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Design Media Learning Digital Game Based Learning (DGBL) Based on Quizizz in Basic Electronics Course

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Abstract

This study aims to design and test the feasibility of Digital Game-Based Learning (DGBL) learning media based on the Quizizz application in the Basic Electronics course. The research method used is Research and Development (R&D) with a 4D development model. In the define stage, an analysis of needs, student characteristics, learning outcomes, and learning problems is carried out. The design stage is carried out through the preparation of quiz designs, selection of Quizizz features, preparation of assessment instruments, and adjustment of materials to learning indicators. The develop stage produces interactive quiz media, and is tested on a limited basis with students through a response questionnaire. The validation results show that the learning media obtained a feasibility percentage of 94% from material experts and 90% from media experts with a very feasible category. Meanwhile, the results of student responses obtained an overall percentage of 84.58% with a very good category. These findings indicate that the Quizizz-based DGBL learning media is worthy of being used as an alternative learning media. This media is able to support conceptual understanding, increase motivation, strengthen student involvement, and encourage independent learning in an interactive and fun way.

Keywords: *Digital Game-Based Learning, Quizizz, Basic Electronics*

Abstract

Penelitian ini bertujuan untuk merancang dan menguji kelayakan media pembelajaran Digital Game-Based Learning (DGBL) berbasis aplikasi Quizizz pada mata kuliah Dasar Elektronika. Metode penelitian yang digunakan adalah Research and Development (R&D) dengan model pengembangan 4D. Pada tahap define dilakukan analisis kebutuhan, karakteristik mahasiswa, capaian pembelajaran, dan permasalahan pembelajaran. Tahap design dilakukan melalui penyusunan rancangan kuis, pemilihan fitur Quizizz, penyusunan instrumen penilaian, serta penyesuaian materi dengan indikator pembelajaran. Tahap develop menghasilkan media kuis interaktif, serta diuji secara terbatas kepada mahasiswa melalui angket respon. Hasil validasi menunjukkan bahwa media pembelajaran memperoleh persentase kelayakan sebesar 94% dari ahli materi dan 90% dari ahli media dengan kategori sangat layak. Sementara itu, hasil respon mahasiswa memperoleh persentase keseluruhan sebesar 84,58% dengan kategori sangat baik. Temuan ini menunjukkan bahwa media pembelajaran DGBL berbasis Quizizz layak digunakan sebagai alternatif media pembelajaran. Media ini mampu mendukung pemahaman konsep, meningkatkan motivasi, memperkuat keterlibatan mahasiswa, serta mendorong kemandirian belajar secara interaktif dan menyenangkan.

Kata Kunci: Digital Game Based Learning, Quizizz, Dasar Elektronika.

Introduction

Learning media is an important component in the learning process, serving as a tool to help convey material so that it is easier for students to understand. The use of appropriate learning media can increase student interest, motivation, and engagement in learning activities[1]. Furthermore, learning media also plays a role in helping teachers convey abstract and theoretical material so that it can be understood more concretely [2]. In higher education, particularly in the Basic Electronics course, students often experience difficulties in understanding basic electronics concepts, such as the introduction of electronic components and the working principles of circuits. Basic electronics material requires learning media that can visualize concepts to make them easier for students to understand [3]. However, in practice, the learning process is still often dominated by lecture methods with limited interactive learning media, so that student interaction and understanding are not optimal.

The development of digital technology has encouraged the use of technology-based learning media as an alternative to improve the quality of learning [4-5]. One approach that can be implemented is Digital Game-Based Learning (DGBL), a learning method that integrates game elements into an educational context to create a more interactive and enjoyable learning environment [6]. However, previous research has shown that the use of DGBL tends to be limited to increasing motivation and learning engagement, and is more often used as an evaluation tool than as an integrated learning tool. Furthermore, the application of DGBL in engineering, particularly in Basic Electronics courses in universities, is still relatively limited, so it has not contributed significantly to improving in-depth conceptual understanding.

