Volume 15 Number 2 (2023)
July-December 2023
Page: 971-986

E-ISSN: 2656-9779
P-ISSN: 1907-6355
DOI: 10.37680/qalamuna.v15i2.3349

QALAMUNA
JURNAL PENDIDIKAN, SOSIAL, DAN AGAMA

Ciculapod for Teaching Circulation Systems: Development and Validity of Biological Learning Media

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Received: 02/07/2023 Revised: 15/09/2023 Accepted: 29/10/2023

Abstract

The goal of this research is to develop valid and feasible Nearpod-based circulation system teaching materials. This research method uses the ADDIE development model, which includes stages of analysis, design, development, implementation, and evaluation. The research was conducted from July 2022 to June 2023. The teaching materials were tested for feasibility in material, media, and language and tested by Biology teachers and students of SMAN 14 Jakarta. The feasibility test results showed that Nearpod-based circulation system teaching materials had an average score of 3.65 (very valid) on the material aspect, 3.89 (very valid) on the media aspect, and 3.53 (very valid) on the language aspect. In Biology, the teacher trial obtained a mean value of 3.51 and an average of 3.31 for the student trials. This shows that Circulapod teaching materials are very valid and feasible to be used as learning media for circulatory systems learning in schools.

Keywords Teaching Material; Nearpod; Circulation System; Conceptual Understanding

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Published by Institut Agama Islam Sunan Giri (INSURI) Ponorogo; Indonesia
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1. INTRODUCTION

The world is entering the Era of the Industrial Revolution 4.0, which is marked by the increasingly rapid advancement of information technology. This era has affected the world of education, which requires educators to create learning activities that utilize technological advances. The application of technology in learning is expected to be able to increase the competence of students in facing the digital era (Yuliati & Saputra, 2019). Learning in the current digital era is supported by more innovative learning media, not only in text but includes audio, video, animation, and the internet in learning (Amaluddin & Machali, 2022; Siregar et al., 2023). In addition, the pandemic conditions have caused unexpected learning situations that have led to digital transformation in the world of education (Martín-Gutiérrez et al., 2022; Soykan et al., 2023). Education is no longer just a learning activity that is only carried out in the classroom but is an activity that can be carried out anywhere and anytime according to the learning needs of students (Nana & Surahman, 2019).

The use of technology in education has long been implemented. However, post-pandemic conditions followed by digital transformation have demanded that the world of education be more assertive in adapting to technological developments to improve the quality of learning (Pitre et al., 2022). Mastery of technology information is important for developing learning activities not limited by space and time (Dewi et al., 2019). This also affects the development of learning media. Learning media that are developed appropriately and by the material and the age of the students will facilitate the implementation of an effective learning process (Akrim, 2018). The use of appropriate learning media will also help teachers to explain abstract and foreign concepts so that they become easily understood by students (Wibawanto, 2017). However, the facts show that the use of technology-based learning media and teaching materials still needs to be improved (Sumintono et al., 2012). This fact is supported by Umardulis (2019), who states that teachers need to use technology to compile interactive teaching materials in teaching. Students also need help using technology-based learning media if the media is difficult to understand, making it difficult for users. This can result in a lack of understanding of the material. It has the potential to decrease student learning outcomes. This condition requires teachers to be able to utilize interactive and interesting technology-based learning media to convey material so that learning is carried out more effectively and is not boring (Nur et al., 2022).

The need for developing digital teaching materials can be supported through educational applications that support digital learning, which can be in the form of an LMS (Learning Management System) and social media (Tauhidah et al., 2021). One of the educational applications that can be used to develop digital teaching materials is Nearpod. Nearpod provides many features that can make variations in learning activities, so one of the main advantages of this application is to support interactive learning for teachers and students (Ryan, 2017).

The research result by (A. Abdullah et al., 2020) proves that the percentage of passing grades for learning using Nearpod is 95%, which is higher than learning without using Nearpod, which is 70%. In addition, Feri and Zulherman's (2021) research shows that Nearpod-based e-modules on science material have proven effective in improving students' comprehension skills, as evidenced by the results of an achievement percentage of 95.27%. Other research also shows that the development of online teaching materials assisted by Nearpod is declared valid, with an assessment percentage of 90% by material experts and 77.6% by design experts (Minalti & Yeni, 2021). This is also supported by the results of research conducted by Pasaribu (2021), which states that using Nearpod for online teaching materials has an average percentage of validation aspects of 80%, categorized as valid. Applying the Nearpod in biology learning has also increased students' acquisition and understanding of information (Lowry-Brock, 2016). Based on the studies above, it can be concluded that neared can be used to develop teaching materials to help students understand.

Biology material, especially the circulatory system, is difficult to understand because students need comprehensive thinking skills to understand the interaction between the functions of the elements in

the circulatory system (Lee et al., 2015). Therefore, in studying the circulatory system, biology teaching media and materials are needed in digital format to provide visualization for students (Nuryani et al., 2020; Safitri et al., 2021). Based on the needs assessment that researchers have carried out shows that the lack of technology utilization in circulatory system learning makes classroom interaction less. This can be a challenge for students in understanding the circulatory system material. In addition, according to need assessment, it also can be known that students need biology media that is interesting, has engaging visual display, and various features. Therefore, researchers propose the development of Nearpod-based circulatory teaching material named Circulapod to help students understand the circulation system comprehensively.

