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DEVELOPMENT OF ANDROID-BASED INTERACTIVE LEARNING MEDIA USING ISPRING SUITE 11 AND QR CODES ON THE HUMAN IMMUNE SYSTEM MATERIAL FOR GRADE XI HIGH SCHOOL STUDENTS

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ABSTRACT

The advancement of technology in education demands innovations in learning media that can enhance students' motivation, interaction, and understanding. In the topic of the Human Immune System, students often struggle to grasp abstract concepts such as immune mechanisms, antigen–antibody interactions, and physiological responses, while learning facilities at school remain limited and lecture-based methods still dominate the learning process. iSpring Suite 11 offers a solution because it enables the development of interactive learning media that can be easily accessed via Android devices, equipped with materials, videos, animations, and quizzes, and can be flexibly distributed through QR Codes. This study aims to produce high-quality Android-based interactive learning media using iSpring Suite 11 and QR Codes for Grade XI students on the Human Immune System topic. The research employed the ADDIE development model with assessment instruments in the form of validation questionnaires and student response questionnaires using a Likert scale. Evaluations were conducted by material experts, media experts, and students during a limited trial stage. The results showed that the developed interactive learning media obtained an average quality score of 3.68, categorized as very good, covering aspects of content feasibility, appearance, interactivity, ease of use, and usefulness in supporting learning. Therefore, the Android-based media using iSpring Suite 11 and QR Codes is classified as having very good quality and is suitable for use in the learning process.

Keywords: Interactive learning media; iSpring Suite 11; Android; QR Code; Immune system.

INTRODUCTION

The development of technology in the field of education encourages the need for innovative learning media that are more effective and engaging for students. Modern learning not only focuses on delivering content but also emphasizes active interaction between students and the learning material. The role of technology in learning is to foster collaborative relationships and construct meaning within contexts that are easier to understand. Educational technology contributes to achieving quality education by providing learning facilities through systematic planning, utilization, development, management, and evaluation of learning resources; addressing existing learning problems through comprehensive analysis that integrates various disciplines; utilizing technology to make tasks more effective and efficient, both as products and as processes to solve learning challenges; and offering alternative solutions for problem-solving (Nurilahwaty, 2022).

Advancements in information and communication technology provide significant opportunities for developing interactive learning media that can be accessed flexibly by students. To optimize the use of interactive media, intensive training for teachers and adequate technological infrastructure in schools are required (Hasani et al., 2025). Therefore, the development of interactive learning media is not only an alternative but also a strategic necessity in efforts to improve the quality of education that is adaptive to the changing times.

On the other hand, the use of interactive learning media in schools is still not optimal. Many teachers continue to rely on lecture-based methods due to limited facilities such as projectors. In the topic of the Human Immune System, this condition further challenges students because the material is abstract and difficult to visualize. Amalia (2019) revealed that students struggle to understand terminology related to the immune system. Dewi et al. (2023) also reported a high level of misconceptions regarding this topic.

iSpring Suite 11 offers a solution as a user-friendly and flexible tool for developing interactive learning media. Khotimah et al. (2019) stated that iSpring can integrate various multimedia elements to enhance students' learning engagement. Anistalidia et al. (2021) also noted that media created through iSpring can be published in easily accessible formats, including those compatible with mobile devices.

Based on these issues, this study was conducted to develop high-quality Android-based interactive learning media using iSpring Suite 11 and QR Codes for Grade XI students on the topic of the Human Immune System.

RESEARCH METHODS

This study employed a Research and Development (R&D) approach using the ADDIE model (Analyze, Design, Development, Implementation, Evaluation) developed by Dick and Carey (1996). The research was carried out up to the development stage, conducted from April to August 2025 in three locations: the Biology Education Study Program, Department of Mathematics and Natural Sciences Education, FKIP, University of Riau for product design, revisions, and expert validation; SMA Negeri 2 Tambang for teacher validation as well as limited trials phase 1 and phase 2; and SMA Negeri 12 Pekanbaru for validation by a biology teacher. A limited trial phase 1 was conducted with 10 twelfth-grade students who had previously studied the immune system topic. The limited trial phase 2 involved 35 eleventh-grade students who were currently learning the same topic. This study aimed to develop high-quality Android-based interactive learning media using iSpring Suite 11 and QR Codes for the immune system material.

Trial Subjects

The subjects of this study were the Grade XI Biology learning materials, specifically the Human Immune System topic, with the Learning Outcomes (CP) requiring students to understand cell structure; cell division; membrane transport; metabolism and protein synthesis; Mendel's laws and patterns of heredity; growth and development; evolutionary theory and its relation to current and past biodiversity as well as climate change; and the relationship between organ structure and function in responding to internal and external stimuli. This study developed learning media consisting of three instructional sessions.

