

## Development of an Android-Based Electronic Module Using Website 2 APK with Islamic Values on Virus Material for Senior High School Students

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### Abstrak:

Inovasi dalam pendidikan, termasuk bahan ajar elektronik meningkatkan motivasi dan pemahaman peserta didik didukung oleh kemajuan teknologi. Namun, penerapan teknologi dalam pembelajaran masih kurang optimal, seperti yang ditemukan dalam pembelajaran Biologi. Materi Virus dianggap sulit karena bersifat abstrak dan penuh istilah ilmiah, sementara pembelajaran masih bergantung pada buku paket tanpa pemanfaatan teknologi yang maksimal. Penelitian ini bertujuan mengembangkan modul elektronik materi Virus berbasis Android dengan integrasi nilai Islam untuk mempermudah pemahaman peserta didik. Pengembangan menggunakan model ADDIE (*Analyze, Design, Development, Implementation, dan Evaluation*) dan divalidasi oleh para ahli serta diuji coba kepada guru dan peserta didik. Data yang diperoleh melalui hasil validasi dan uji coba dianalisis secara kuantitatif dan kualitatif. Hasil validasi menunjukkan tingkat kelayakan sangat tinggi berdasarkan aspek materi, media dan nilai-nilai Islam yakni (98% ahli materi, 99% ahli media, 92% ahli nilai-nilai Islam). Hasil uji coba mencakup aspek materi, media dan nilai-nilai Islam memperoleh skor tinggi dari guru (93,7%) dan peserta didik (90,1%), menunjukkan e-modul sangat baik dan efektif dalam mendukung pembelajaran yang lebih menarik, fleksibel, dan bermakna dalam memahami materi Virus dan dapat digunakan dalam pembelajaran tatap muka maupun daring.

**Kata kunci:** Modul elektronik; Android; virus; nilai-nilai Islam.

### Abstract:

Innovation in education, including the use of electronic teaching materials, has been proven to enhance students' motivation and understanding, supported by advances in technology. However, the implementation of technology in learning remains less than optimal, as observed in Biology education. The topic of Viruses is often considered difficult because it is abstract and filled with scientific terminology, while learning still largely depends on textbooks without maximizing the use of technology. This study aims to develop an Android-based electronic module on Viruses integrated with Islamic values to facilitate students' understanding. The development process followed the ADDIE model (*Analyze, Design, Development, Implementation, and Evaluation*) and was validated by experts before being tested with teachers and students. Data obtained from validation and trials were analyzed both quantitatively and qualitatively. The validation results indicated a very high level of feasibility across material, media, and Islamic value aspects, with scores of 98% from material experts, 99%

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from media experts, and 92% from Islamic values experts. Trial results, which also covered aspects of material, media, and Islamic values, received high scores from both teachers (93.7%) and students (90.1%). These findings demonstrate that the e-module is highly effective and of excellent quality in supporting more engaging, flexible, and meaningful learning, particularly in understanding the concept of Viruses. Furthermore, the e-module can be utilized in both face-to-face and online learning environments.

**Keyword:** Electronic module; Android; virus; Islamic Values.

## 1. Introduction

The advancement of science and technology has led to innovations that support various aspects of human life, including the field of education. The development of information and communication technology has brought significant changes to the learning process, enabling broad access to learning materials through various digital platforms [1]. Electronic learning materials have become a primary necessity in education, as they help enhance students' motivation, comprehension, and learning effectiveness. However, the implementation of technology-based instructional materials requires specific techniques to ensure their optimal utilization [2].

One of the technologies that can be used in learning is the smartphone. Mobile learning offers a flexible solution for instructional materials, allowing students to learn anytime and anywhere [3]. Android has become a popular platform for developing technology-based learning materials because it is open-source and cost-effective [4].

In addition to technology, science and religion also play important roles in education [5]. The integration of Islam and science in education instils spiritual values in students, shaping individuals who are faithful and apply knowledge in accordance with Islamic teachings. Education is not solely aimed at enhancing intelligence but also at forming individuals who are devoted to Allah SWT. Through this approach, students come to understand that science and religion complement each other, thereby strengthening their faith in Islamic teachings [6].

