Inornatus: Biology Education Journal
Volume 3, Issue 2 (2023): 75 – 84
DOI: 10.30862/inornatus.v3i2.422

Designing the human circulatory system e-module to increase student achievement

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Submitted: 17-05-2023
Accepted: 24-06-2023
Published: 26-06-2023

Abstract: The purpose of this study was to develop an e-module that has valid and practical criteria in the subject of the human circulatory system in class VIII SMP. The development model used is the ADDIE development model. The research subjects were 12 students of class VIII. The instruments used are validation sheets, questionnaires and learning achievement tests. The results of the study showed: (1) an average of 87.14% was obtained from media experts for validity and 88.3% for material experts from material experts. Student responses obtained an average score of 80.4 which indicates that the e-module is very practical to use. The average n-gain of class VIII students is 0.945 with a high interpretation. So it can be concluded that e-module on human circulatory system material are valid, practical, and can improve student learning outcomes. Trials for the implementation phase of ADDIE need to be carried out to find out the effectiveness of the e-module.

Keywords: Achievement, human circulatory system, student performance

Abstrak: Tujuan penelitian ini adalah mengembangkan e-modul yang memiliki kriteria valid dan praktis pada materi sistem peredaran darah manusia di kelas VIII SMP. Model pengembangan yang digunakan adalah model pengembangan ADDIE. Subyek penelitian adalah 12 siswa kelas VIII. Instrumen yang digunakan adalah lembar validasi, angket dan tes hasil belajar. Hasil penelitian menunjukkan: (1) penilaian validitas dari ahli media diperoleh rata-rata 87,14% dan dari ahli materi diperoleh validitas rata-rata 88,3%. Respon siswa diperoleh skor rata-rata 80,4 yang menunjukkan bahwa e-modul sangat praktis untuk digunakan. Rata-rata n-gain siswa kelas VIII sebesar 0,945 dengan interpretasi tinggi. Sehingga dapat disimpulkan e-modul pada materi sistem peredaran darah manusia termasuk valid, praktis, dan dapat memperbaiki hasil belajar siswa. Uji coba untuk tahap implementasi dari ADDIE perlu dilakukan untuk mengetahu efektivitas e-modul.

Kata kunci: Prestasi, sistem peredaran darah manusia, kinerja siswa

INTRODUCTION

Technological developments have shifted the way of viewing in various areas of life, including in the field of education. Educational technology is the study as well as ethical practice as a facility for learning and improving performance to produce, use, manage appropriate technological resources (Setyantoko et al., 2023). Technology in the world of education continues to progress. Educators are encouraged to be able to leverage technology and can produce personal computer-based learning media products in the midst of today's developments. With the advancement of technology, teachers easily create learning media for subjects that require large costs (Damopolii et al., 2022). In the world of education today technology is increasingly rapid and can be used in learning methods, by creating and

developing innovative learning media as well as as a source of information. However, the use of technology in the teaching process is not fully optimal. The use of technology in the teaching process by using media is still said to be a little less than synchronous learning by using teleconferencing applications such as WhatsApp (Kurniawan et al., 2021; Musyeri et al., 2022; Yurida et al., 2021).

The learning media that suits the current condition is the electronic module (e-modul). E-module is among the instructional media in which there are symbols or animated images and ways of work such as pneumatic valves (Yomaki et al., 2023). Computers can accommodate students who are slow in receiving lessons, so they can provide an emotional learning atmosphere in a more individual way, not easy to forget, not bored, and pay attention when running instructions because they are emotional in an individual way as the program expects (Mbaubedari et al., 2022; Schindler et al., 2017). Delivery through e-modules can attract learners so that the use of this media toward learning results can be a good solution in learning students (Setyantoko et al., 2023). E-module is an educational medium designed in electronic form in which there is a variety of materials that are presented with images, audio, or video that can make students more interested in studying it (Astalini et al., 2019; Aulia & Hardeli, 2022; Fisnani et al., 2020; Harefa et al., 2021).

Science subjects on the material of the human circulatory system certainly need to do practical work to fulfill science learning. This material is difficult material for students to understand. This material is complex material equipped with an anatomical structure (Gnidovec et al., 2020) which makes it difficult for students to understand (Alkhawaldeh, 2012; Raved & Yarden, 2014). Human circulatory system material contains anatomical structures that students must understand so they can understand their physiological processes (Cheng & Gilbert, 2015). Therefore, in order for students to get simulations in their learning, learning media are needed and provide benefits to the potential impact of increasing the quality of learning. In technological developments that are rapidly progressing, print media will be replaced by technological media in learning and during the Covid-19 pandemic. We can see this with the many digital teaching media such as e-books, e-modules, etc. (Kurniawan et al., 2021; Yurida et al., 2021).