2. METHOD

The type of research used is development research, which refers to the ADDIE development model. The ADDIE development model is considered to have systematic stages and provides a design with an orderly series of work (Widyastuti & Susiana, 2019). The research was conducted at SMAN 14 Jakarta from July 2022 to June 2023 to produce Nearpod-based circulatory system teaching materials that are feasible and validated by experts. Subjects in this development research were one class of eleventh-grade eleventh-grading in Mathematics and Natural Sciences, which consisted of 36 students, biology teachers, media experts, material experts, and language experts. The ADDIE research and development method has five stages, as illustrated in Figure 1.

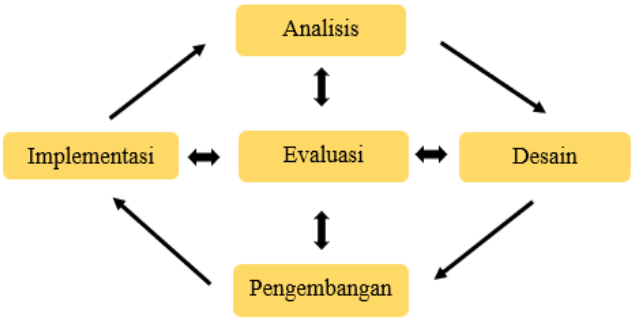


Figure 1. Research Stages of ADDIE Model Development

In Figure 1, it can be explained that the ADDIE development model has the main stages of analysis, design, development, implementation, and evaluation. In the analysis stage, the distribution of instruments for analyzing the needs of students and teachers was carried out. The purpose of distributing this instrument is to find out the problems that occur when studying the circulation system in schools. The student needs assessment instrument was addressed to one class, and the teacher needs assessment instrument was aimed at an eleventh-grade Biology teacher. Data from the needs assessment of teachers and students will be analyzed and used as a reference for the design phase.

In the second stage, material analysis and storyboarding were carried out. Material analysis aims to adapt the material to be used in circulation system teaching materials with the school's needs and with the applicable curriculum. After analyzing the material, it is followed by making a storyboard. Next is the development stage of Nearpod-based circulation system teaching materials, which also carry out product validation tests by experts, including assessments in terms of material, media, and language.

At the implementation stage, a trial of the product that has been developed is carried out. The trial was carried out with one class of eleventh-grade students and a Biology teacher to know the responses of students and teachers to the circulation system teaching materials that had been developed. The final stage, namely the evaluation, is carried out to correct deficiencies in the product

that has been produced and implemented.

In this study, some data were collected. The data collection instruments that researchers use include student and teacher needs assessment questionnaires, validation sheets, and product trial response instruments for teachers and students. The results of the validity scores obtained from the product feasibility test and product trials test were analyzed using quantitative analysis techniques. The feasibility of circulation system teaching materials can be determined using Ratumanan & Laurens's (2011)'s interpretation of the feasibility test score. The interpretation table of the feasibility test score can be seen in Table 1.

Table 1. Table of Feasibility Test Score Interpretation

Category Interval	Criteria	Feasibility Criteria
$3,25 > x \leq 4,00$	Very Valid	It can be used without revision
$2,50 \geq x \leq 3,25$	Valid	Usable with minor revisions
$1,75 > x < 2,50$	Less Valid	It can be used with multiple revisions
$1,00 > x < 1,75$	Not Valid	It is not yet usable and needs consultation

(Ratumanan & Laurens, 2011)

3. FINDINGS AND DISCUSSIONS

Analysis

In the analysis phase, students and Biology teachers are observed to analyze the needs and conditions of students and teachers during Biology lessons at school. Need assessments were conducted by distributing questionnaires via Google form link. Following are the results of students' perceptions about circulatory system material.

Table 2. Students' Perception of Circulatory System Material

Statement	Perception	Frequency	Percentage (%)
Circulatory system material is one of the difficult materials in Biology lessons	Strongly agree	0	0
	Agree	30	13,90
	Disagree	5	83,30
	Strongly disagree	1	2,80

Based on the results obtained, 30 students (83.3%) agreed that circulation system material is one of the most difficult materials in Biology lessons. In addition, it was found that five students (13.9%) said they disagreed, one other student (2.8%) said they strongly disagreed, and no students said strongly agreed related to the question. This is supported by previous research, which stated that the circulation system is a material with a fairly high difficulty level (Azrai et al., 2023).

Table 3. Circulatory System Topics That Are Considered Difficult

Topic	Frequency of answers	Percentage (%)
Organs of the circulatory system	13	36,10
Blood type and transfusion	16	44,40
Mechanism of human blood circulation	18	50
Abnormalities of the human circulatory system	3	8,30
All of the above	5	13,90

Based on the information from Table 3, it can be seen that several topics of the circulatory system are considered difficult, including the organs that make up the circulatory system, blood type and transfusion, and the mechanism of human blood circulation. The mechanism of human blood circulation is considered the most difficult topic in the circulatory system material, with 18 respondents choosing this topic. This is also supported by previous research, which shows that more misconceptions

are found in the circulatory pathway material than in other sub-materials (Vitharana, 2021).