The interview results with a Biology teacher for Phase E at Senior High School (SMAN) 2 Sekampung indicate that the topic of viruses is considered difficult to understand due to its abstract nature and the presence of numerous

scientific terms that require visualization to clarify concepts. However, learning is still dominated by textbooks, while the use of technology is rarely utilized, making its integration less optimal. Moreover, integrating Islamic values into virus-related content presents challenges, as teachers must connect complex scientific explanations such as viral replication, disease transmission, and vaccination with ethical and spiritual perspectives, including cleanliness, responsibility, and the obligation to seek treatment. This requires a careful balance between scientific accuracy and religious meaning, while also demanding creativity and appropriate pedagogical strategies due to the lack of supporting resources.

Technology plays a crucial role in education by enhancing interactivity, facilitating access to materials, and helping students grasp abstract concepts through visual media, videos, and interactive quizzes, which make learning more engaging and effective. Although students are allowed to use smartphones in learning, their utilization remains suboptimal. Moreover, the validity of the learning resources accessed by students is not consistently monitored. Therefore, teachers need to provide reliable references and make use of digital learning platforms to support more accurate and engaging understanding of the material [7].

The results of the needs assessment questionnaire indicated that students perceived the topic of viruses as uninteresting, even though they recognized the importance of understanding the material. The lack of engaging delivery methods contributed to their learning difficulties [8]. Students also expressed a desire for more interactive learning materials that are integrated with Islamic values. They hope for electronic learning resources that include images, videos, and interactive quizzes, so they can use them independently to better understand the topic of viruses.

Electronic modules are collections of instructional materials in digital format, systematically organized to support independent learning [9]. This module can be accessed through various devices such as computers, laptops, or smartphones, and it is designed using specialized software. Therefore, the use

of learning modules in the learning process encourages students to find solutions to problems through their own approaches [10]. An electronic module can include images, videos, and interactive quizzes to enhance students' understanding. This module is a modification of a regular module, incorporating the latest technology to make it more engaging and interactive. With multimedia features, the e-module allows students to interact more extensively with learning resources [11].

Electronic modules can be developed into Android-based applications to facilitate student access by using software such as Website 2 APK, which converts web files or HTML5 into applications without the need for coding. This integration enables students to learn flexibly and effectively [12]. This study aims to develop an e-module on the topic of viruses integrated with Islamic values. The development will be evaluated based on expert validation and student responses during the trial phase, with the expectation that it will enhance students' understanding of the virus material in a more engaging and meaningful way.

## **2. Research Method**

This research is a type of development research using the Research and Development (R&D) method and employs the ADDIE model, which includes the stages of analysis, design, development, implementation, and evaluation. This model was chosen because each stage incorporates evaluation to enhance the effectiveness of the product [13]. Data were collected through interviews, documentation, and questionnaires to assess the feasibility of the e-module based on evaluations from subject matter experts, media experts, Islamic values experts, as well as feedback from teachers and students.

Data analysis was conducted using descriptive qualitative and quantitative methods. Qualitative data were obtained through interviews with teachers and students, as well as feedback from validators who are lecturers at Universitas Muhammadiyah Metro. Meanwhile, quantitative data were gathered from expert validation questionnaires and responses from teachers and students using a five-category rating scale to determine the feasibility of the

e-module. The results of the analysis confirmed that the e-module effectively meets the learning needs [14].

The scores obtained were then converted into percentages to assess the feasibility of the e-module. The assessment was conducted using an instrument in the form of a questionnaire consisting of 20 items, which was distributed to validators, including subject matter experts, media experts, Islamic values integration experts, and teachers. In addition, a small group trial involving 30 students was also conducted. The aspects evaluated in this assessment included material feasibility, media quality, and the integration of Islamic values, with the percentages calculated using the following formula:

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

Information:

$P$  = percentage

$\Sigma x$  = total score obtained

$n$  = maximum possible score [15].

Based on the formula, the results obtained from the product validation and testing can be seen in the categories listed in Table 1 below.