Types and Sources of Data

This study used both quantitative and qualitative data. Quantitative data were obtained from validation scores and responses from the limited trials using a Likert scale (1–4). Qualitative data were derived from suggestions written on expert validation sheets and student response questionnaires. The data sources consisted of primary and secondary data. Primary data were

obtained from expert validators, biology teachers, and students. Secondary data were obtained from documentation of validation results and response questionnaires.

Data Collection Instruments

The data collection instruments used in this study were validation sheets in the form of questionnaires, which were employed to determine whether the developed product was valid or not. The validation sheets consisted of a material expert validation sheet, a media expert validation sheet, and a student response questionnaire.

Validation Sheet

Media Expert Validation Sheet

The following is the instrument blueprint table for the interactive learning media expert validation sheet.

Table 1. Blueprint of the Media Expert Validation Instrument

No	Aspect	Number of Items	Item Number
1	Media Presentation	10	1,2,3,4,5,6,7,8,9,10
2	Pedagogy and Content Feasibility	10	11,12,13,14,15,16,17,1819,20
3	Ease of Use and Media Feasibility	7	21,22,23,24,25,26,27
4	Language Quality	3	28,29,30

(Source: Wahono, 2006)

Material Expert Validation Sheet

The following is the blueprint table for the material expert validation instrument.

Table 2. Blueprint of the Material Expert Validation Instrument

No	Aspect	Number of Items	Item Number
1	Content Feasibility	18	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18
2	Presentation Feasibility	9	19,20,21,22,23,24,25,26,27
3	Language Quality	3	28,29,30

(Source : Badan Standar Nasional Pendidikan (BSNP), 2014).

Student Response Questionnaire

A limited trial phase 1 was conducted with 10 twelfth-grade students, and a limited trial phase 2 was conducted with 35 eleventh-grade students. Both classes were given the questionnaire and the media during the limited trials to assess students' responses to the developed media.

Table 3. Blueprint of the Student Response Questionnaire Instrument

No	Aspect	Number of Items in the Validation Sheet	Item Number
1	Content Feasibility	6	1,2,3,4,5,6
2	Feasibility of Content	8	7,8,9,10,11,12,13,14
3	Media Practicality	3	15,16,17
4	Language Quality	3	18,19,20

(Source : Arikunto, 2006)

Data Collection Techniques

The data in this study were obtained through the completion of validation sheets and response questionnaires during the limited trials. The validation process was carried out by expert teams according to their respective fields. The validation sheets were completed by assigning scores using a Likert scale and providing suggestions for media improvement. The average validation results served as the research data source. After the validation process was completed, the first limited trial was conducted with 10 twelfth-grade students, followed by the second limited trial with 35 eleventh-grade students. These limited trials were accompanied by the completion of response questionnaires by the students.

Data Analysis Techniques

The method used in processing the data was descriptive analysis, which aimed to describe the assessment results provided by the validators after completing the validation process. The aspects evaluated by the validators were presented in the form of a rating scale. A Likert scale with a value

range of 1–4 was used. This scale allowed validators to provide varied assessments of the developed learning media.

Validation by Validators

Validation by the validators aimed to assess whether the developed learning media was feasible and aligned with educational needs. Material experts focused on examining the suitability of the content with the learning objectives and the quality of language usage. Meanwhile, media experts evaluated the technical aspects and the visual presentation of the media to ensure its effective use in learning. In addition, the validation process provided feedback and recommendations for improvements to refine the product before wider implementation. The categories assigned by the validators are presented in Table 4 below.

Table 4. Validation Sheet Assessment Categories by Validators

No	Assessment Categories	Score
1	Disagree	1
2	Somewhat Disagree	2
3	Agree	3
4	Strongly Agree	4

(Source: Sugiyono, 2021)

Then, the obtained data were analyzed using the following formula:

$$M = \frac{\Sigma F\chi}{N}$$

(Source: Sugiyono, 2021)

Description:
M = Average score
Fx = Frequency of each response
N = Number of components/validation samples

The validity measurement scale used in this study employed intervals, which can be seen in Table 5 below.