One widely used Digital Game-Based Learning learning medium is the Quizizz application. Quizizz is a game-based learning platform that can be used as a medium for interactive learning practice and evaluation and can be accessed flexibly via mobile devices [7]. Several studies have reported that using Quizizz can increase student interest and engagement [8][6] However, most of these studies still focus on the use of Quizizz as a learning evaluation tool and have not examined its development as a learning medium that is systematically designed and integrated with lecture materials. Therefore, it is necessary to develop DGBL-based learning media using Quizizz that functions not only as an evaluation tool but also as a learning tool that can improve students' conceptual understanding, particularly in the Basic Electronics course.

Based on the description, it can be identified that there are still limitations in the availability of interactive, contextual learning media, and are able to facilitate optimal understanding of concepts in the Basic Electronics course. In addition, the use of Digital Game-Based Learning (DGBL) through the Quizizz application in learning has not been optimized as an integrated learning medium, but is more widely used as an evaluation tool. This condition indicates a need for the development of DGBL-based learning media that is designed systematically and in accordance with the characteristics of the material and the needs of students. Therefore, this study aims to design and validate Quizizz-based DGBL learning media in the Basic Electronics course to improve the effectiveness of learning and students' understanding of concepts [9].

Method

This study uses a quantitative Research and Development (R&D) method [10]. The development model used is the 4D model (Define, Design, Develop, and Disseminate) [11] which is applied to develop Quizizz-based *Digital Game-Based Learning* (DGBL).

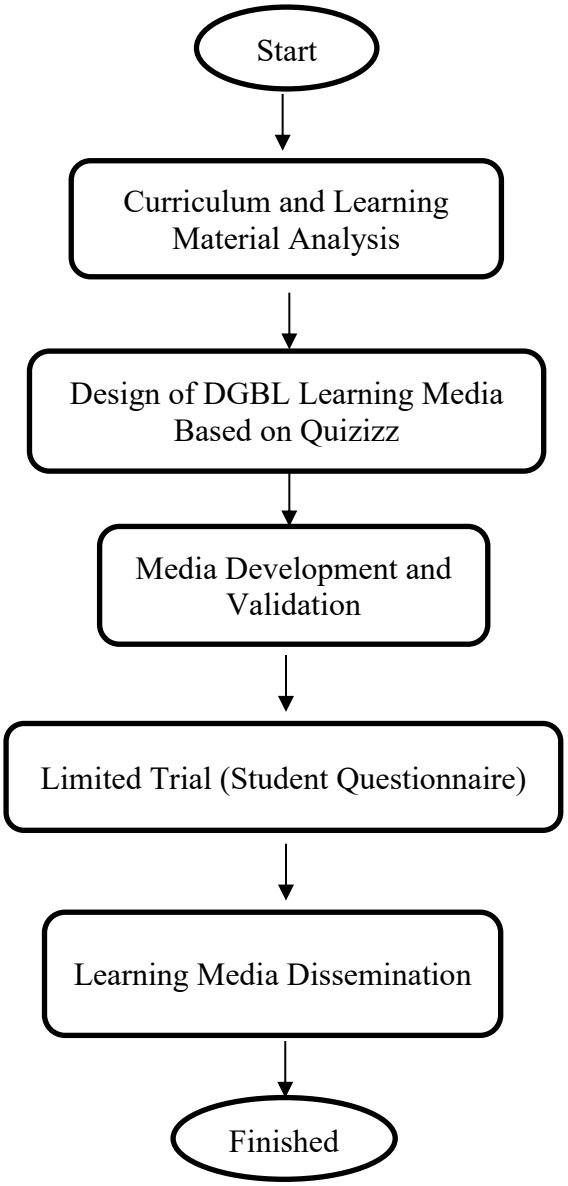


Figure 1. DGBL Learning Media Research Flow.

This learning media in the Basic Electronics course, because this model has systematic stages and is suitable for developing learning media [12]. The flow of learning media development stages based on the 4D model [13] can be seen in Figure 1. The description of the research stages in Figure 1 is as follows:

1. Curriculum Analysis and Learning Materials (Define)
   The define stage in the 4D development model is the initial stage or planning stage in the learning media development process [14]. This stage begins with an analysis of the curriculum and learning materials for the Basic Electronics course. The analysis was conducted to identify learning outcomes, student characteristics, and

appropriate materials for implementation using Quizizz-based DGBL learning media.