**Table 1.** Expert Validation and Product Trial Categories

Score Scale	Percentage	Category	
		Expert Validation	Product Testing
5	84% – 100%	Very Suitable	Very Good
4	68% – 83,9%	Suitable	Good
3	52% – 67,9%	Fairly Suitable	Fair
2	36% – 51,9%	Less Suitable	Poor
1	20% – 35,9%	Very Unsuitable	Very Poor

### 3. Results and Discussion

#### a. Result

This research uses the ADDIE development model, which consists of five stages: analyze, design, development, implementation, and evaluation as follows.:

##### *Analyze*

An analysis is conducted to identify problems and find solutions in the development of teaching materials, which includes performance analysis, needs

analysis, and curriculum analysis [16]. The performance analysis through interviews indicates that teachers still predominantly use textbook-based methods, which results in less interactivity and limited use of technology. The needs analysis reveals that students have difficulty understanding the topic of viruses and prefer self-learning materials that include images, videos, and interactive quizzes. The curriculum analysis shows that SMA Negeri 2 Sekampung has implemented the Merdeka Curriculum in biology lessons, including the topic of Viruses.

### *Design*

The design of the e-module is developed through the stages of framework creation and storyboard development. The e-module framework includes an introduction, core material, assignments, quizzes, summaries, evaluations, glossary, and references [17]. The material consists of the history, characteristics, replication, classification, and roles of viruses, viroids, prions, and preventive actions [18]. Each topic is accompanied by Islamic values, biological concepts, and scientific news. The storyboard includes the selection of Freesans font in 14pt, a dominant blue color scheme, and the integration of images and four supporting videos. Assignments and quizzes are provided for each topic, consisting of five multiple-choice questions, while the final evaluation contains 20 questions. This e-module is designed to facilitate students' understanding of the topic of Viruses.

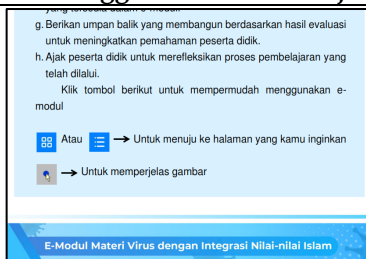
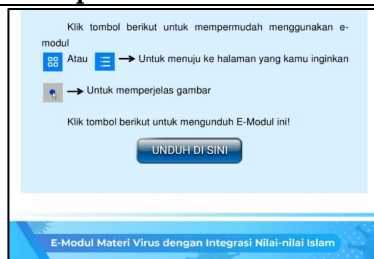
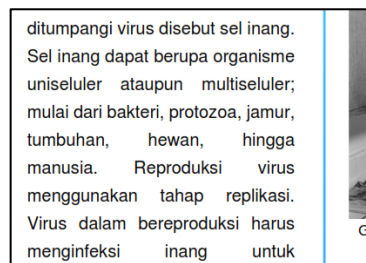
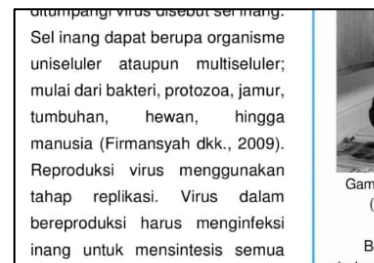
### *Development*

The development stage of the e-module involves the creation, publication, conversion into an Android application, and expert validation. The creation of the e-module is done using Microsoft Word 2021 for content and Adobe Illustrator CC 2017 for design, then saved in PDF format. Publishing is done using Flip PDF, adding interactive elements such as quizzes, videos, pop-up images, and a table of contents to facilitate navigation and understanding of the material [19]. Interactive quizzes allow learners to assess their understanding independently, while educational videos clarify concepts through visual and audio formats [20]. Pop-up images enlarge pictures to enhance readability, and the table of contents speeds up access to specific

sections of the e-module. After adding these interactive features, the e-module is converted into an HTML format and then transformed into an APK using Website 2 APK, making it installable on Android smartphones. With this format, the e-module becomes more practical, flexible, and interactive, allowing learners to study anytime and anywhere with easier access [21].