Table 4. Learning Difficulty Factor of Circulation System

Learning Difficulty Factor	Frequency of answers	Percentage (%)
Abstract material	8	22,20
Too much memorizing	24	66,70
Interrelated concepts	16	44,40
Less interesting learning media	9	25
The teacher doesn't explain the material	3	8,30

Based on the information above, factors that cause circulation system material to be considered quite difficult include too much memorizing, interrelated concepts, and less interesting learning media. As many as 24 respondents considered that too much memorizing affects the difficulty level when studying circulation system material. Biology material that relies too much on memory is one of the difficulties in learning biology (Hadiprayitno et al., 2019).

Biology learning at SMAN 14 Jakarta is generally carried out using whiteboard and powerpoint. Most students do not know and have never used Nearpod as a platform to support biology learning. In addition, based on observations, students tend to choose learning media with engaging appearances and interesting features. As many as 88.9% of respondents agreed, and the remaining 11.1% strongly agreed to develop Nearpod-based circulation system teaching materials to help understand circulatory system subjects.

Design

The design phase includes analyzing the scope of circulation system material and making storyboards from Nearpod-based circulation system teaching material products. The results of the material analysis are in the form of adjustments to the circulation system material with basic competencies, learning objectives, and indicators, and the results of the needs assessment obtained. In addition to conducting material analysis, the design phase includes compiling storyboards from Nearpod-based circulation system teaching materials. In general, the material contained in the circulatory system teaching materials includes (1) the organs of the circulatory system, (2) the mechanism of blood circulation, (3) blood type and blood transfusion, and (4) abnormalities in the circulatory system. Based on the material above, it will be made as a circulation system concept mapping, as shown in Figure 2.

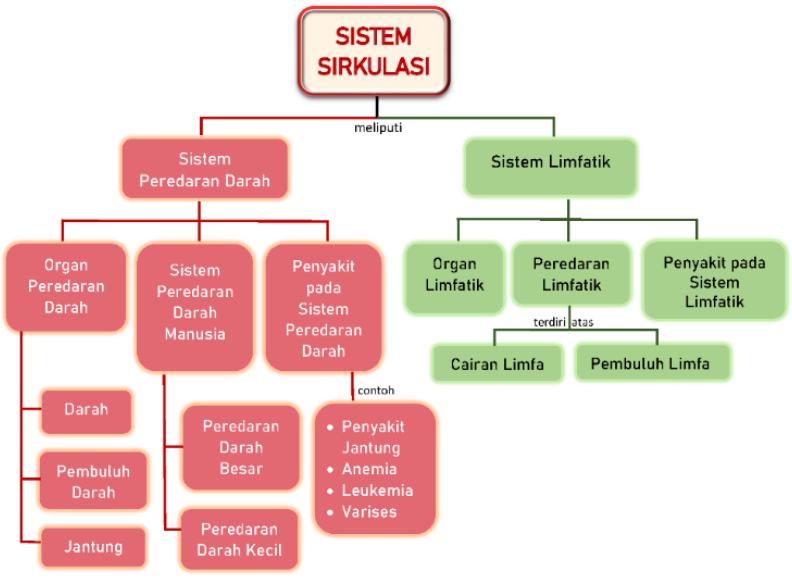


Figure 2. Concept Mapping of Circulatory System Material

After analyzing the material, the next step is making a storyboard as a rough design of Circulapod teaching materials. A storyboard is an arrangement of images displayed sequentially to visualize moving graphics or interactive media sequences, including website interactivity, to provide an overview of the product to be produced (Kunto et al., 2021).

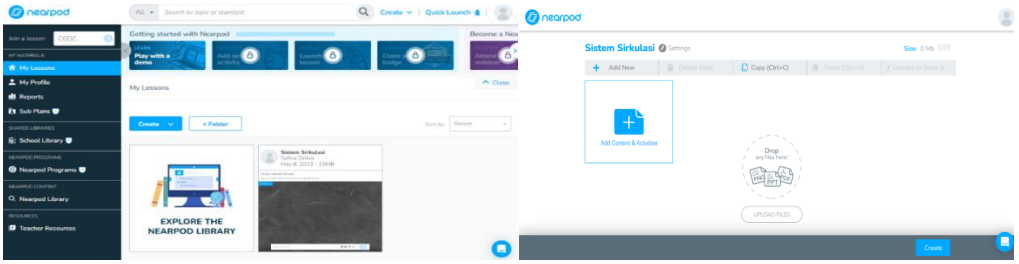
Development

At this stage, Circulapod teaching materials were developed, and experts carried out product development validation. The development of Circulapod begins with compiling material content, worksheets, and evaluations using Microsoft Word. The next step is inserting material content and worksheets into Canva to make the design as engaging as possible, and it will be saved in a PDF file format. The design of the content material that has been developed can be seen in Figure 3.

(a) (b) (c)

Figure 3. (a) Circulation Material Pages and Images; (b) Video Pages for Circulation System Materials; (c) Material Page and QR Code

Circulatory system material created in PDF format will be uploaded into Nearpod by creating lessons first. The homepage and lesson views on Nearpod can be seen in Figure 4.