2. Design of Quizizz-Based DGBL Learning Media (Design)
   The design stage is the stage of designing learning media before implementation [12]. At this stage, researchers developed a Quizizz-based Digital Game Based Learning (DGBL) media design by adjusting it to the learning outcomes of the Basic Electronics course and student characteristics. Researchers first determined the material, learning indicators, number of questions, and variations in question formats, then compiled a grid as a guideline for writing questions. Next, researchers accessed the Quizizz platform by downloading the application or opening the official website, then created an educator account and logged in. After that, researchers created a new quiz by filling in the title, description, and setting the subject and education level. Questions were compiled and input into the Quizizz application according to the grid, by selecting the question type, writing questions, determining the correct answer, setting the time to complete, and adding images to certain questions to clarify the concept. This process was carried out until all questions were completed. To support the Digital Game Based Learning element, researchers activated game features such as automatic scoring and a leaderboard. After all questions were completed, researchers rechecked and previewed them, then saved the quiz so that it was ready for use in the next development stage.
3. Implementation and Validation of Learning Media (Develop)
   This stage is the implementation of learning media into the Quizizz application as well as testing its feasibility through validation by material experts and media experts. Validation is carried out using an instrument in the form of a questionnaire sheet compiled based on learning media feasibility indicators. In the material aspect, assessment indicators include the suitability of the material to learning outcomes, conceptual accuracy, and the completeness and relevance of the material. Meanwhile, in the media aspect, it includes language, presentation, appearance, ease of use, and the effectiveness of the media in supporting learning. The assessment uses a Likert scale of 1–5, where a score of 1 indicates very unfeasible and a score of 5 indicates very feasible. Validation data is analyzed by calculating the feasibility percentage based on the comparison of the obtained score with the maximum score, then interpreted into feasibility categories. Media is declared feasible if it meets the minimum feasible category and can proceed to the limited trial stage.
4. Limited Trial (Student Questionnaire)
   After the learning media was declared suitable based on expert validation results, a limited trial was conducted with students to determine the response to the use of Quizizz-based DGBL learning media. This trial involved 12 students of the Electrical Engineering Education Study Program who had taken the Basic Electronics course. The sampling technique used was purposive sampling, with the consideration that the selected students had studied the relevant material and were in accordance with the research needs. Data collection was carried out through a student response questionnaire compiled using a Likert scale, covering

aspects of material understanding, question and language clarity, ease of use, and the benefits of the media for the learning process.

5. Dissemination of Learning Media (Disseminate)
   The dissemination stage is carried out by implementing Quizizz-based DGBL learning media in the learning process in the Basic Electronics course and socializing its use as an alternative digital-based learning media.

Data collection in this study was conducted through a validation process and limited trials. Validation was carried out using a validation sheet given to four validators**,** consisting of two lecturers who are subject matter experts. And two media expert lecturers from the Electrical Engineering Education Study Program, UIN Ar-Raniry Banda Aceh. The validation process was carried out after the learning media was designed and implemented into the Quizizz application [7]. The learning media applied is in the form of learning media Digital Game-Based Learning (DGBL) uses the Quizizz application**,** which contains interactive questions on the Basic Electronics course. This media is designed by considering learning objectives, student characteristics, and ease of use of the application. Learning questions are developed and uploaded to the Quizizz application by utilizing supporting features such as time settings, automatic scoring, and *a leaderboard* [15].

In addition to expert validation, data collection was also conducted through a limited pilot study with students**.** Students were asked to complete a Basic Electronics learning quiz using the Quizizz app and then complete a student response questionnaire distributed via an online link to determine the clarity of the material, ease of use of the media, and student interest in DGBL-based learning [16]. The data analysis technique used in this study is quantitative data analysis**.** Quantitative data was obtained from the results of the assessment of material expert and media expert validators through validation sheets, as well as from the results of student response questionnaires at the limited trial stage [17].