Table 5. Product Validity Criteria

No	Average Score Interval	Category
1	$3.25 \leq X < 4$	Highly Valid
2	$2.5 \leq X < 3.25$	Valid
3	$1.75 \leq X < 2.5$	Less Valid
4	$1 \leq X < 1.75$	Invalid

(Source: Sugiyono, 2021)

Limited Trial with Students

The limited trial in the development of learning media aimed to collect initial feedback from students regarding the practicality, ease of use, and appeal of the developed media. This stage was conducted with a small group of students to assess the extent to which the media could be effectively used in the learning process. The trial was conducted in two phases: limited trial phase 1 and limited trial phase 2. A Likert scale with a score range of 1–4 was used. The categories for the limited trial based on student responses can be seen in Table 6 below.

Table 6. Assessment Categories by Limited Trial Respondents

No	Assessment Categories	Score
1	Disagree	1
2	Somewhat Disagree	2
3	Agree	3
4	Strongly Agree	4

(Source: Sugiyono, 2021)

Next, to determine the results of the limited trial, the following formula can be used:

$$M = \frac{\Sigma F\chi}{N}$$

(Source: Sugiyono, 2021)

Description:
M = Average score
Fx = Frequency of each response
N = Number of components/validation samples

The criteria for determining the results of the limited trial can be seen in Table 7 below:

Table 7. Limited Trial Criteria

No	Average Score Interval	Category
1	$3.25 \leq X < 4$	Very Good
2	$2.5 \leq X < 3.25$	Good
3	$1.75 \leq X < 2.5$	Fair
4	$1 \leq X < 1.75$	Poor

(Source: Sugiyono, 2021)

Product Quality Test

The quality of the interactive learning media product that has been developed is determined based on the average results of the media expert validation, material expert validation, limited trial stage 1, and the average results of limited trial stage 2, which are calculated using the mean score formula as follows:

$$M = \frac{\Sigma F\chi}{N}$$

Description:
M = Mean score
Fx = Score obtained from the media expert validation, material expert validation, limited trial stage 1, and limited trial stage 2
N = Number of samples

Table 8. Product Quality Criteria

No	Average Score Interval	Category
1	$3.25 \leq X < 4$	Very Good
2	$2.5 \leq X < 3.25$	Good
3	$1.75 \leq X < 2.5$	Fair
4	$1 \leq X < 1.75$	Poor

(Source: Sugiyono, 2021)

To evaluate the overall quality of the media, it is necessary to assess all criteria or evaluation aspects. All data analysis results obtained are used as the basis for determining the quality of the developed learning media. The media product is considered feasible if the overall quality score falls at least within the "good" category.

RESULTS AND DISCUSSION

Results

Media Validation Results

Table 9. Media Expert Validation Results

No	Aspect	Mean per Session			Average	Category
		1	2	3		
1.	Media Presentation	3,93	3,87	3,87	3,89	**SV**
2.	Pedagogy and Content Feasibility	3,83	3,63	3,73	3,73	**SV**
3.	Ease of Operation and Feasibility of the Learning Media	3,81	3,85	3,76	3,81	**SV**
4.	Language Quality	3,67	3,67	3,67	3,67	**SV**
	Total	15,24	15,02	15,03	15,1	
	Average	**3,81**	**3,76**	**3,75**	**3,78**	**SV**

Description: SV = Very Valid

Based on Table 9, the aspect that obtained the highest average score was the Media Presentation aspect, with an average of 3.89, categorized as very valid. This was followed by the aspect of Operational Ease and Feasibility of the Learning Media, with an average of 3.81, also categorized as very valid. Overall, the validation aspects obtained an average score of 3.78, which falls into the very valid category.

Material Validation Results

Table 10. Material Expert Validation Results

No	Aspct	Mean per Session			Average	Category
		1	2	3		
1.	Content Feasibility	3,81	3,74	3,81	3,78	**SV**
2.	Presentation Feasibility	3,78	3,85	3,78	3,81	**SV**
3.	Language Quality	4,00	4,00	3,89	3,96	**SV**
	Total	11,59	11,59	11,48	11,55	
	Average	**3,86**	**3,86**	**3,82**	**3,85**	**SV**

Description: SB = Very good

The overall results of the material validation showed a validation score of 3.78, categorized as very valid, and the overall aspects of the second material validation obtained a score of 3.85, also categorized as very valid. These results indicate that the Interactive Learning Media product developed using Android, iSpring Suite 11, and QR Codes is feasible to proceed to the limited trial stage.

