

Development of the Biology Magazine on Virus as Teaching Materials for 10th Grade High School

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ABSTRACT

The development of a biology magazine focused on viruses was motivated by students' lack of understanding of viruses and the lack of teaching materials for virus topics at Kartikatama Metro High School. The purpose of this research is to develop a biology magazine about viruses, analyze the validity of the developed product, and assess the responses of teachers and students to the product. The method used in this study is research and development (R&D) using the ADDIE development model (Analysis, Design, Development, Implementation, and Evaluation). The test subjects in this study were a biology teacher and ten students from class X Science at Kartikatama Metro High School. The data analysis techniques used in this study include both quantitative and qualitative analysis. The data collection instruments consisted of an open-ended questionnaire for students and a closed-ended questionnaire for teachers. The product validation results indicated that the developed teaching materials were considered "highly valid" for testing, with 93% approval from material experts and 85% from media experts. Additionally, the trial responses to the product were rated as "very good," with a 97.7% response rate from the teachers and 97.4% from the students.

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INTRODUCTION

Biology is a science nature that studies life from all aspects. Biology learning isn't it only as group control knowledge in the form of facts, concepts or principles, but also a learning process in discovering something. Biology Learning in High School It is hoped that it can become a medium for students to study oneself and nature around, as well as further development continue in implementation in his daily life (Suci Febrianti & Karyadi, 2018).

The use of teaching materials is a component in learning, this is very necessary to achieve student competence. The development of teaching materials includes knowledge, skills and attitudes that become a reference for students, needed by educators in planning and evaluating learning. It becomes easier for educators with teaching materials for understand the material in learning in depth, and make it easier to learn do teaching. Development of teaching materials can also help eliminate students' boredom with the material they have learned and enhance the benefits of these materials for both educators and students. The development of teaching materials really helps educators and students in the process of achieving teaching and learning activities (Sungkono, 2022).

Based on a preliminary survey conducted at SMA Kartikatama Metro, information obtained from interviews and student needs questionnaires revealed that 40% of students found the biology lessons less engaging. This is because biology teachers only use the same learning methods, relying solely on government-provided printed textbooks and Student Worksheets (LKS) as references. The content of these textbooks is too complex for students to understand. Additionally, 80% of students reported difficulties in studying the biology topic on viruses due to the lack of varied teaching materials, such as LKS and government-provided textbooks, which resulted in low motivation and difficulty in understanding the material. Thus, students need additional teaching materials that are varied, engaging, clear, detailed, and include attractive images to aid their understanding.

To address these issues, the development of alternative teaching materials is necessary. By using appropriate teaching materials, students are expected to better grasp and understand the content delivered. One supportive teaching material is a magazine. A magazine is a medium that can be used to understand biology content while providing enjoyment in learning biology. As a teaching tool, a biology magazine can support students' understanding of the material presented by the teacher and offer an engaging learning experience. This is in line with Prastowo (2013) magazines are periodic publications whose contents include various journalistic coverage and views on actual topics that readers should know. Magazines in this context are media that can be used as a tool for understanding biology subject matter, as well as providing enjoyment in studying biology subjects. As a learning medium, biology magazines can support students' understanding of the material presented by the teacher and provide an interesting learning feel (Nesya Arantika Dewi & Agus Wasisto Dwi Doso Warso, 2014).

Based on the explanation above, it can be concluded that research needs to be carried out on the development of teaching materials in the form of biology magazines. This magazine will cover biology material about viruses for grade 10 high school students.

RESEARCH METHODS

This study uses the Research and Development (R&D) method, and the development procedure is based on actions built according to the steps of the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) model of the R&D method. The data collection techniques in this study utilize both qualitative and quantitative data. Qualitative data is obtained from interviews with biology teachers and 10th-grade students regarding the teaching materials used, as well as from comments and suggestions from material and media experts and teachers during the trial phase. This data is then analyzed descriptively and used for considerations and improvements in the development of the biology magazine on virus materials. Quantitative data includes product quality assessments obtained from validation questionnaires given to material and media experts and trial questionnaires given to teachers and students (Sugiyono, 2014).