Data analysis was performed by calculating the scores obtained from each assessment indicator. The ideal score for determining the feasibility of learning media was calculated based on the multiplication of the number of statement items, the highest score for each answer, and the number of respondents. The feasibility percentage of Digital Game-Based Learning (DGBL) learning media using the Quizizz application was calculated using the following equation:
The percentage of suitability of teaching aids can be seen using equation (1).

$$Percentage = \frac{Total\ Score\ Obtained}{Maximum\ Score} \times 100\% \quad \ldots\ldots\ldots (\mathbf{1})$$

Information:
P = Percentage of scores obtained
F = Total score obtained
N = Maximum score

Results and Discussion

a. Media Development Results

The research conducted shows that the developed Digital Game Based Learning (DGBL) media is proven to be feasible and effective for use as a learning medium for Basic Electronics material. The development process follows R&D steps which include problem identification, product design, design validation, limited trials, product revisions to the final product [18]. The results of the study indicate that DGBL media is effective and feasible for use in the learning process because most students obtain high grades, have good learning interests, and a high level of learning activity [17].

The results of this study include a Digital Game-Based Learning (DGBL) learning medium using the Quizizz application in the Basic Electronics course. The developed learning medium contains interactive questions structured based on learning outcomes, material indicators, and student characteristics. This medium is designed to help students understand basic electronics concepts through more interactive and engaging digital game-based learning. digital quizzes accessible through the Quizizz app. Educators share the quiz link with students, who then access the quiz using their respective devices, either mobile phones or laptops. A screenshot of the DGBL learning media using the Quizizz app can be seen in Figure 2.

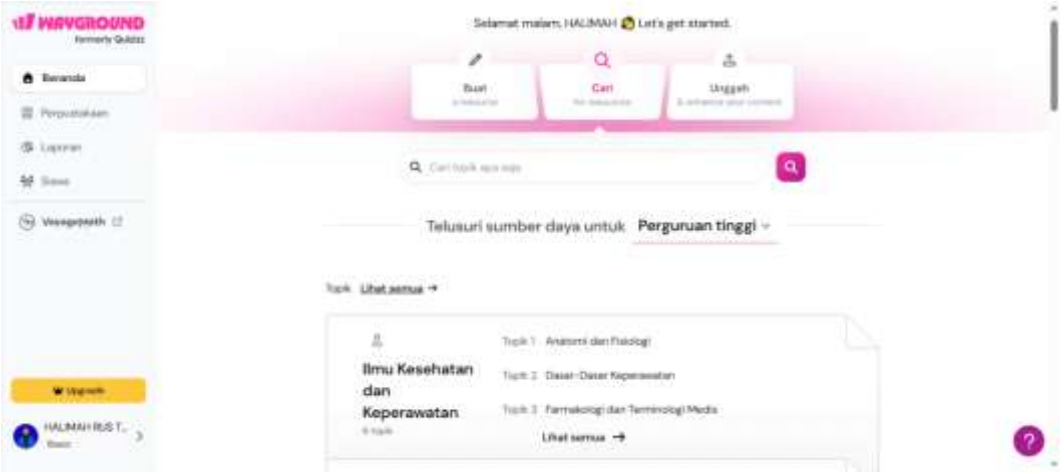


Figure 2. Display of Quizizz-Based Learning Media

This learning media utilizes four types of questions available in the Quizizz application: multiple-choice, short answer, essay, and picture answer. A total of 20 questions is presented, consisting of 11 multiple-choice, 2 short answer, 5 essay, and 2 picture answer questions. This variety of question formats aims to more comprehensively assess students' understanding, both in terms of knowledge and analytical skills. An example of the interactive question display in the learning media using the Quizizz application can be seen in Figure 3.