The developed e-module requires several improvements based on feedback from expert validators. From a content perspective, direct links to the e-module should be added in the user instructions to facilitate user access. Additionally, references or sources of information should be included to strengthen the accuracy of the content [22]. Answer keys for quizzes and evaluations also need to be provided to help users verify their understanding. In terms of Islamic values, the writing of verses and hadith should be included, along with improvements in the writing and selection of more relevant hadiths. Furthermore, Quranic verses supporting the material should be included to enrich the Islamic perspective. The following presents the revisions from the content, media, and Islamic values experts in Table 2.

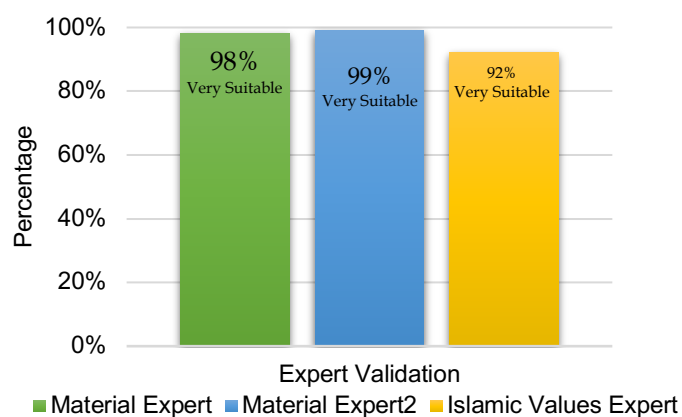
**Table 2.** The Revisions from The Content, Media, and Islamic Values Experts

Comments and Suggestions from Subject Matter Expert Validators			
<p>1. In the instructions for using the electronic module, add a link to the electronic module.</p>	 <p>Before Revision</p>	 <p>After Revision</p>	
	 <p>Before Revision</p>	 <p>After Revision</p>	