The product quality assessment is ultimately described descriptively into interval data using a Likert scale. The Likert scale is used to measure an individual or a group of people based on aspects of attitude and perception towards social events. With the Likert scale, these social events are measured and described into indicators. These indicators are then organized as items in an instrument, which may include questions or statements (Didik Ari Wibowo, 2019).

The analysis of validation questionnaires for content experts, media experts, teacher response tests, and student response tests was carried out by comparing the total scores obtained ($\sum x$) with the maximum possible scores on the validation questionnaire (n).

$$P = \frac{\sum x}{n} \times 100\%$$

Description:

P = Validity percentage

$\sum x$ = The number of scores obtained for each criterion

n = Maximum total score

The percentage obtained from the validation formula in the expert validation questionnaire, teacher response questionnaire, and student response questionnaire is compared to the achievement and qualification level criteria as shown in Table 1.

Table 1. Level of Achievement and Qualifications

No	Tingkat Pencapaian	Kualifikasi	Keterangan
1	81-100%	Very good	Very valid
2	61-80,9%	Good	Valid
3	41-60,9%	Fairly good	Fairly valid
4	31-40,9%	Not Good	Invalid
5	<20-30,9%	Very bad	Highly invalid

The instruments used in this study include preliminary study instruments, expert validation instruments, and product trial instruments. The instrument specifications are as follows (Okpatrioka, 2023):

1. Preliminary Study Instrument

The preliminary study instrument is conducted during the preliminary survey activities. This instrument is provided in the form of interviews with teachers and questionnaires for students. The purpose of these instruments or questionnaires is to identify issues with the teaching materials used during classroom instruction and to provide feedback for the development of the biology magazine being developed.

2. Expert Validation Instrument for Content

The expert validation instrument for content consists of a validation questionnaire that assesses the appropriateness of the content or material to ensure the suitability of the biology magazine being developed, evaluated based on the alignment of the material with the curriculum. The specifications of the content expert validation instrument can be seen in Table 2.

Table 2. Specifications of the Content Expert Validation Instrument

No.	Aspect	Indicator	Item Numbers	Number of Items
1.	Content	Completeness, breadth, and depth of learning material	1,2,3	3
		Accuracy of learning material	4,5,6,7	4
		Currency of learning material	8,9	2
2.	Language	Compliance with language rules	10,11,12,13,14	5
3.	Learning	Suitability with student development	15,16	2
		Communicative	17,18	2

Dialogic and interactive	19,20	2
Total Number of Items		20

Adaptation from research (Syaferi et al., 2022)

3. Media Validation Instrument

The media validation instrument is used to assess the developed teaching materials and provide feedback or suggestions for the biology magazine being developed. The specifications of the media expert validation instrument can be seen in Table 3.

Table 3. Specifications of the Media Expert Validation Instrument

No.	Aspect	Indicator	Item Numbers	Number of Items
1.	Usability	Ease of use, attractiveness, and practicality	1,2,3	3
2.	Appearance	Design, illustrations, and images	4,5,6	3
		Cover design	7,8,9	3
		Fonts and colors	10,11,12,13,14,15	6
		Use of language	16	1
		Quality of images	17	1
3.	Instruction	Relevance to the content	18	1
		Support for learning	19,20	2
Total Number of Items				20

Adaptation from research (Siti Soleha, Tri Andri Setiawan, 2022)

4. Teacher Response Test Instrument

This instrument was given to one biology teacher at Kartikatama High School, the minimum number of respondents was due to the limited number of biology teachers who met biology education qualifications. The purpose of this instrument is to assess teacher responses to magazine products. Specifications for the teacher response questionnaire are presented in Table 4.