(a) (b)

Figure 4. (a) Homepage display of Nearpod; (b) Initial display of lesson Nearpod

Figure 4 (a) is the Nearpod homepage display, which includes features for creating lessons, account profiles, and reports. Meanwhile, Figure 4 (b) shows the initial appearance of the Nearpod lesson. Lessons can be filled with various features provided by Nearpod.

The feature used to upload PDF file format into Nearpod is called a *PDF viewer*. This feature allows students to view circulation system material. Materials can also be downloaded when accessing Nearpod via laptop or computer. Figure 5 shows a display of circulation system pdf material when accessing Circulation.

Besides that, other supporting features can also be added, such as the collaboration board shown in Figure 6. The collaboration board is a feature that can be used for students and teachers to have discussions. This section is filled with preliminary questions to stimulate students' curiosity and to recall the blood circulation material that has been studied at the previous level. Students can provide answers anonymously by typing in the box provided.

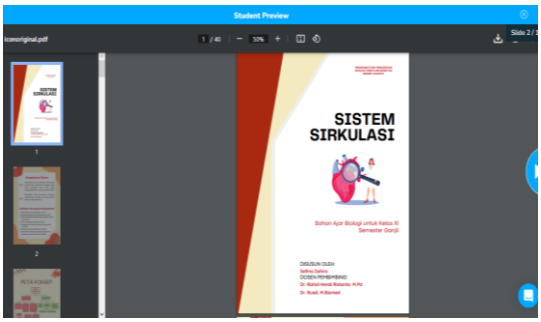


Figure 5. Circulapod View when accessing PDF Materials

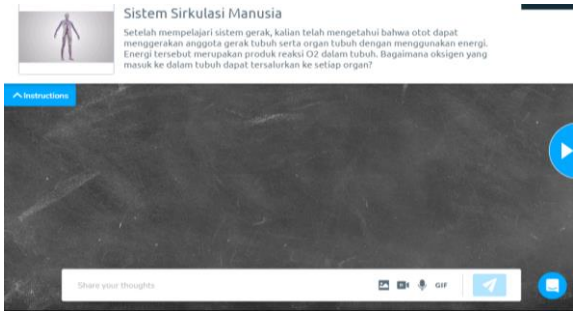


Figure 6. Collaborative Board

Meanwhile, worksheet content is integrated with Nearpod's gamification features, namely Draw-it, Matching Card, and Fill in The Blank, which can be seen in Figure 6.

Figure 7. (a) Draw-it Feature; (b) Matching Card Feature; (c) Fill in the Blank Feature.

The Draw-it feature shown in Figure 6 (a) allows students to draw, add text, or add images and shapes. One of the worksheet activities is identifying the components of blood, which is very suitable when integrated with the Draw-it feature. The Draw-it feature allows students to interact with the lesson content in various ways, such as simple drawing activities or advanced tasks like annotating the material on screen (Moore, 2016). In the Matching Card feature shown in Figure 9 (b), the card on each side can be filled with text or images that will later be matched. This feature is applied to the circulatory

system worksheet, a matching activity between images of circulatory organs with the correct description. Figure 9 (c) shows the worksheet activity integrated with the fill-in-the-blank feature. The activity is to fill in the missing words from the narrative of the blood clotting process.

Overall, the Nearpod-based circulation system teaching materials (Circulapod) are well-equipped with comprehensive material and engaging features. Therefore, employing Circulapod is one method of improving students' comprehension of the circulation system. Circulation is accessible through digital devices such as gadgets, laptops, and PCs. Teaching materials will be validated to determine their practicality regarding material, media, and language. Two validators assessed the three parts of the evaluation during the circled validation.

The next step is validation by experts to assess the material feasibility test of the product. The material feasibility test evaluates the compatibility of Circulapod teaching material content with basic competencies, learning indicators, and objectives according to the 2013 curriculum. The results of the material feasibility test can be seen in Table 5.

Table 5. Material Feasibility Test

Assessment Indicators	Item	Average of Item Value	Average of Indicators Value	Category
Suitability of content with the curriculum	1	3,50	3,50	Very Valid
	2	4,00		
	3	3,50		
	4	3,00		
	5	3,50		
The accuracy of the substance in learning media	6	3,50	3,58	Very Valid
	7	4,00		
	8	3,50		
	9	3,50		
	10	3,00		
	11	4,00		
General description	12	3,50	3,75	Very Valid
	13	4,00		
Effectiveness of the presentation in the material	14	3,50	3,75	Very Valid
	15	4,00		
Attractiveness and motivation giving	16	4,00	3,83	Very Valid
	17	3,50		
	18	4,00		
Suitability to the target (students)	19	3,50	3,50	Very Valid
	20	3,50		
Average			3,65	
Category			Very Valid	

The material feasibility test shows a value of 3.65, included in the very valid category (Ratumanan & Laurens, 2011). This indicates that the teaching materials are by the basic competencies (KD), accurate and latest content, and can encourage student curiosity (Watoni et al., 2022). Although it can be used without revision, based on the comments obtained from the expert validators, revisions were made by replacing some illustrations with more related images and correcting writing errors in paragraphs. In addition, question content was added that emphasized the relationship between the organs of the circulatory system and functional disorders and medical technology.