Observations were made during the school field introduction program to find learning problems. Some of the students at one of the junior high schools in Manokwari were still unable to answer the questions given by the teacher. Some students cannot even respond to the instructor's queries because they are unable to comprehend the material being taught. The use of less attractive teaching media such as printed books and e-books. However, some students are still reluctant to read e-books because there is too much material. Students only rely on the material presented by the teacher and also some material in the form of PowerPoint and also screenshots of material from e-books. As for facilities and infrastructure at school, it is said to be adequate, such as computers, wifi, and even some students also have Android or even laptops. Some teachers think that making innovative

learning media takes a lot of time. This causes teachers to still use a system of lectures and assignments as well as learning media which are still in the form of powerpoints, electronic printed books, and uninteresting modules. There is still an abundance of students with scores below the average learning value, which can impact student learning outcomes. Using the 2013 curriculum, which has been supported in the development of science and technology, necessitates that students comprehend technology as a source of information related to learning materials as part of the learning process. To obtain the achievement of learning outcomes, it is necessary to apply good and appropriate and interesting learning media, the teaching media that will be used is e-module.

Several researchers, including Yomaki et al. (2023), have researched the development of e-module learning media as a learning resource for students. The design and implementation of the e-module obtained "very valid" validation and trial results so that the developed e-module is appropriate for use as instruction material. Meanwhile, research by Lestari and Parmiti (2020) showed that students' learning results were significantly distinct before and after they used the science e-module. This indicates that the e-module is effective for improving learning outcomes. Another study by Setyantoko et al. (2023) found that the development of e-modules for the human digestive system meets valid criteria and can enhance student learning achievement.

Presentation of e-modules can be presented with various pictures, materials, questions and learning videos that students can access. Through the use of e-module media, it is anticipated that learning achievement can be enhanced, conditions for learning made more engaging, and students' comprehension of the material enhanced. The aim of this study was to develop an e-module that has valid, practical criteria for improving student learning outcomes in the subject of the human circulatory system.

METHOD

The type of research used is Research and Development with the ADDIE model. The research subjects were 12 class VIII students. Material experts and media experts each carry out the validation process for the e-module being developed. The e-module is validated and then tested on students. They are given a test before learning. After using the e-module, students are again given tests to measure their learning outcomes.

The validation sheet on learning tools to validate learning media at the development stage consists of media, media validation sheets, lesson plans validation, learning achievement test validation sheets, and material validation sheets filled in by the validators. The questionnaire instrument given to students was used to obtain data regarding students' responses to learning media. This instrument aims to evaluate how practically applicable the newly produced e-module is. Questionnaires can be in the form of questions or statements sent via the WhatsApp application. Retrieval of this data is to determine the increase in the effectiveness of student learning outcomes by giving a test at the end of the action. Tests are conducted to calculate how far the learning outcomes of students. This test consists of 10

questions along with a test grid that has been prepared by the researcher based on the goals and indicators to be achieved in knowing the level of learning outcomes in the human circulatory system material. Akbar (2013) validation standard was used for validation analysis and student responses

RESULTS AND DISCUSSION

It is known that the school where the research was conducted used the 2013 curriculum, so the researchers developed the e-module according to the Learning Implementation Plan used in the school. This examination is carried out in order to ascertain the composition of the e-module constituent materials. The findings of the material examination of the human circulatory system, include the sub-themes of the human circulatory system's structure and function, as well as disruptions and measures to avoid them. This material is material that students still find puzzling because part of the content is abstract and cannot be seen directly. As a result, it must be represented via the use of various forms of media. The content detailed in the electronic module has been modified to align with the Core and basic Competencies included in the curriculum for 2013.

Researchers have analyzed appropriate learning media to be developed and used by students. Previously, researchers made observations while carrying out school practice programs during Covid-19. The results of the analysis found that the teaching media used by students were not qualified, only e-books, PowerPoint and printed books. So the researchers chose flipbooks as a learning tool that can be used anytime and anywhere. Students have creative characteristics and think critically but when asked to do assignments or questions from the teacher the results of some students' assignments have not reached completeness, so students need teaching materials that can assist students in learning to strengthen their learning outcomes.

The e-module is designed in Microsoft word which is called Storyboard. The storyboard is used to ascertain the location of items in the developed e-module. These items are in the form of cover sections, prefaces, table of contents, instructions for using e-modules, competencies, achievement indicators, introductions, objectives, concept maps, chapters, sub-chapters, material descriptions, summaries, questions, feedback, answer keys and bibliography.