Table 4. Specifications of the Teacher Response Test Instrument

No.	Aspect	Indicator	Item Numbers	Number of Items
1.	Material Suitability	Suitability of material to the syllabus	1	1
		Suitability of material with instructional goals	2	1
		Suitability of material with learning resource needs	3	1
		Suitability of material with students	4	1
		Material presentation captures students' attention	5	1

No.	Aspect	Indicator	Item Numbers	Number of Items
2.	Appearance	Clarity of subject matter	6	1
		Clarity of font size and style	7	1
		Illustrations in the biology magazine are easy to understand	8	1
		Images in the biology magazine are engaging and easy to understand	9	1
		Combination and layout of text on the cover are appealing	10	1
		Clarity of font color	11	1
		Language used is easy to understand	12	1
		Material is presented systematically/chronologically	13	1
		Cover illustrations are attractive	14	1
3.	Use of Teaching Materials	Images match the material	15	1
		Instructions for using the biology magazine are clear	16	1
		Facilitates teachers in conducting the learning process	17	1
		Teachers and students are interested in using the biology magazine	18	1
Total Number of Items				18

Adaptation from research (Siti Soleha, Tri Andri Setiawan, 2022)

5. Student Response Test Instrument

This instrument was administered to ten students in Grade X at SMA Kartikatama. The blueprint of the student response test instrument is presented in Table 5.

Table 5. Blueprint of the Student Response Test Instrument

No.	Aspect	Indicator	Assessment Item Numbers	Number of Items
1.	Student Response	Teaching materials	1,2,3	3
		Content	4,5	2
		Technical aspects	6,7,8,9,10	5
Total Assessment Items				10

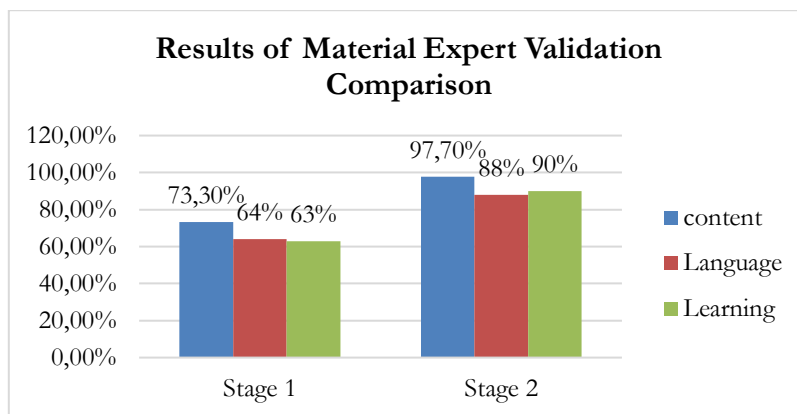
Adaptation from research (Siti Soleha, Tri Andri Setiawan, 2022)

RESEARCH RESULTS

The research results, presented as data, are shown in 4 graphs and described as follows.

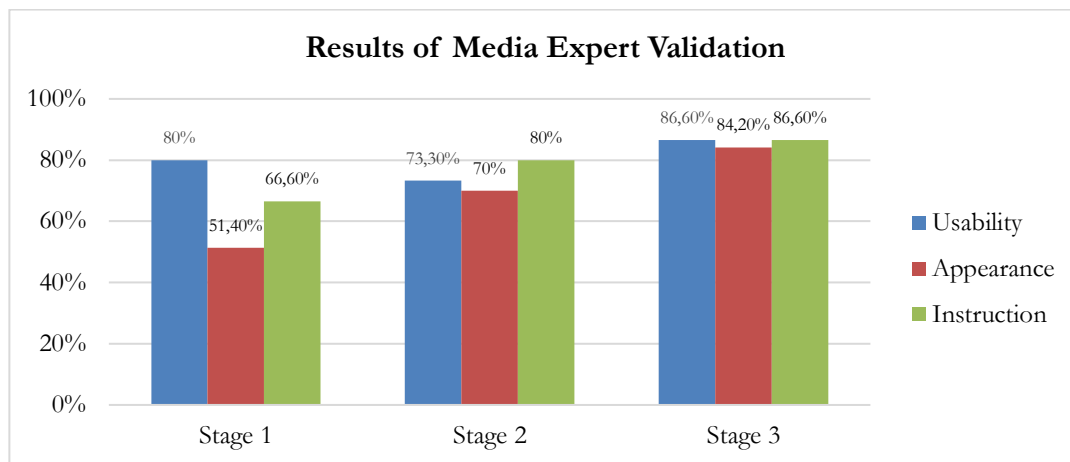
Graph 1 presents the results of the expert material validation comparison. **Graph 2** presents the