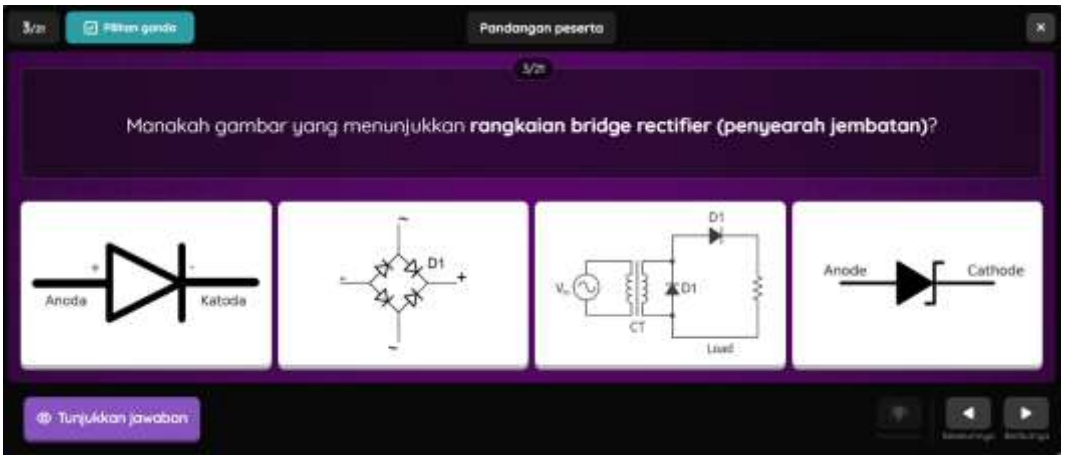


Figure 3. One Example of the Type of Questions Used in the Quizizz Application

Questions are presented in a timed manner and are equipped with an automated scoring system and a leaderboard. The leaderboard feature displays student rankings based on their scores, thereby increasing student motivation and engagement throughout the learning process.



Figure 4. Quizizz Score Results Display

b. Media Testing Results

The results of the learning media testing aim to determine the level of feasibility, practicality, and effectiveness of the media that has been developed before it is widely used in the learning process. Media testing is carried out through several stages, namely validation by media experts**,** validation by material experts, and validation by limited trial [19]. This validation was conducted by 4 lecturers from the Electrical Engineering Education Study Program, 2 of whom validated the material, 2 of whom validated the material experts, and 2 of whom validated the media experts. The validation by the material experts aimed to assess the suitability of the material with the learning outcomes and curriculum of the Basic Electronics course. Meanwhile, the validation by the media experts was conducted to assess the appropriateness of the media in terms of presentation, language, ease of use, and the benefits of the media in learning. The results of the validation conducted by the material experts to test the appropriateness of the

content and suitability of the material in the Quizizz-based DGBL learning media are as shown in Table 1.

Table 1. Results of Material Expert Validation

Item	Indicator	Question Aspects	Criteria	
			V1	V2
1	Completeness of materials	1) Suitability of the material in the Digital Game Based Learning (DGBL) learning media based on the Quizizz application with the learning outcomes of the Basic Electronics course	5	5
2	Suitability of learning objectives	2) Suitability of the material in the Digital Game Based Learning (DGBL) learning media based on the Quizizz application with the learning achievement indicators in the Basic Electronics course	5	5
3	Breadth of material	3) The depth of the material in the Digital Game Based Learning (DGBL) learning material based on the Quizizz application is able to provide students with provisions to understand and study the next material in the Basic Electronics course.	5	5
4	Breadth of material	4) The material in Quizizz questions is presented in line with the images or illustrations used, thus supporting understanding of the concept.	5	4
5	Breadth of material	5) The level of difficulty of the questions on the Quizizz learning media is adjusted to the cognitive abilities of students in understanding basic concepts.	5	5
6	Accuracy of material	6) The material used in the Quizizz learning media for the Basic Electronics course is written in easy-to-understand language and presented clearly.	5	5
7	Accuracy of material	7) The suitability of the material presented in the Quizizz learning media in the Basic Electronics course can be scientifically justified.	5	3
8	Relevant materials and media	8) The role of Quizizz learning media in providing students with an understanding of basic electronics concepts	5	4
9	Relevant materials and media	9) Quizizz learning media presents basic electronics material that is applicable and relevant to support students' understanding and skills in the learning context.	5	4
10	Relevant materials and media	10) The material in the Quizizz learning media plays a role in increasing students' understanding of basic electronics concepts that can be applied in learning practices.	5	4
		Amount	**50**	**44**
		Percentage (%)	**100**	**88**
		Overall Percentage (%)	**94**	