After the development of the e-module, it was subjected to validation by a pair of experts in the relevant fields, namely the material expert validator and the media expert validator. By carrying out this validation, the researcher may evaluate the quality of the e-module that was developed and figure out whether or not the validity of a certain medium lies in whether or not it is used by students. The following are the findings of validation conducted with specialists in both the material and the media.

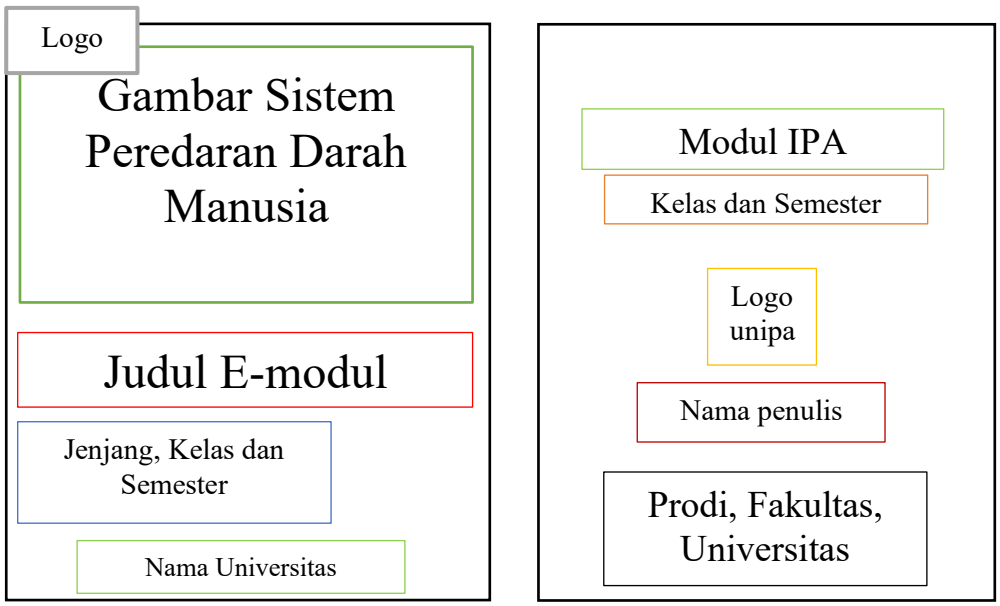

Figure 1. Storyboard cover design

Figure 2. Display of the e-module cover

The material validation consists of several statements regarding content, presentation, language, curiosity, accuracy of the material. Table 1 displays the findings of the material experts who conducted the validation on the e-module material.

Table 1. Material expert validation results

Aspect	Value	Criteria
Content	91.6%	Very Valid
Presentation	91.6%	Very Valid
Language	100%	Very Valid
Curiosity	75.0%	Valid
Material accuracy	83.3%	Very Valid
Average	88.3%	Very Valid

The validation results of the material experts in the e-module in Table 1 show that the material in the e-module has very valid criteria with a feasibility value of 88.3% so the e-module is feasible and tested. In the material expert validation of the material, it shows that the e-module is feasible to use with several minor revisions. As for some suggestions given from material experts on e-module material, they are as follows: 1) the time information in the introductory words is changed according to the current year, 2) typos in several words and lack of letters in words, 3) sentence spacing, 4) replace practice questions that hone students' understanding, 5) video links on material descriptions.

In the media validation there are several statements about the design, appearance of the e-module media design, ease of use and button functions. With this media validation it helps to assess whether the e-module is appropriate for use by students. This media assessment uses a validator sheet. The validation results from media experts on e-module media are presented in Table 2.

Table 1. Media expert validation results

Aspect	Value	Criteria
Media Design	100%	Very Valid
Design View	95.86%	Very Valid
Ease of Use	77.70%	Valid
Button Function	75.00%	Valid
Average	87.14%	Very Valid

The media expert validation results in Table 2 show that the e-module is said to be very valid with a feasibility value of 87.14% and is ready for testing. Media expert validation shows that the e-module is feasible to use with several small revisions. As for some suggestions given from media experts regarding e-module media, they are as follows: 1) adding source images related to the material, 2) using italic sentences in foreign words, 3) images clarified.

At the validation stage by expert, there is the validation of other tools, namely lesson plans (86.84% = very valid), tests, test questions on learning outcomes (100% = very valid), and student responses (93.75 = very valid). After being validated, the e-module was tested in a class with 12 respondents. During the trial, students were given pre- and post-test tests and response questionnaires after learning was completed.