results of the expert media validation comparison. **Graph 3** presents the results of the teacher trial responses. **Graph 4** presents the results of the student trial responses.



Graph 1. Results of Material Expert Validation Comparison

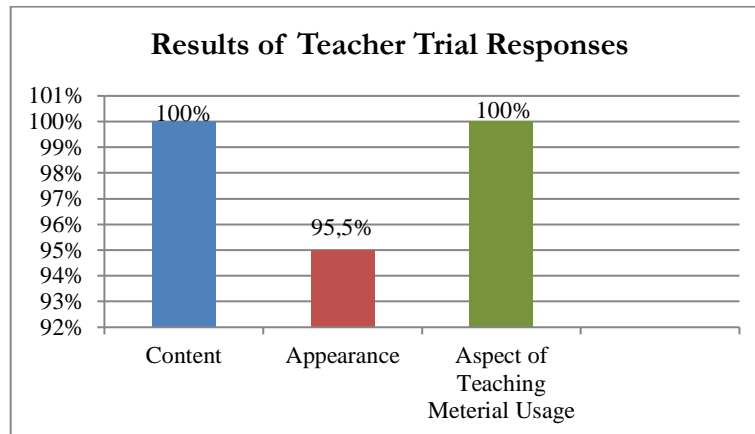
Based on the Graph 1, the validation results of the first and second stages by material experts show an increase in the product's validity from 68% in the first validation to 93% in the second validation. The details of the validation results in stage 1 in content an average percentage of 73.3%, in Language 64%, and in Learning 63%. Meanwhile, in the second validation in content the average percentage was 97.70%, Language 88%, and Learning 90%. The conclusion is that the biology magazine product on viruses as teaching material for Grade X SMA/MA students is suitable for use without revision and can proceed to the trial stage. Apart from quantitative data, validation results include qualitative data including input and suggestions provided by material experts regarding the product being developed. The qualitative data obtained during validation is that the use of language and sentences in the material is structured more effectively and adapted to high school students, and the use of virus examples is more related to viruses that exist in everyday life, for example adding bacteriophage type viruses in the virus impact section. as an object in public health.



