The Development of eLEMA-SCL Protozoa for Invertebrate Zoology Courses

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Abstract: The development of electronic learning materials is very necessary for the midst of the COVID-19 pandemic which requires lecture activities to be carried out online. This was carried out to support physical distancing to break the chain of transmission of COVID-19. Currently, there are not many electronic learning materials available that lead to student-centered learning (SCL) and can be implemented amid the COVID-19 pandemic. The purpose of this research is to develop an eLEMA (Electronic Learning Material) application, an Android-based electronic learning material with content or material that can be accessed online and offline, and with features that make it easier for users to operate. This research is a research development (Research and Development; R & D) to develop Android-based ELEMA-SCL Protozoa (Electronic Learning Material-Student Centered Learning) for Zoology courses. This development model consists of 3 phases of approach, namely: (1) Phase 1: Needs Assessment; (2) Phase 2: Design; and (3) Phase 3: Develop / Implement. The product developed in the form of an Android-based eLEMA application made using the MIT App Inventor is feasible to implement. The implementation results show: (1) the effectiveness of online and offline lectures with a gain value of 0.52 in the Medium category; (2) student response to the implementation of eLEMA is positive. Thus, the eLEMA application can be used for online and offline lectures during the COVID-19 pandemic.

Keywords: Electronic Learning Materials, Android, COVID-19, Distance Learning

How to Cite: Haryono, A., Basuki, B., Adam, C., Savitri, S., Araina, E., & Fahrina, R. The Development of eLEMA-SCL Protozoa for Invertebrate Zoology Courses. *The 3rd International Conference on Elementary Education*, *3*(1), 212-218.

INTRODUCTION

Science and technology in the 21st century have experienced very rapid development in almost all fields including education (Chu, Reynolds, Tavares, Notari, & Lee, 2017). Distance learning is a form of influence of the development of science and technology in the field of education using the internet network. Digital learning materials and media are packaged in the form of web pages or document files stored using cloud storage services. Students can access learning materials and media using a computer or mobile device with an internet connection (Aggarwal, 2003).

The development of electronic teaching materials is very necessary for the midst of the COVID-19 pandemic which requires lecture activities to be carried out online to support physical distance to break the chain of COVID-19 transmission. Currently, there are not many electronic teaching materials that lead to student-centered learning (SCL). Technological developments have resulted in learning support applications online, including Google Classroom, Moodle (Chourishi, Buttan, Chaurasia, & Soni, 2015), Schoology, and Easy class. These applications provide virtual space to replace physical classrooms for the implementation of the online learning process but do not provide the required teaching materials.

The environment around the University of Palangka Raya has biological resources that can be used as a learning resource for biology, especially Protozoa. Amoeba sp. and Euglena sp. is a protozoan species found in the water canals around the University of Palangka Raya.

The purpose of this research is to develop an eLEMA (Electronic Learning Material) application, an Android-based electronic learning material with content or material that can be accessed online and offline, and with features that make it easier for users to operate. The main material content in this application utilizes biological resources that can be found in the environment around the University of Palangka Raya.

METHOD

This research is a research development (Research and Development; R & D) to develop Android-based ELEMA-SCL PROTOZOA (Electronic Learning Material-Student Centered Learning) for Zoology courses. Development research in education is a process used to develop and validate educational products. Development research steps in education generally consist of product development, product implementation, and product revision to correct the weaknesses found during implementation (Borg & Gall, 1989). This development research used the Hannafin and Peck development model. This development model consists of 3 phases of approach, namely: (1) Phase 1: Needs Assessment; (2) Phase 2: Design; and (3) Phase 3: Develop / Implement.

Phase 1: Needs Assessment

Needs assessment is a needs analysis stage to know the needs of students, the problems students face in learning biology, especially in the Zoology course, by distance learning.

Phase 2: Design

The results of the analysis in phase 1 (needs assessment) are used as a basis for designing teaching materials according to student needs. At this stage, the application flowchart design and graphic design (icon, layout, banner) are carried out.

Phase 3: Develop and Implement

Phase 3 is the stage of product development in the form of electronic teaching materials based on Android ELEMA-SCL PROTOZOA (Electronic Learning Material-Student Centered Learning) for zoology courses. Product development results from the realization of the design or designs that were made in phase 2. eLEMA were developed online using MIT App Inventor. The implementation is aimed to examine the effectiveness of the eLEMA-SCL Protozoa in Invertebrate Zoology learning. The effectiveness of eLEMA-SCL Protozoa is determined based on gain scores adopted from Hake (1998) and student's feedbacks were analyzed by the Likert Scale method (Joshi, Kale, Chandel, & Pal, 2015). In this implementation, 2 groups of undergraduate students of Biology Education Program consists of 58, Faculty of Teacher Training and Education, University of Palangka Raya, was involved. The design of the implementation is a one-group pretest-posttest design (Campbell & Stanley, 1963).