Based on the results of expert validation by two validators on the Quizizz-based Digital Game Based Learning (DGBL) learning media for the Basic Electronics course, Validator 1 obtained a score of 100% and Validator 2 obtained a score of 88%, with an overall percentage of 94%. These results indicate that the developed learning media is in the very feasible category.

Table 2. Media Validation Results

Item	Categorization	Criteria	Score	
			V1	V2
A. Evaluation Eligibility Aspect Linguistics				
1	Clarity of instructions use	Instruction use Quizizz media delivered clearly and easily understood by students	5	4
2	Language compatibility with students' level of thinking	The language used in the media is appropriate to the cognitive level of students in the Basic Electronics course	4	4
3	Language skills in encouraging interest in learning	Language in the media encourages students' motivation and curiosity to study electronics material.	4	4
4	Politeness in language use	Use of language that remains polite and does not reduce educational values	4	4
B. Evaluation Eligibility Aspect Presentation				
5	Sequence of presentation of material	The presentation of the material is done in a sequential/systematic manner.	5	4
6	Media can involve student interaction	Media presentation supports students to interact in learning	5	4
C. Evaluation Aspect Affect Media Against Strategy Learning				
7	Ease of use	Media is easy to use in learning, both in the class and outside the class	5	5
8	Media support for independent learning student	Media support students to learn independently	5	5
9	The ability of media to enhance motivation	Media add student motivation to learn	5	5
10	Ability media add knowledge	Media increase student knowledge	5	4
		Amount	**47**	**43**
		Percentage (%)	**94**	**86**
		Overall Percentage (%)		**90**

Based on the results of media expert validation by two validators on the Quizizz-based Digital Game Based Learning (DGBL) learning media, the assessment percentage obtained from Validator 1 was 94% and from Validator 2 was 86%, with an overall percentage of 90%. These results indicate that the learning media is in the very feasible category. Based on the validation results by material experts and media experts, the Digital Game Based Learning (DGBL) learning media based on Quizizz was declared very suitable for use in learning Basic Electronics courses, with a suitability percentage of 94% from material experts and 90% from media experts. from media experts. These results indicate that the developed media meets the learning objectives, outcomes, and student needs. The validation results of the Quizizz-based DGBL learning media by

material and media experts are shown in the following graph. Student responses to the use of Quizizz-based DGBL learning media were obtained through a questionnaire and presented in Table 3.

Table 3. Student Response Results

No	Statement	Answer Options				Total
		SS	S	TS	STS	
A. Understanding the Material						
1	Basic Electronics material is easier to understand through the use of the Quizizz application.	4	8	0	0	83%
2	The questions on the Quizizz application help understand the basic concepts of diodes.	2	10	0	0	79%
3	The questions on the Quizizz app help understand half-wave and full-wave rectifiers.	8	4	0	0	91%
B. Clarity of Questions and Language						
4	The language in the Quizizz app questions is easy to understand.	5	7	0	0	85%
5	The instructions for completing the quiz on the Quizizz application are clear and not confusing.	5	6	1	0	83%
6	Images or illustrations in Quizizz application questions help understanding the material.	1	11	0	0	77%
7	The format of the questions in the Quizizz application makes it easier to understand the material.	4	8	0	0	83%
C. Ease and Independence of Learning						
8	The level of difficulty of the questions on the Quizizz application is according to the student's ability.	5	7	0	0	85%
9	The Quizizz application is easy to use for learning.	5	7	0	0	85%
10	Quizzes on the Quizizz application can be done independently.	5	7	0	0	85%
11	The Quizizz application can be used anytime and anywhere to learn.	5	7	0	0	85%
12	The Quizizz app helps with independent learning outside of lecture hours.	3	9	0	0	81%
13	Using the Quizizz application does not cause any technical difficulties.	5	7	0	0	85%
D. Benefits of Using the Quizizz Application						
14	The Quizizz application makes it easy to learn Basic Electronics.	1	11	0	0	77%
15	The Quizizz application is useful as a supporting tool for learning Basic Electronics.	6	6	0	0	87%
16	The Quizizz application is useful as a means of practicing and evaluating Basic Electronics learning.	4	8	0	0	83%
17	The use of the Quizizz application provides a positive learning experience in the Basic Electronics course.	4	8	0	0	83%