Graph 2. Results of Media Expert Validation Comparison

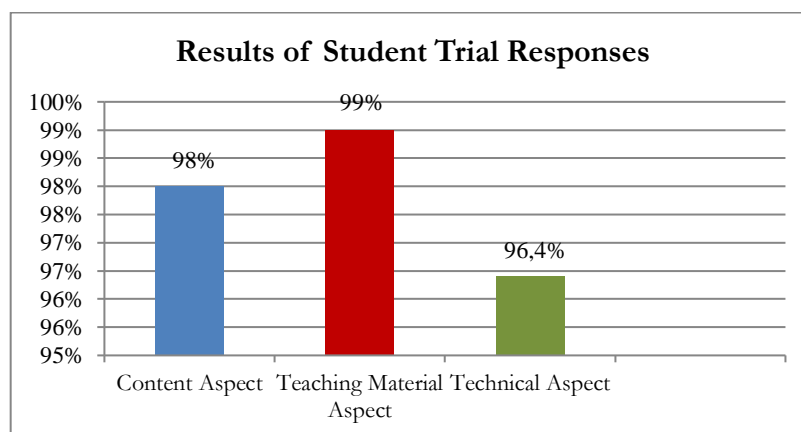
The graph 2 shows that the results of the first, second, and third stages of validation by media experts indicate a significant increase in the product's validity, from 58% in the first validation, 72% in the second validation, to 85% in the third validation. The description of the results of the first validation by media experts from the usage aspect got a score percentage of 80%, the display aspect got a percentage of 51.4%, and the learning aspect got a percentage of 66.6% and a total score percentage of 58%. the results of the second validation by media experts consisting of the usage aspect got a score percentage of 73.3%, the display aspect got a percentage of 70%, and the learning aspect got a percentage of 80%. With a total score of 72%. The results of the third validation by media experts consist of 3 aspects, namely the usage aspect, display aspect and learning aspect. It can be seen that the usage aspect gets a score percentage of 86.6%, the display aspect gets a percentage of 84.2%, and the learning aspect gets a percentage of 86.6%. The conclusion is that the biology magazine product on viruses as teaching material for Grade X SMA/MA students is suitable for use without revision and can proceed to the trial stage.

Qualitative data resulting from material expert validation in the form of adjustments to the size of the magazine which will be made starting from the margins to the font size according to the magazine description (margins 2 cm and font size 11), on the subject of the benefits of viruses to harmful viruses, made in a uniform layout and differentiate the layout color of each sub-chapter of material, and place infobio rubrics between the main topics of the material being discussed, so that students better understand the material being presented and adapt it to the main infobio material being discussed as well as differentiating font types between the main material and additional rubrics such as rubrics. "Did You Know" and "Infobio".



Graph 3. Results of Teacher Trial Responses

Based on the Graph 3, the teacher responses to the biology magazine on viruses showed a score of 100% with a category of "Very Good" for the material aspect, 95.5% with a category of "Very Good" for the appearance aspect, and 100% with a category of "Very Good" for the teaching material use aspect. The overall percentage score for the biology magazine on viruses is 88, with a percentage of 97.7% and categorized as "Very Good" with no revisions required for the developed product. This demonstrates that biology teachers agree with the developed product, which is the biology magazine on viruses as teaching material for Grade X SMA/MA students. Qualitative data from the teacher response test shows that the product developed is very interesting to read, the paper quality is good, but the price of the biology magazine product developed is quite expensive if students want to own the biology magazine. So, based on suggestions and comments from biology subject teachers, researchers developed a biology magazine product into two forms, namely, print and electronic (using FlipHTML5).



Graph 4. Results of Student Trial Responses

Based on the Graph 4, the student responses to the biology magazine on viruses as teaching material for Grade X SMA/MA students, in a small group trial with 10 students at SMA

Kartikatama who had previously studied viruses, showed a percentage score of 98% with a category of "Very Good" for the teaching material aspect, 99% with a category of "Very Good" for the content aspect, and 96.4% with a category of "Very Good" for the technical aspect. The overall percentage score for the biology magazine on viruses is 97.4%, falling into the "Very Good" category. Based on the trial results, the product can be used without further trials and can be utilized as teaching material in the educational process for both teachers and students.

DISCUSSIONS

The product resulting from this research is a teaching material in the form of a biology magazine on viruses for Grade X SMA/MA students, developed in both print and electronic formats (using FlipHTML5). The aim of this research was to analyze the validity, and evaluate both teacher and student responses to the developed biology magazine. The development of this teaching material encompasses several stages: analysis, design, development, implementation, and evaluation. Additionally, the researchers conducted systematic testing using experts in material and media, and used questionnaires to gather responses from both teachers and students (Sundari, 2017).