	<p>Vaksin : Mikroorganisme atau bagian dari mikroorganisme yang telah dilemahkan, kemudian disuntikkan ke tubuh orang sehat guna memperoleh sistem kekebalan secara aktif.</p> <p>Virion : Produk dari siklus replikasi virus yang lengkap setelah dilepaskan dari sel yang terinfeksi, mereka sepenuhnya mampu menginfeksi sel lain dari jenis yang sama.</p>	<table><tr><th colspan="4">KUNCI JAWABAN</th></tr><tr><th>Kuis 1</th><th>Kuis 2</th><th>Kuis 3</th><th>Kuis 4</th></tr><tr><td>1. A</td><td>1. E</td><td>1. B</td><td>1. D</td></tr><tr><td>2. B</td><td>2. A</td><td>2. E</td><td>2. B</td></tr><tr><td>3. E</td><td>3. B</td><td>3. C</td><td>3. E</td></tr><tr><td>4. D</td><td>4. C</td><td>4. D</td><td>4. A</td></tr><tr><td>5. C</td><td>5. D</td><td>5. A</td><td>5. C</td></tr></table> <table><tr><th colspan="4">EVALUASI</th></tr><tr><td>1. E</td><td>6. A</td><td>11. E</td><td>16. D</td></tr><tr><td>2. C</td><td>7. D</td><td>12. D</td><td>17. B</td></tr><tr><td>3. B</td><td>8. B</td><td>13. A</td><td>18. E</td></tr><tr><td>4. A</td><td>9. E</td><td>14. C</td><td>19. A</td></tr><tr><td>5. D</td><td>10. C</td><td>15. B</td><td>20. C</td></tr></table>	KUNCI JAWABAN				Kuis 1	Kuis 2	Kuis 3	Kuis 4	1. A	1. E	1. B	1. D	2. B	2. A	2. E	2. B	3. E	3. B	3. C	3. E	4. D	4. C	4. D	4. A	5. C	5. D	5. A	5. C	EVALUASI				1. E	6. A	11. E	16. D	2. C	7. D	12. D	17. B	3. B	8. B	13. A	18. E	4. A	9. E	14. C	19. A	5. D	10. C	15. B	20. C
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1. Adding verses to the hadith.	<p>Berikut merupakan beberapa upaya yang dicontohkan oleh Rasulullah SAW dan para sahabat dalam menangani wabah:</p> <p>1. Larangan Perjalanan dan Karantina</p> <p>Dalam hadits riwayat Bukhari, dari Abdurrahman bin Auf, Rasulullah SAW bersabda:</p> <p>"Apabila kamu mendengar wabah berjangkit di suatu negeri, janganlah kamu datang negeri itu. Dan apabila wabah itu berjangkit di negeri tempat kamu berada, maka janganlah keluar dari negeri itu karena hendak melarikan diri".</p> <p>2. Menjaga Jarak dan Menghindari Kontak</p> <p>Rasulullah SAW mengajarkan bahwa mereka yang sakit tidak boleh berinteraksi dengan masyarakat luas. Hal tersebut berlandaskan dari sebuah hadits riwayat Bukhari Muslim, Rasulullah SAW bersabda:</p> <p>"Jauhanlah orang yang terkena penyakit mendatangi orang yang sehat".</p>	<p>Berikut merupakan beberapa upaya yang dicontohkan oleh Rasulullah SAW dan para sahabat dalam menangani wabah:</p> <p>1. Larangan Perjalanan dan Karantina</p> <p>Dalam hadits riwayat Bukhari, dari Abdurrahman bin Auf, Rasulullah SAW bersabda:</p> <p>قَالَ رَسُولُ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ الطَّاعُونَ آيَةُ الْإِيمَانِ إِنَّهُ لَعَزَّ وَجَلَّ بِهِ نَاسًا مِنْ عِبَادِهِ فَإِذَا شِغِبَتْ بِهِ فَلَا تُدْخِلُوا عَلَيْهِ وَإِذَا وَقَعَ بِأَرْضٍ وَأَنْتُمْ بِهَا فَلَا تَقْرُبُوا مِنْهُ</p> <p>"Tha'un (wabah penyakit menular) adalah suatu peringatan dari Allah Subhanahu Wa Ta'ala untuk menguji hamba-hamba-Nya dari kalangan manusia. Maka apabila kamu mendengar penyakit itu berjangkit di suatu negeri, janganlah kamu masuk ke negeri itu. Dan apabila wabah itu berjangkit di negeri tempat kamu berada, jangan pula kamu lari daripadanya."</p> <p>2. Menjaga Jarak dan Menghindari Kontak</p>																																																				