Next is the media feasibility test, which assesses presentation, features, and usability. Based on the results of the media validity test in Table 6, the overall average value is 3.80, which can be interpreted as very valid and used without revision. However, revisions were still made according to the expert's comments, namely replacing images that were slightly low quality with more high-definition images.

Table 6. Media Feasibility Test

Assessment Indicators	Item	Average Item Value	Average of Indicators Value	Category
General description	1	4,00	4,00	Very Valid
	2	4,00		
Completeness of Nearpod-based circulation system teaching materials features	3	3,50	3,75	Very Valid
	4	3,50		
	5	4,00		
	6	4,00		
Interactivity	7	3,50	3,75	Very Valid
	8	4,00		
General description of feasibility	9	4,00	3,66	Very Valid
	10	3,50		
	11	3,50		
Quality of Nearpod-based circulation system teaching material features	12	3,50	3,87	Very Valid
	13	4,00		
	14	4,00		
	15	4,00		
Average			3,80	
Category			Very Valid	

The highest average value is obtained on the display overview indicator. The indicator contains a statement regarding background selection, color composition, and feature layout. This shows that Circulapod is a high-quality teaching medium with attractive visualization and interactive features.

The last assessment carried out by the validator is product assessment in terms of language. The language feasibility test is based on the type size of letters, the sentences used, the accuracy of Biology terms, and the use of good and correct words. The result can be seen in Table 7.

Table 7. Language Feasibility Test

Assessment Indicators	Item	Average Item Value	Average of Indicators Value	Category
Suitability to the level of student development	1	4,00	3,75	Very Valid
	2	3,50		
Writing system	3	3,50	3,50	Very Valid
	4	3,50		
Legibility	5	3,50	3,33	Very Valid
	6	3,00		
	7	3,50		
Effectiveness of sentences	8	3,00	3,25	Valid
	9	3,50		
Use of terms and symbols	10	3,50	3,62	Very Valid
	11	3,50		
	12	4,00		
	13	3,50		
Providing motivation	14	4,00	3,75	Very Valid
	15	3,50		
Average			3,53	
Category			Very Valid	

The results of the language feasibility test assessment from the expert validator show an average value of 3.53. They are classified as a very valid category that can be used without modification. Although it can be used without modification, improvements are still being made based on comments given by experts in each aspect of the assessment. Revisions were made to several sentences considered

ineffective and contained writing errors, the shadow effect on the title font was removed, and the additional information on the blood cell illustration was.

Implementation

In the implementation phase, only limited trials were carried out to determine the feasibility of Circulapod as teaching material based on the responses of Biology students and teachers. Student trials were carried out by filling out questionnaires. Based on the results of student trials in Table 8, Circulapod teaching materials are classified as very valid, with an overall average value of 3.31 (Ratumanan & Laurens, 2011).

Table 8. Results of Student Responses to the Use of Circulapod

Component	Item	Average value	Average Component Value
Content	1	3,43	
	2	3,3	3,38
	3	3,43	
Appearance	4	3,3	
	5	3,36	
	6	3,26	3,31
	7	3,43	
	8	3,2	
Benefit	9	3,2	3,21
	10	3,23	
Overall Average		3,31	3,31
Category		**Very Valid**	**Very Valid**

Nearpod-based circulatory system teaching materials are considered to have advantages because it has content equipped with engaging images, videos, animations, and colors, as well as interactive content that can help visualize material concepts so that students can easily understand them. This is consistent with other research, which shows learning using Nearpod supports engagement and discussion among students and increases understanding of the material (McClean & Crowe, 2017). Based on the students' comments, positive responses were obtained stating that Circulapod is a good application, very helpful in understanding the material, and makes learning more interesting. Apart from being a positive response, students also provided comments in the form of suggestions and input. For example, using Circulapod in smartphones is often lagging, and it would be better to use a device such as a laptop with a good internet network.

Meanwhile, the results of the biology teacher trial showed that Circulapod teaching materials had an average value of 3.51, with a very valid interpretation in Table 9.

Table 9. Results of Biology Teacher Responses to the Use of Circulapod

Assessment Indicators	Item	Value	Average of Indicators Value	Category
Suitability of teaching materials content with the curriculum	1	4,00	3,66	Very Valid
	2	3,00		
	3	4,00		
Accuracy of teaching materials with the development of science and technology	4	3,00	3,50	Very Valid
	5	4,00		
Comprehensiveness of circulation system material	6	3,00	3,50	Very Valid
	7	4,00		
	8	3,00		
Layout	9	4,00	3,00	Valid
	10	4,00		
	11	4,00		

	12	3,00		
Suitability of font, color, and display size	13	3,00	3,00	Valid
	14	3,00		
The use of sentences that are easy to understand	15	4,00	4,00	Very Valid
Impressions on media use	16	4,00	4,00	Very Valid
Motivating learning	17	3,00	3,50	Very Valid
	18	4,00		
Increase understanding of the circulatory system material	19	3,00	3,50	Very Valid
	20	4,00		
Average		3,55	3,51	
Category			Very Valid	

Comments from biology teachers during the testing process included that Circulapod was very interesting in displaying circulatory system material and content that was felt to have represented indicators of competency achievement and basic competencies (KD).