1. Analysis

The results of the needs analysis and curriculum analysis are that the teaching materials that are often used in the biology learning process, especially the virus material, are Student Worksheets (LKS) and package books prepared by the government. The virus material is material that is difficult for students to understand, while the teaching materials that are less varied, so students feel less satisfied with the teaching materials used by teachers in learning.

Curriculum analysis at Kartikatama High School shows that the school is still using the 2013 curriculum, while the virus material is in class characteristics, replication and role of viruses in public health aspects. KD 4.3: Present data about the characteristics, replication and role of viruses in public health aspects, with learning objectives namely, students are able to know the history of viruses, students are able to determine the characteristics of viruses, students are able to explain the stages of virus replication and students are able to explain the role of viruses which are beneficial and detrimental.

2. Design

At this stage, researchers create a concept for virus material. This concept is adapted to the 2013 curriculum syllabus for core competencies, basic competencies, indicators and learning

objectives used at Kartikatama High School. The biology magazine product that will be developed is made using Canva or a similar application. The biology magazine product on virus material consists of: front cover, table of contents, instructions for using the biology magazine, virus material, author biography and back cover.

The writing format used in the development of this biological magazine product is as follows: A4 paper size (210 x 297 mm), orientation: portrait, with chosen fonts being Collective, Failurein, and Amaranth, at a font size of 11. Additionally, the magazine includes interesting and easy-to-understand pictures. The material on viruses is arranged in the following order: 1) Definition of viruses, 2) Characteristics of viruses, size of virus bodies, shape of viruses, structure of viruses, 3) How viruses live, 4) Replication of viruses, 5) The role of viruses in aspects of public health 6) Prevention of the spread of viruses.

3. Development

The front cover of the magazine consists of a book title adapted to the subject being developed, namely "Biomagz Virus" and is given a background of an animated image of a virus. The purpose of providing this background is so that readers can understand the meaning of the title before opening the contents of the biology magazine. On the front cover there are also some core material to be studied and the class level. Biomagz virus can be accessed by <https://online.fliphtml5.com/rqqlp/wecf/?1684581233910>. The appearance of the Biomagz virus can be seen in image 1.

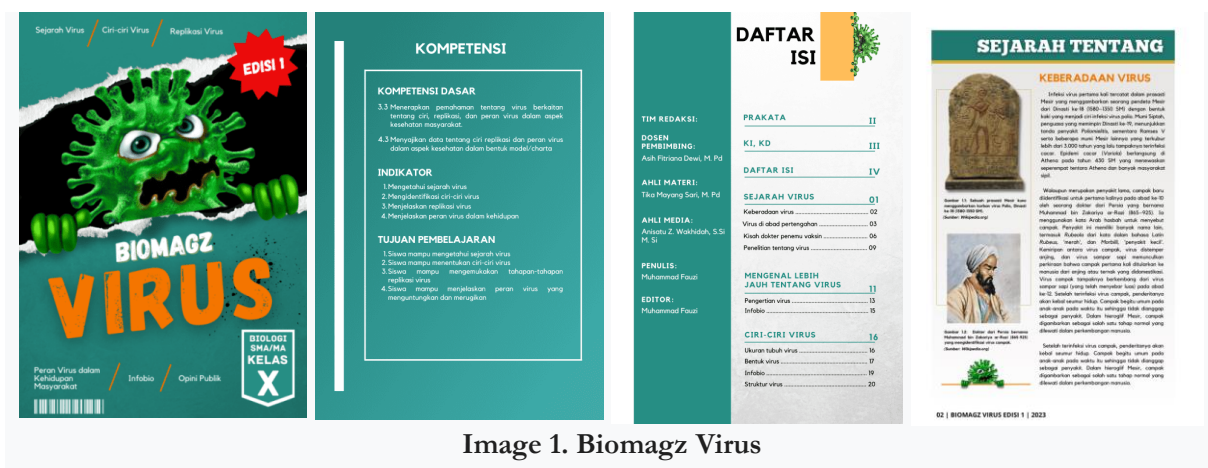


Image 1. Biomagz Virus

One of the criteria for the biology magazine on viruses as teaching material for Grade X SMA/MA students is having a high level of validity. Validity means that the developed product can measure what it is supposed to measure. To determine the level of validity or feasibility of a