No	Statement	Answer Options				Total
		SS	S	TS	STS	
E. Impact on Learning Outcomes						
18	The Quizizz application helps improve understanding of Basic Electronics material.	3	8	1	0	79%
19	The Quizizz application helps evaluate and improve understanding of Basic Electronics material.	4	8	0	0	83%
20	Using the Quizizz application helps improve accuracy in answering questions.	2	10	0	0	79%
	Amount	**81**	**157**	**2**	**0**	**1,658**
	Percentage (%)	**33.8%**	**65.4%**	**0.4%**	**0%**	**82.9%**
				Overall Percentage		**82.9%**

Based on the results of student responses to the use of the Quizizz application in the Basic Electronics course, the percentage of strongly agree was 33.8% and agree was 65.4%, so that the total positive response reached 82.9%. Meanwhile, the response of disagree was only 0.4% and there was no response of strongly disagree. These results indicate that the Quizizz application is considered easy to use, clear in the presentation of questions, and useful in helping students understand the material and learn independence. Thus, the use of the Quizizz application is feasible and effective as a supporting medium for learning Basic Electronics [16].

Based on the research results, the Quizizz-based Digital Game-Based Learning (DGBL) learning media for the Basic Electronics course has been validated by media and content experts. The validation results indicate that the developed learning media is categorized as very feasible**,** both in terms of media and content aspects. The results of the media expert validation showed that the appearance, presentation of questions, and the use of Quizizz features such as time management, automatic scoring, and leaderboards were able to increase student interaction and engagement in learning. This finding is in line with research by Arum Tri Wulandari et al., which stated that the use of Quizizz as a game-based learning medium was able to increase active participation and student interest in the learning process [19]. Meanwhile, the results of the material expert validation showed that the material presented was in accordance with learning outcomes and was written in easy-to-understand language.

In addition to expert validation tests, the results of the student response questionnaire showed that the Quizizz-based DGBL learning media received a very good category[20-21]. Students assessed that this media was easy to use, helped understand the material, and supported independent learning. These results are in line with research stating that the use of the Quizizz application as a learning and evaluation media can increase student motivation and learning engagement [6][22].

Although the results of this study are in line with previous studies, this study has differences and novelties**.** Previous studies generally used the Quizizz application as a learning evaluation medium or applied it at elementary and secondary education levels [19]. Meanwhile, this study places the Quizizz application as a learning medium based on Digital Game-Based Learning (DGBL) which is used in an integrated manner in the learning process of Basic Electronics courses in higher education [23].

In addition, this study emphasizes student learning independence**,** where Quizizz media can be accessed anytime and anywhere as a means of practicing and consolidating material. This is in line with research stating that the Digital Game-Based Learning approach is able to increase student learning motivation and independent learning experience [6][24]. Thus, this study provides a new contribution in the application of digital game- based learning in engineering courses, especially in the Basic Electronics course [25].

Conclusion

Based on the research results and discussion, it can be concluded that the Quizizz-based Digital Game Based Learning (DGBL) learning media for the Basic Electronics course was successfully developed using the 4D model. The validation results showed that the learning media obtained a feasibility percentage of 94% from material experts and 90% from media experts, which is included in the very feasibility category. Thus, the Quizizz-based DGBL learning media is declared suitable for use in the Basic Electronics course and is effective in increasing student motivation, involvement, and conceptual understanding.

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