Evaluation

The evaluation stage is the final stage of the ADDIE development model. This stage is the process of perfecting the Nearpod-based circulation system teaching materials. At this stage, the researcher evaluates the process from analysis to implementation. This action is intended to improve Circulapod teaching materials by analyzing the validator's suggestions for the final product.

Discussion

Circulapod teaching materials are the result of this study. The developed Circulapod is oriented towards increasing students' understanding of the circulation system concept. This is because Nearpod-based teaching materials presented an engaging appearance and interactive features that can help visualize the concept of blood circulation. This is by previous research; Nearpod's interactive features make it possible to attract attention and make it easier for students to understand the content of the material being taught (Pramesti et al., 2023). In addition, the results of other studies also show that Nearpod supports students' understanding of the topics being taught by increasing interaction between students and teachers (Yanuarto et al., 2023). The matching card feature on Nearpod, which takes the form of a game that connects pictures with the appropriate information, is a feature that can increase student activity and understanding by practicing problem-solving on a command (Oktafiani & Mujazi, 2022).

The content presented by Circulapod is comprehensive and accurate. Also, the questions in it can train students' cognitive thinking skills, which turn memorizing activities into active learning to solve a problem. This is supported by previous research. The biology learning process requires activities that can make students active because learning biology does not only depend on educators but also the active involvement of students to train their ability to understand lessons (Ristanto et al., 2018). The use of Nearpod in the learning process shows increased understanding because active and collaborative learning can occur (Rios-Zaruma et al., 2019). Furthermore, the use of the collaborative aspects during face-to-face and online learning provides opportunities for students to interact with content, activities, teachers, and other students to create a better learning experience (Ahmed & Elmubark, 2022; Jing & Yue, 2016; Minalti & Yeni, 2021).

The result of the developed Circulapod teaching materials has advantages and disadvantages. Based on a series of feasibility tests and trials that have been carried out, Circulapod's strengths include having a unique and attractive appearance and various features such as collaboration boards, PDF viewers, gamification, and quizzes. Circulapod content is presented with various pictures, illustrations, and videos and in full. In the circulation system material section, which is accessed with the pdf viewer feature, it can be downloaded for students to study without requiring an internet connection.

Circulapod can also be accessed by both teachers and students anywhere and anytime. Teachers can edit the content in Circulapod at any time and adapt it to curriculum developments. In addition, the material content in it is coherent and complete. Also, the questions on worksheets and quizzes are arranged according to a high level of cognitive thinking to train students' understanding of concepts. Additional content such as videos, virtual labs, and discussion questions are included using video features, web content, and collaboration boards. Virtual Labs can be an alternative learning media to improve students' conceptual understanding and laboratory skills (Wati, 2021).

Disadvantage of Circulapod teaching materials, namely requiring an internet connection to be able to access and view Circulapod teaching materials. The display of the Circulapod on the smartphone is not so good and more difficult to navigate than when using a laptop or computer. Another obstacle when using Nearpod is cloud storage limitations (Abdullah et al., 2022). The free nearpod account gets 100 MB of memory to fill the content in Nearpod, but it can be solved by adding content in pdf file format, which has smaller storage. Using the Nearpod platform also places higher demands on teachers' competencies, especially the ability to utilize technology and time (Xian, 2021). Teachers' preparation time will be longer to design lessons using Nearpod, which must adapt the interactive features to the learning model and match the learning objectives. The advantages and disadvantages are determined by converting the assessment from several experiments and feasibility tests that have been conducted. These advantages and disadvantages can be utilized as a guide for future study more closely tied to Circulapod instructional materials to create better learning resources.

4. CONCLUSION

Circulapod teaching materials have been developed and obtained very valid interpretations. The results of the feasibility test of material, media, and language of Circulapod, respectively, are 3,65, 3,80, and 3,52, which all the values can be interpreted as very valid. Meanwhile, the results of biology teacher and student trials of using Circulapod are 3,51 and 3,31, which can be interpreted as very valid and shows that circulapod is feasible to use in biology learning. Suggestions that can be given in developing Circulapod teaching materials for further research are to conduct an effectiveness test to measure the level of product effectiveness in increasing students' conceptual understanding abilities.

REFERENCES

Abdullah, A., Yahaya, M. F., & Mat Isa, N. (2020). The Impact of Nearpod Interactive Learning Platform in Quality Accounting Education for Sustainable Development. In *Charting a Sustainable Future of ASEAN in Business and Social Sciences* (pp. 203–213). Springer Singapore. https://doi.org/10.1007/978-981-15-3859-9_19

Abdullah, M. I., Inayati, D., & Karyawati, N. N. (2022). Nearpod is used as a learning platform to improve student learning motivation in an elementary school. *Journal of Education and Learning (EduLearn)*, *16*(1), 121–129. https://doi.org/10.11591/edulearn.v16i1.20421

Ahmed, A. M., & Elmubark, A. Y. (2022). An Investigation into Using Nearpod as an Interactive Tool to Aid Students' Achievement and Motivation for Learning Educational Technology. *Research on Humanities and Social Sciences*, *12*(4). https://doi.org/10.7176/RHSS/12-4-01

Akrim, M. (2018). Media Learning in Digital Era. *Proceedings of the 5th International Conference on Community Development (AMCA 2018)*. https://doi.org/10.2991/amca-18.2018.127

Amaluddin, M. R., & Machali, I. (2022). Pemanfaatan Media Digital Sebagai Sarana Pembelajaran di SMA Babussalam Pekanbaru. *Prosiding The 3rd Annual Conference on Madrasah Teachers (ACoMT)*, *5*, 275–286.