Limited Trial Stage 1 Results

Table 11. Limited Trial Stage 1 Results

No	Aspect	Average per Meeting			Average	Category
		1	2	3		
1.	Content Feasibility	3,65	3,61	3,63	3,63	SB
2.	Media Feasibility	3,75	3,73	3,78	3,75	SB
3.	Practicality in Accessing the Media	3,57	3,67	3,67	3,64	SB
4.	Linguistic Quality	3,67	3,8	3,77	3,75	SB
	Total	14,64	14,81	14,85	14,76	
	Average	**3,66**	**3,70**	**3,71**	**3,69**	**SB**

Keterangan : SB = Very good

Based on Table 11, it can be seen that the highest average score in the limited trial stage 1 was obtained in the Media Feasibility and Linguistic Quality aspects, with an average score of 3.75, categorized as very good. This was followed by the Content Feasibility and Practicality in Accessing the Media aspects, with an average score of 3.64, also categorized as very good. These results indicate that the product is ready to proceed to limited trial stage 2.

Limited Trial Stage 2 Results

Table 12. Limited Trial Stage 2 Results

No	Aspect	Average per Meeting			Average	Category
		1	2	3		
1.	Content Feasibility	3,36	3,31	3,35	3,34	**SB**
2.	Media Feasibility	3,08	3,15	3,11	3,11	**B**
3.	Practicality in Accessing the Media	3,17	3,05	3,02	3,08	**B**
4.	Linguistic Quality	3,41	3,46	3,46	3,44	**SB**
	Total	13,02	12,97	12,94	13,59	
	Average	**3,25**	**3,24**	**3,23**	**3,39**	**SB**

Description : SB = Very good

Based on Table 4.14, it can be seen that the highest average score in the limited trial stage 2 was obtained in the Linguistic Quality aspect, with an average score of 3.44, followed by the Content Feasibility aspect, with an average score of 3.34.

Product Quality Test Results of the Learning Media

Table 13. Product Quality Test Results of the Learning Media

Quality Aspects	Average	Description
Media Validity Test	3,78	SB
Material Validity Test	3,85	SB
Limited Trial Stage 1	3,69	SB
Limited Trial Stage 2	3,39	SB
Average	**3,68**	**SB**

Description : SB = Very good

Based on Table 13, it can be seen that the quality score obtained from the media validity test, material validity test, limited trial stage 1, and limited trial stage 2 was 3.68, which falls into the very good category. This indicates that the Interactive Learning Media can be used as instructional material and as a learning tool for students.

Discussion

The development of Android-assisted interactive learning media using iSpring Suite 11 and QR Codes for the immune system material was assessed as highly valid based on the results of media and material expert validation, as well as limited trials conducted with students. Several key aspects were analyzed, including media presentation, content and pedagogical feasibility, ease of operation, language quality, and user responses.

Media Validation

Media Presentation Aspect

The developed media displays an attractive and interactive visual design. The use of Canva and iSpring Suite 11 helps produce an aesthetic yet functional appearance. The innovative integration of iSpring Suite 11 and QR Codes adds value by providing quick access to videos, quizzes, and other supporting content, thereby increasing engagement and independent exploration. This aligns with Ramadhan et al. (2023), who stated that the use of QR Codes in iSpring Suite 11–based learning media enhances student learning interest and interactivity. The average score of 3.89 in this aspect indicates that the media meets the criteria of being highly valid, with the highest score obtained in the first meeting. This means the media is capable of presenting information systematically, attractively, and in a way that is easy to follow. The media designed using iSpring Suite 11 aligns with the characteristics of today's learners, equipped with interactive digital features and appealing visuals. It is believed to contribute positively to the effectiveness of the learning process and to students' learning motivation.

Pedagogical Aspects and Content Feasibility

The pedagogical aspect obtained an average score of 3.73 (highly valid), indicating that the media aligns with the curriculum, learning outcomes, and instructional objectives. The inclusion of components such as identity, concept maps, learning objectives, and interactive evaluations helps students follow the learning flow systematically. This is supported by Mahendra & Agustiana (2024), who noted that explicit learning objectives in digital media facilitate self-regulated learning. The integration of videos, quizzes, and crossword puzzles also stimulates student engagement, curiosity, and critical thinking (Huzaifah et al., 2023), making the media not only informative but also educational and applicable. The use of instructional videos plays an important role in enhancing content quality, as videos are effective in illustrating abstract concepts, particularly in biology. The integration of videos with quizzes and crossword puzzles as reinforcement tools adds further value to content feasibility.

Ease of Operation and Media Feasibility

This aspect received an average score of 3.81 (highly valid). iSpring Suite and QR Codes enable users to access learning materials without technical barriers, supporting flexible and independent learning. The media is easy to use on smartphones as well as laptops, which is suitable for today's digital learning environment. These findings align with Permana & Hazizah (2024), who emphasized that QR Code–based media create an efficient learning experience and adapt well to current educational technology developments. Ease of operation is associated with the extent to which media can be accessed without requiring complex technical skills. The QR Codes allow students to instantly access iSpring Suite 11 content containing materials, videos, quizzes, and crossword puzzles. Handayani & Haryati (2023) also noted that the use of QR Codes in learning media improves access efficiency and fosters students' learning independence.

