major students in grade 11. Students were provided with a link to access the learning media in the form of an e-module and a response questionnaire prepared by the researcher. This small-scale testing process aimed to observe students' responses regarding several aspects of module assessment, including cognitive aspects, information presentation aspects, artistic and aesthetic aspects, as well as usefulness aspects. By evaluating these four aspects, the researcher could understand students' responses regarding their assessment of the learning media used.

The results of the small-scale testing conducted by the researcher yielded positive values with an excellent average criterion, with an average score of 82.95%. For a more detailed breakdown of each component, the results can be seen in Table 5. The positive results from the small-scale testing allowed the researcher to proceed with large-scale testing. In this study, the researcher tested the learning media with 35 students from the 11th grade majoring in biology. The

testing was conducted in the same way as the small-scale testing, where participating students were provided with a link to access the learning media in the form of an e-module and a response questionnaire for their assessment of the learning media.

Table 5. Results of the small-scale testing

No	Component	Percentage	Criteria
1	Cognitive	83,18%	Excellent
2	Presentation of information	81,36%	Excellent
3	Artistic and aesthetic	84,24%	Excellent
4	Usefull	85%	Excelent
Total		82,95%	Excellent

The large-scale testing produced the same positive results as the small-scale testing, with a score of 90.90% from all participants, detailed in Table 6. Based on the results of these four aspects, namely the cognitive aspect, information presentation aspect, artistic and aesthetic aspect, and overall aspect, the learning media developed by the researcher on average received an excellent criterion in its application. However, there are still shortcomings in its implementation, such as the use of media that can only be accessed online.

Table 6. Results of the large-scale testing

No	Component	Percentage	Criteria
1	Cognitive	90,83%	Excellent
2	Presentation of information	91, 67%	Excellent
3	Artistic and aesthetic	92,22%	Excellent
3	Usefull	88,89%	Excelent
Total		90,90%	Excellent

The use of interactive learning media, based on the assessment of responses, can be considered to have achieved positive results. The developed media meets the needs of both teachers and students, as identified in the interviews conducted during the analysis phase, where students require more creative and accessible learning media. The use of media based on student responses is also able to enhance interest and motivation in learning. According to Sirajudin in his journal, teachers as facilitators are expected to provide learning media that can support learning resources.

The use of interactive learning media in the form of Articulate Storyline-based e-modules is expected to support students' additional learning resources, namely textbooks and PowerPoint. According to Putri, Sumaryo, and Kristianto (2022) and Novriandami et al. (2023), in their research, learning media based on Articulate Storyline has a positive influence and is more effective in improving students' learning outcomes.

The final stage in the research process is the evaluation stage. In this stage, the researcher evaluates the learning media that has been designed and developed. The developed media has several strengths. If we measure the strengths based on student responses, it can be said that the learning media excels in the illustration field. Illustrations in the interactive learning media developed by the researcher include images, animations, and videos to support learning materials. With supportive and engaging illustrations, students can understand the material well because it is complemented by suitable illustrations. Additionally, varied illustrations in the learning media, such as images, animations, and videos, prevent students from getting bored during the learning process (Guilherme, 2019).

The weakness of this learning media lies in its accessibility. Students must have stable internet access when accessing the learning media. In addition to stable internet access, the data usage size when accessing the learning media is quite large. The offline learning media has a size of 145 MegaBytes, excluding the data usage for videos on YouTube within the media. Certainly, for students, this data usage can be considered very large. The results of this limitation are reflected in student responses, where the scores for the overall aspect in the questions discussing the availability of media for use anytime and anywhere received very low scores compared to other questions. The hope for developers of similar interactive learning media is to address the limitations of this learning media.

Conclusion

Based on the research conducted, it can be concluded that the product resulting from the development of interactive learning media using the ADDIE development model with the stages of analyze, design, and development, received positive responses with excellent criteria, both in terms of validator assessment and student assessment. The total score from the material validator assessment was 84% with an excellent criterion. Meanwhile, the total score from the media validator assessment was 89%. The results from the large-scale testing received positive responses to the interactive learning media with excellent criteria. The scores for each aspect were as follows: cognitive aspect scored 90.83%, information presentation scored 91.67%, artistic and aesthetic aspect scored 92.22%, and overall aspect scored 88.89%. Based on these student responses, the use of interactive e-module learning media based on Articulate

Storyline can meet the needs of students as supporting learning media for the concept of the digestive system.

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