Azrai, E. P., Razak, A. A., & Sartono, N. (2023). The E-learning-based group investigation (gi) effectiveness on student biology learning outcomes. *Biosfer*, *16*(1), 176–185. https://doi.org/10.21009/biosferjpb.25015

Dewi, K., Cahya, P. I. C., Herman, D. S., & Priyanto. (2019). *BLENDED LEARNING Konsep dan Implementasi pada Pendidikan Tinggi Vokasi*. Swasta Nulus.

Feri, A., & Zulherman, Z. (2021). Development of neared-based e-module on science material "energy and its changes" to improve elementary school student learning achievement. *International Journal of Education and Learning*, *3*(2), 165–174. https://doi.org/10.31763/ijele.v3i2.400

Hadiprayitno, G., Muhlis, & Kusmiyati. (2019). Problems in learning biology for senior high schools in Lombok Island. *Journal of Physics: Conference Series*, *1241*(1), 012054. https://doi.org/10.1088/1742-6596/1241/1/012054

Jing, T. W., & Yue, W. S. (2016). Real-Time Assessment with Nearpod in the BYOD Classroom. In *Assessment for Learning Within and Beyond the Classroom* (pp. 103–107). Springer Singapore. https://doi.org/10.1007/978-981-10-0908-2_10

Kunto, I., Ariani, D., Widyaningrum, R., & Syahyani, R. (2021). Ragam Storyboard Untuk Produksi Media Pembelajaran. *Jurnal Pembelajaran Inovatif*, *4*(1), 108–120. https://doi.org/10.21009/JPI.041.14

Lee, S., Kang, E., & Kim, H.-B. (2015). Exploring the Impact of Students' Learning Approach on Collaborative Group Modeling of Blood Circulation. *Journal of Science Education and Technology*, *24*(2–3), 234–255. https://doi.org/10.1007/s10956-014-9509-5

Lowry-Brock, M. R. (2016). *The effect of using Nearpod as a tool of active learning in the high school science classroom*. Montana State University.

Martín-Gutiérrez, Á., Díaz-Noguera, M. D., Hervás-Gómez, C., & Morales-Pérez, G. L. (2022). Models of Future Teachers' Adaptation to New Post-Pandemic Digital Educational Scenarios. *Sustainability*, *14*(21), 14291. https://doi.org/10.3390/su142114291

McClean, S., & Crowe, W. (2017). Making room for interactivity: using the cloud-based audience response system Nearpod to enhance engagement in lectures. *FEMS Microbiology Letters*, *364*(6). https://doi.org/10.1093/femsle/fnx052

Minalti, M. P., & Yeni, E. (2021). Penggunaan Aplikasi Nearpod Untuk Bahan Ajar Pembelajaran Tematik Terpadu Tema 8 Subtema 1 Pembelajaran 3 Kelas IV Sekolah Dasar. *Journal of Basic Education Studies*, *4*(1).

Moore, S. N. (2016). Nearpod. *The Charleston Advisor*, *17*(4), 31–34. https://doi.org/10.5260/chara.17.4.31

Nana, & Surahman, E. (2019). Pengembangan Inovasi Pembelajaran Digital Menggunakan Model Blended POE2WE di Era Revolusi Industri 4.0. *Prosiding SNFA (Seminar Nasional Fisika Dan Aplikasinya)*.

Nur, Y. D. S., Harmawati, H., & Maulana, R. (2022). Analisis Pemanfaatan Teknologi Informasi dalam Pembelajaran Daring pada Masa Pandemi Covid-19 di Sekolah Dasar. *Jurnal Basicedu*, *6*(1), 869–876. https://doi.org/10.31004/basicedu.v6i1.2022

Nuryani, N., Saifuddin, M. F., Imana, A. H. N., Istiqomah, D., Haningsih, M. S., Ardani, V. P., Astuti, A. Y., & Ma'rifah, D. R. (2020). REMAP-RT in the Circulatory System Material to Improve Students Cognitive Learning Output. *Mangifera Edu*, *5*(1), 55–63. https://doi.org/10.31943/mangiferaedu.v5i1.86

Oktafiani, O., & Mujazi, M. (2022). Pengaruh Media Pembelajaran Nearpod Terhadap Motivasi Belajar Pada Mata pelajaran Matematika. *JPGI (Jurnal Penelitian Guru Indonesia)*, *7*(1), 124. https://doi.org/10.29210/022033jpgi0005

Pasaribu, E. P. (2021). *Pengembangan Bahan Ajar Daring Berbantuan Nearpod Pada Topik Bilangan Oksidasi untuk Menganalisis Keaktifan Peserta Didik*. Fakultas Keguruan dan Ilmu Pendidikan. Universitas Sanata Dharma.

Pitre, I. J., Bolivar, M. G., & Pitre, R. G. (2022). Digital Transformation In The Education Sector Due To The Impact Of Covid-19. *Journal of Language and Linguistic Studies*, *18*(3), 75–87.