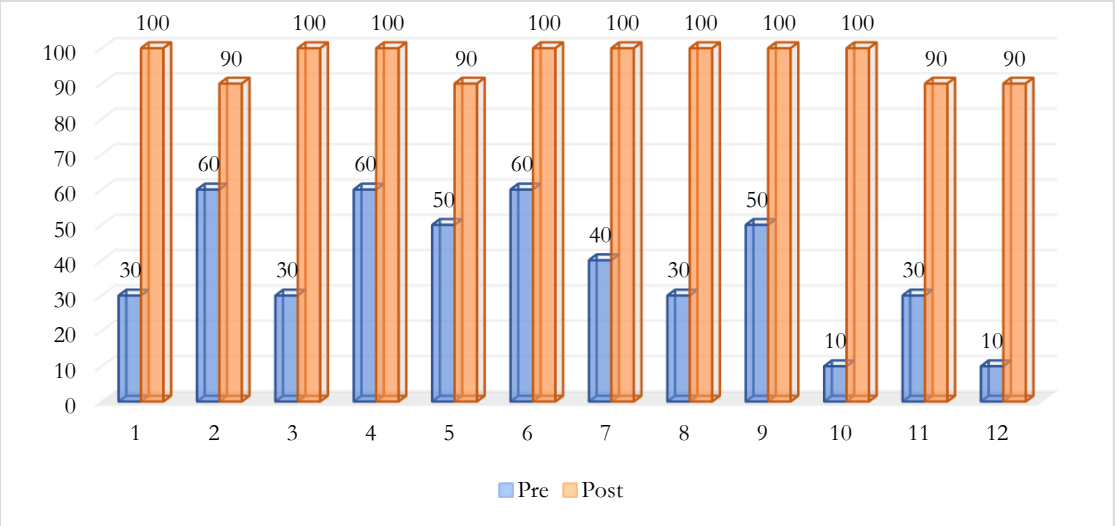

Figure 3. Students achievement

Table 3. The learning outcomes of the trial class students

Pre-test	Pos-test	Nilai *N-gain*	Criteria
38,33	96,67	0,945	High

The data in Table 3 shows that the improvement in student learning achievement after using the e-module is in the High category (N-gain = 0.945).

Table 4. The results of the response of the trial class students

No	Aspek	Score	Criteria
1	The human circulatory system e-module has an attractive appearance and is easy to use	81.00	Excellent
2	E-module human circulatory system can be studied independently	75.00	Good
3	The images contained in the e-module are interesting and in accordance with the material	87.50	Excellent
4	The material in the human circulatory system e-module is easy to understand	73.00	Good
5	The instructions in the e-module are easy to understand	75.00	Good
6	E-modules can be used anywhere and anytime	89.60	Excellent
7	Happy and interested in using the e-module	70.83	Good
8	Enthusiasm in learning using e-modules	77.08	Good
9	By using the e-module, I get more knowledge	87.50	Excellent
10	E-modules are effectively used for learning	87,50	Excellent
	Average	80.40	Excellent

Table 4 shows that the student response to the e-module is good with an average score of 80.40 so the e-module can be used at the implementation stage with small revisions.

The results of this study have indicated that the developed e-module meets valid criteria and is practically used in learning. The existence of a valid assessment from experts

indicates that the module is valid and can be used (Irwansyah et al., 2017). The trial results showed a high increase in student learning outcomes. Good learning resources can enhance student learning achievement (Damopolii et al., 2019). According to Khasanah and Nurmawati (2021), the use of e-modules is effective in increasing significant student learning achievement in learning compared to not using e-modules in learning because e-modules make it simpler for students to understand lessons and can be accessed anytime and anywhere. Learning is carried out in class using e-module media that has been assessed by material expert validators and media experts to make it easier for students to understand the content of the material, and be independent.

When students are taught using e-modules, they give good responses. Student responses to learning using e-module learning media were good. Students feel happy when learning to use e-modules (Mahardika et al., 2021; Munandar et al., 2021). The existence of a good response indicates that they are interested in learning by using the e-module. The e-module learning media makes it easier for students to comprehend the material of the human circulatory system, because the material presented in the e-module media is more attractive with a display design such as opening a book on an android, can be studied anywhere and anytime, equipped with text and pictures more interesting (Yomaki et al., 2023). The use of e-modules in the human circulatory system material helps students to find abstract material. E-modules were developed to suit the characteristics of students. Learners can open the e-module on their android. The e-module contains usage instructions to help students utilize it. The application of e-module media in research as a learning medium that can improve student learning outcomes.

CONCLUSION

This reasearch concluded that the material e-module of the human circulatory system is included in the valid standard. Student responses after using the E-module are included in practical standards. E-module can be used as a digital-based learning resource that has the benefit of improving student learning outcomes.

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