developed product, validation is carried out. Aspects considered in the biology magazine on viruses include content, language, usage, appearance, and learning aspects. Validation is conducted by presenting experienced experts (validators) to assess the product and identify its strengths and weaknesses. A product is said to be suitable if it includes several components, namely the material suitability component which includes suitability of KI and KD, the presentation component which includes clarity of the learning objectives to be achieved and the linguistic component which includes clarity of information and conformity with Indonesian language rules (Riti Desmiwati, 2017).

The assessment results from content experts on the content aspect showed a percentage of 97.7% with a "Very Valid" category, indicating that the material covered in the biology magazine on viruses aligns with the core competencies (KI) and basic competencies (KD). The language aspect received an average percentage of 88% with a "Very Feasible" category, showing that the language used is generally clear and easy to understand. Finally, the learning aspect received an average percentage of 90% with a "Very Valid" category.

For the media expert assessment, the usage aspect received a percentage of 86.6% with a "Very Valid" category, showing that the magazine on viruses can be used practically. The appearance aspect received an average percentage of 84.2% with a "Very Valid" category, indicating that the design of the magazine on viruses is appropriate and can attract readers' interest. Lastly, the learning aspect received a percentage of 86.6% with a "Very Valid" category, showing that the magazine on viruses is relevant to the material being studied and can support students in learning independently. This result aligns with (Amalia, 2022) opinion that practical learning media means media that is easy to use and can be applied by both teachers and students in the learning process.

4. Implementation

The biology magazine on viruses received positive responses from biology teachers. Based on the teacher response trials, the magazine on viruses was assessed from various aspects including content, appearance, and usage. The data shows that teachers rated it as "Very Good" with a percentage score of 97.7%, falling into the "Very Valid" category. This indicates that the developed biology magazine facilitates teachers in conducting the learning process. This aligns with (Hasmiati et al., 2017) who stated that the ease of use of the developed product allows both teachers and students to be interested in the product, with interest based on the product's ease of use.

Regarding the student responses to the developed biology magazine on viruses, feedback from various aspects, including teaching material, content, and technical aspects, showed a "Very Good" response with an average percentage score of 97.4%, categorizing it as "Very Valid". This indicates that students enjoyed using the biology magazine on viruses in biology lessons because it relates to everyday life. This is consistent with (Karlina, 2020) view that magazines can provide visualizations that attract students' interest in learning. The average response also shows that students had a positive reaction to the developed biology magazine. This is in line with (Wicaksono et al., 2014) opinion that a positive response is indicated if more than 50% of the questionnaire responses fall into the positive category. The average student response indicates that the biology magazine (Biomagz) on viruses is highly suitable for use in the learning process.

5. Evaluation

The biology magazine on viruses developed in this research differs from previous studies and offers several advantages, including comprehensive content related to daily life, an attractive design with numerous pictures, and various sections such as "Did You Know," "InfoBio," and "Public Opinion." These features make the virus material in the magazine relevant to students' everyday lives. This approach aligns with Rahmawati (2020), who explains that presenting material in a contextual and engaging manner can enhance students' interest in learning.

CONCLUSIONS

Material validation was conducted twice, resulting in a final score percentage of 93%, placing it in the "Very valid" category. Media expert validation was conducted three times, with a final score percentage of 85%, also placing it in the "Very valid" category. Based on these validation results, the biology magazine on viruses was deemed worthy of testing. The results from the teacher and student response tests were positive, with educators providing a "Very good" response and a score of 97.7%, categorizing it as "Very valid." Based on the validity test analysis and user response tests, it can be concluded that the magazine is suitable for use as biology teaching material.

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