Pramesti, A. D., Masfuah, S., & Ardianti, S. D. (2023). Media Interaktif Nearpod Guna Meningkatkan Hasil Belajar Siswa Sekolah Dasar. *Jurnal Educatio FKIP UNMA*, *9*(1), 379–385. https://doi.org/10.31949/educatio.v9i1.4578

Ratumanan, G. T., & Laurens, T. (2011). *Evaluasi Hasil Belajar pada Tingkat Satuan Pendidikan*. UNESA University Press.

Rios-Zaruma, J., Chamba-Rueda, L., Zumba-Zuniga, M. F., & Pardo-Cueva, M. (2019). Application of ICT and M-Learning to Improve Collaborative Learning and Interaction Using the Nearpod Platform. *2019 14th Iberian Conference on Information Systems and Technologies (CISTI)*, 1–6. https://doi.org/10.23919/CISTI.2019.8760728

Ristanto, R. H., Zubaidah, S., Amin, M., & Rohman, F. (2018). From a reader to a scientist: developing corgi learning to empower scientific literacy and mastery of biology concept. *Biosfer*, *11*(2), 90–100. https://doi.org/10.21009/biosferjpb.v11n2.90-100

Ryan, B. J. (2017). Near Peers: Harnessing the power of the populous to enhance the learning environment. *Irish Journal of Technology Enhanced Learning*, *2*(1). https://doi.org/10.22554/ijtel.v2i1.16

Safitri, A., Noorhidayati, & Sri, A. (2021). Pengembangan Bahan Ajar Konsep Sistem Peredaran Darah Manusia Biologi SMA Dalam Bentuk Booklet Digital. *BIOMA: Jurnal Biologi Dan Pembelajarannya*, *3*(2), 13–30. https://doi.org/10.31605/bioma.v3i2.1246

Siregar, J., Riniati, W. O., Aziz, F., Mahendika, D., & Abdullah, D. (2023). The Role Of Pictures And Videos In The Learning Independence Of Elementary School Students. *Journal on Education*, *5*(4).

Soykan, E., Bastas, M., & Çakici, A. (2023). Editorial: Digital transformation of education in the COVID-19 process and its psychological effects on children. *Frontiers in Education*, *8*. https://doi.org/10.3389/feduc.2023.1117458

Sumintono, Bambang, Wibowo, Setiawan, A., Mislan, Nora, & Tiawa, D. (2012). Penggunaan Teknologi Informasi dan Komunikasi dalam Pengajaran: Survei pada Guru-Guru Sains SMP di Indonesia. *Jurnal Pengajaran MIPA*, *17*(1), 122–131.

Tauhidah, D., Jayanti, U. N. A. D., Rahmasiwi, A., Pamungkas, R., & Saifulloh, A. (2021). Utilization of e-learning platforms by lecturers during the COVID-19 pandemic in Indonesia. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, *7*(3), 198–207. https://doi.org/10.22219/jpbi.v7i3.16816

Umardulis, U. (2019). Peningkatan Kompetensi Guru Menggunakan Teknologi Informasi dan Komunikasi (TIK) dalam Pembelajaran di Sekolah Dasar melalui Supervisi Klinis. *JURNAL PAJAR (Pendidikan Dan Pengajaran)*, *3*(4). https://doi.org/10.33578/pjr.v3i4.7539

Vitharana, P. R. K. A. (2021). Secondary School Learners Conceptions of the Structure and Function of the Human Circulatory System. *International Journal of Humanities, Social Sciences and Education*, *8*(4). https://doi.org/10.20431/2349-0381.0804024

Wati, A. (2021). Penggunaan Media Virtual Laboratory untuk Meningkatkan Penguasaan Konsep Materi dan Kemandirian Siswa Melakukan Praktikum. *Jurnal Guru Dikmen Dan Diksus*, *4*(2).

Watoni, E. S., Ngabekti, S., & Wijayati, N. (2022). Development of Lombok Island Environmental Change E-Module to Improve Environmental Literacy and Data Literacy of High School

Students. *Journal of Innovative Science Education*, *11*(2), 156–169.

Wibawanto, W. (2017). *Desain dan Pemrograman Multimedia Pembelajaran Interaktif*. Penerbit Cerdas Ulet Kreatif.

Widyastuti, E., & Susiana. (2019). Using the ADDIE model to develop learning material for actuarial mathematics. *Journal of Physics: Conference Series*, *1188*, 012052. https://doi.org/10.1088/1742-6596/1188/1/012052

Xian, J. (2021). A Critical Evaluation of Nearpod's Usefulness in Teaching K-12 Biology Science Online Classroom. *Advances in Social Science, Education, and Humanities Research*, *615*. https://doi.org/10.2991/assehr.k.211220.156

Yanuarto, W. N., Setyaningsih, E., & Amri, K. (2023). Employing Nearpod as a Resource to Encourage Active Students in BYOD Mathematics Learning Model. *JTAM (Jurnal Teori Dan Aplikasi Matematika)*, *7*(1), 174. https://doi.org/10.31764/jtam.v7i1.11864

Yuliati, Y., & Saputra, D. S. (2019). Pembelajaran Sains di Era Revolusi Industri 4.0. *Jurnal Cakrawala Pendas*, *5*(2).