Linguistic Aspect

The linguistic aspect received an average score of 3.67 (highly valid), indicating that the language used in the media is communicative, adheres to standard writing rules, and is easy for high school students to understand. The use of biological terminology is consistent and accurate, while still presented in a simplified manner to avoid student confusion. This aligns with Sari & Lestari (2023), who stated that clear and concise language in learning media enhances comprehension.

Material Validation

Content Feasibility Aspect

The material content validity score of 3.78 indicates that the media meets the criteria of accuracy, relevance, currency, and connection to real-life contexts. The material is arranged contextually and systematically to support the achievement of Learning Outcomes (CP). This aligns with Ervina et al. (2021), who emphasized that the feasibility of learning media content is determined by its alignment with the curriculum and learner needs. The validation results show that the media effectively meets these four indicators. The content does not only emphasize theoretical aspects but is also connected to real-life contexts, making it easier to understand and meaningful for students. As'ari (2019) stated that content feasibility in instructional materials must include accuracy, currency, and real-life relevance to foster student learning motivation.

Presentation Feasibility Aspect

The presentation aspect received an average score of 3.81 (highly valid). The material is presented systematically, accompanied by visualizations, navigation buttons, and formative evaluations such as quizzes and crossword puzzles. Such presentation has been proven to enhance motivation, conceptual understanding, and student engagement (Erin et al., 2025). Kusumawati (2021) noted that presentation aspects in instructional material development must consider structure, coherence, and attractiveness to ensure that materials are easy to understand and support active student involvement. Sequential material presentation helps students build understanding step-by-step, while engaging presentation increases students' focus during learning. Visual and interactive elements also improve student attention and comprehension.

Linguistic Aspect of the Material

The language used in the material was rated highly valid with an average score of 3.96. The sentences are effective, concise, and appropriate for learners in the formal operational cognitive stage. The use of simple scientific language helps students avoid misconceptions and understand abstract biological concepts.

Limited Trial Stage 1

Based on the analysis results, the overall average score of student responses to the learning media falls into the very good category. This indicates that students generally considered the developed media capable of presenting learning material clearly, attractively, and in line with the intended learning objectives. Material presentation in learning media must consider coherence, clarity of flow, and alignment with learning outcomes so that learners can more easily understand the content (Kusumawati, 2021). The inclusion of concept maps and learning outcomes in this media supports presentation feasibility.

The visual appearance of the media also received positive responses. Students noted that the media has an attractive design, appropriate color selection, and a layout that is not confusing. Additional illustrations, videos, quizzes, and crossword puzzles enhance media appeal and encourage active engagement.In terms of ease of operation, students also responded positively. The embedded QR Codes make it easy for users to directly access learning content without complicated steps.

Muttaqin et al. (2021) emphasized that ease of access in digital learning media increases user interest in utilizing it for learning activities. Thus, it can be concluded that the Android-assisted interactive learning media developed using iSpring Suite 11 and QR Codes meets the criteria of being highly feasible based on the stage 1 trial.

Limited Trial Stage 2

Based on the limited trial stage 2 conducted with high school students, the average score across the four observed aspects was 3.39, categorized as very good. This indicates that the Android-assisted interactive learning media developed using iSpring Suite 11 and QR Codes is considered feasible and can be used as an alternative media for teaching biology, particularly in the immune system topic.

These results show an improvement in quality compared to the previous stage, although some aspects still received relatively lower scores. Overall, stage 2 results demonstrate that the Android-

based interactive learning media meets feasibility criteria in terms of content, appearance, language, and practicality.

Product Quality Test

The quality of the Android-assisted interactive learning media developed using iSpring Suite and QR Codes on the immune system topic was obtained from the average scores of validator assessments and the average scores from limited trial stage 1 and stage 2. The stage 1 limited trial obtained an average score of 3.67 (very good). The stage 2 limited trial obtained an average score of 3.39 (very good).

CONCLUSION

Based on the results of the research on the development of Android-assisted Interactive Learning Media using iSpring Suite 11 and QR Codes on the topic of the Human Defense System for Grade XI Senior High School, it can be concluded that the learning media has a very good quality, with an average score of 3.68. This indicates that the developed media is suitable to be used as a learning medium in schools.

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