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2. Correct spelling errors and add relevant hadiths	<p>Karena Rasulullah SAW bersabda, "Sakit demam itu menjauhkan setiap orang mukmin dan api neraka." (HR al-Bazzar)</p> <p>Hadis ini mengandung makna bahwa Allah menurunkan penyakit dan wabah bukan tanpa sebab, melainkan karena Allah menyayangi hamba-hambanya. Maka Allah akan turunkan bagi hambanya yang sangat disayanginya itu suatu penyakit agar hambanya itu senantiasa beristirahat dari segala lelahnya dunia yang hambanya itu hadapi, dan ketika hambanya itu sakit, maka jika hambanya itu bersabar dalam penyakit atau wabah yang Allah berikan terhadap hambanya tersebut, maka Allah senantiasa mengurangi dosa-dosa hambanya tersebut dan digantikannya dengan pahala.</p> <p>Hadis tersebut mengandung makna penting terkait nilai <b>akhlaq</b>, khususnya mengenai kesabaran, tawakal, dan keikhlasan dalam menghadapi ujian hidup, seperti penyakit atau wabah. Allah menurunkan penyakit sebagai bentuk kasih sayang-Nya kepada hamba-Nya, agar mereka dapat beristirahat sejenak dari kesibukan dunia dan merenung. Dalam akhlak Islam, sabar adalah sikap terpuji yang dicontohkan dalam menghadapi segala ujian hidup. (Mawardi, 2019: 100)</p>	<p>الحُمَى حَقٌّ كُلُّ مُؤْمِنٍ مِنَ الدَّاءِ</p> <p>Rasulullah SAW bersabda, "Sakit demam itu menjauhkan setiap orang mukmin dan api neraka." (HR al-Bazzar)</p> <p>Hadis ini menegaskan bahwa Penyakit bukan hanya ujian fisik, melainkan sarana penghapusan dosa dan pengingat untuk mendekatkan diri kepada Allah. Dengan sabar, tawakal, dan ikhlas, seorang mukmin tidak hanya meraih pengampunan dosa, tetapi juga derajat yang lebih tinggi di sisi-Nya. Selain itu, hadis lain menyebutkan:</p> <p>إِذَا مَرَسَ الْعَبْدُ أَوْ سَافَرَ، كَتَبَ لَهُ مِثْلُ مَا كَانَ يَفْعَلُ فَمِنْهُمَا صَاحِبُهَا</p> <p>"Jika seorang hamba sakit atau melakukan perjalanan, maka akan dicatat baginya pahala amalan yang biasa ia kerjakan saat sehat" (HR. Bukhari).</p> <p>Kedua hadis ini mengajarkan bahwa Allah tetap memberikan pahala kepada hamba-Nya meskipun tidak mampu melaksanakan ibadah karena sakit atau uzur. Penjelasan ini mencakup <b>nilai akidah</b>.</p>																																																				
	Before Revision	After Revision																																																				
3. Add relevant verses of the Koran.	<p>menyatakan mengenai kekuasaan atas alam ini sampai materi atau organisme yang paling kecil (zarah) disebutkan dalam surah As-Saba ayat 22.</p> <p>QS. As-Saba' Ayat 22</p> <p>قُلْ أَذْعُوا الَّذِينَ زَعَمُوا مِنْ دُونِ اللَّهِ لَا يَنْبُلُونَ مَقْضَلًا ذُرِّيًّا فِي السَّمَوَاتِ وَلَا فِي الْأَرْضِ وَمَا لَهُمْ فِيهِمْ مِنْ شَيْءٍ وَمَا لَهُمْ مِنْهُمْ مِنْ شَيْءٍ ۝</p> <p>22. Katakanlah: "Serulah mereka yang kamu anggap (sebagai tuhan) selain Allah, mereka tidak memiliki (kekuasaan) seberat zarrahpun di langit dan di bumi, dan mereka tidak mempunyai suatu sahupun dalam (penciptaan) langit dan bumi dan sekali-kali tidak ada di antara mereka yang menjadi pembantu bagi-Nya."</p> <p>Ayat QS. As-Saba' ayat 22 mengandung makna penting mengenai <b>nilai akidah</b>, karena dapat diketahui dengan jelas bukti</p>	<p>QS. Al-Furqan Ayat 2</p> <p>أَلَمْ يَلِدْ لَهُم مَّا كُنْتُمْ تُعْبَدُونَ وَالْأَرْضُ وَلَهُمْ يَتَخِفُّونَ لَهَا وَلَمْ يَكُنْ لَهَا شِرْكٌ فِي أَلْمَلِكِ وَخَلَقَ كُلَّ شَيْءٍ فَقْدَرَهُ تَقْدِيرًا ۝</p> <p>2. yang kepunyaan-Nya-lah kerajaan langit dan bumi, dan Dia tidak mempunyai anak, dan tidak ada sekutu bagi-Nya dalam kekuasaan(Nya), dan dia telah menciptakan segala sesuatu, dan Dia menetapkan ukuran-ukurannya dengan serapi-rapinya.</p> <p>Melalui ayat ini, Allah menunjukkan bahwa semua ciptaan-Nya, termasuk virus, diciptakan dengan ukuran, fungsi, dan peran tertentu yang sangat rapi. Virus bukan hanya objek studi ilmiah, tetapi juga mengingat spiritual bagi manusia. Pandemi yang disebabkan oleh virus seperti SARS-CoV-2 telah menunjukkan betapa rentannya manusia terhadap kekuasaan Allah yang Maha Kuasa.</p>																																																				
	Before Revision	After Revision																																																				

After the e-module has been successfully converted into an Android application, the next step is to consult the e-module with validators, consisting of content experts, media experts, and experts in Islamic values from lecturers at Muhammadiyah University of Metro. This validation process aims to assess the e-module based on aspects of content, media, and Islamic values. The results

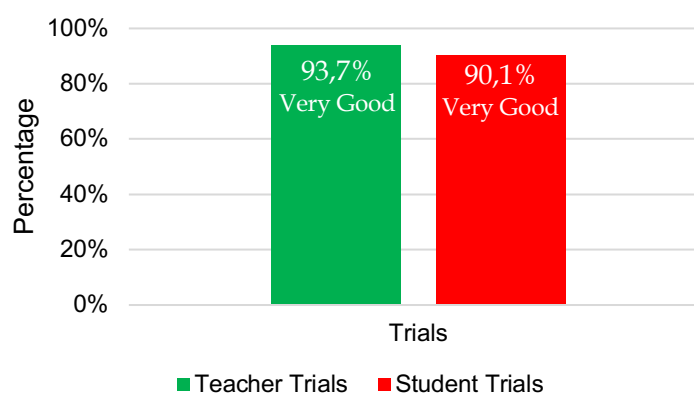
of the expert validation are presented visually through a bar chart, as shown in Figure 1 below.



**Figure 1.** Expert Validation Results for Material, Media and Islamic Values

### *Implementation*

The trial phase of the Android-based e-module was conducted at SMA Negeri 2 Sekampung, involving a biology teacher and 30 students who had studied the topic of viruses. The purpose of this trial was to assess the responses of the teacher and students towards the e-module, particularly regarding the feasibility of the media, the quality of the content, and the integration of Islamic values, to determine whether the e-module meets the criteria of being "very good" or not. The results of the teacher and student response questionnaires are presented visually through a bar chart shown in Figure 2 below.



**Figure 2.** Results of Teacher and Student Trials

### ***Evaluation***

The evaluation stage, as the final step in the ADDIE model, is conducted by revising the e-module based on feedback and suggestions from expert validators in content, media, and the integration of Islamic values, as well as the results from teacher and student responses during the implementation stage.

### **b. Discussion**

This Android-based e-module is developed to support the learning of Virus Phase E material in high school by using Website 2 APK, which converts HTML pages into an Android application. The module is designed to be accessible without an internet connection after installation, providing flexibility for learners to study anywhere and anytime [23].

The validation results indicate that the module is highly suitable for use, with a feasibility rating of 98% from subject matter experts, 99% from media experts, and 92% from experts on Islamic values. Trials with teachers and learners also yielded high scores of 93.7% and 90.1%, respectively, both categorized as "very good," reinforcing its quality in supporting the learning process.

The main advantage of this module is the integration of multimedia elements such as text, videos, interactive quizzes, and pop-up images, which aid in visualizing the abstract concept of viruses. As an educational innovation, this module provides a more interactive and engaging learning experience, allowing learners to adjust the learning pace according to their needs [24]. In addition, the module integrates Islamic values by linking the concept of viruses with the teachings of qadarullah (divine will) and the importance of maintaining health. Learners are encouraged to understand the wonders of Allah's creation through the structure of viruses and the wisdom behind their existence, making the learning experience more meaningful both academically and religiously [25].

According to Pribowo et al. (2024), compared to other teaching materials, this e-module has advantages in terms of offline availability, integration of Islamic values, and interactive features that make learning more dynamic than

traditional printed or PDF modules [26]. However, limitations such as reliance on Android devices remain a challenge.

Overall, this module provides significant benefits in enhancing learners' understanding of virus-related material, while also shaping their religious character. With its strengths in access flexibility, interactivity, and integration of Islamic values, this module can serve as a model for future digital developments.

#### **4. Conclusion**

The developed e-module has been validated by content experts, media experts, and experts in Islamic values with the category of "very feasible." Teachers provided a "very good" response, covering aspects of content, media, and Islamic values, and assessed the module as suitable for use without any revisions. The results of the student survey indicate a "very good" category. The strength of this module lies in its systematic and interactive presentation of teaching materials, supporting both face-to-face and online learning, and contributing to addressing learning challenges by providing comprehensive learning resources. Based on expert validation as well as feedback from teachers and students, this e-module is considered excellent and suitable for use in learning.

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