RESULTS AND DISCUSSION

The results of the study are described in detail as follows:

Product Specifications

The detailed ELEMA-SCL PROTOZOA product specifications are: (1) Operating system support: Android; (2) File Type: .apk; and (3) Content availability: Online & Offline. Flowchart design is presented in Figure 1.

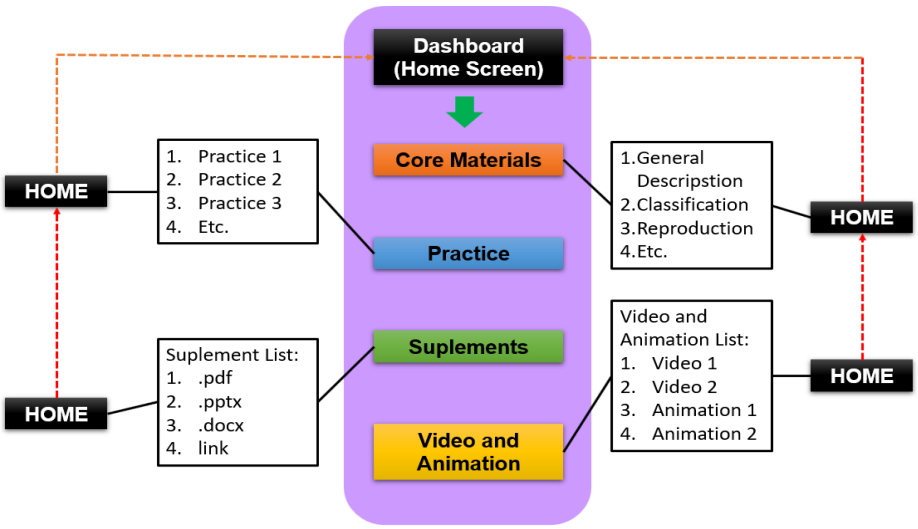

Figure 1. eLEMA-SCL Protozoa Flowchart

Product Design

Graphics

Graphic components of ELEMA-SCL PROTOZOA mostly designed using Adobe Photoshop CS6 including Logo/Icon and banner. The logo on this ELEMA-SCL PROTOZOA product is a renewal of the logo design on the previous prototype product which is made simpler with a circular shape (Figure 2).

Banners are also designed using Adobe Photoshop CS6. Each banner is used as a header on each ELEMA-SCL PROTOZOA application page which consists of Dashboard, Material, Practicum, Material Supplement, Video & Animation, and Test.

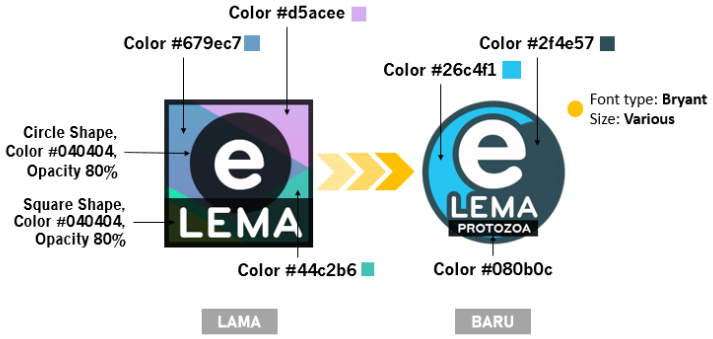

Figure 2. eLEMA-SCL Protozoa Icon/Logo Design

Contents

The ELEMA-SCL PROTOZOA content consists of 5 (five) main menus, namely Materials, Practicum, Material Supplements, and Videos & Animation. Apart from the main menu, there is also an additional menu consisting of About eLEMA and EXIT eLEMA. About eLEMA contains information about the ELEMA-SCL PROTOZOA application development product and the eLEMA EXIT is a feature to exit the application.

The Material menu provides course subject matter based on the Invertebrate Zoology textbook compiled by the Lecturer Team of the Zoology Biology Education Group, Palangka Raya University. The Material menu is divided into sub-menus for easy access to the contents and the << BACK button to return to the Dashboard page. Content on the Material menu can be accessed offline.

The Practicum menu provides Student Worksheets for online practicum activities through the ELEMA-SCL PROTOZOA application. Student Worksheets for practicum activities on the ELEMA-SCL PROTOZOA application are designed for virtual observations of the videos available on the Video & Animation Menu.

The Material Supplement Menu provides additional material in the form of documents and presentation slides to support the main course material. Content on the Material Supplement Menu can be accessed online.

The Video & Animation menu provides digital content in the form of videos and animations related to lecture materials that can be accessed offline without an internet connection (Figure 3). Most of the videos available are video documentation of observations conducted at the Biology Education Laboratory.

The TEST menu provides student test answer sheets consisting of a pretested form and a posttest form. This menu can be accessed online to open forms created using the Google Forms service via the ELEMA-SCL PROTOZOA application. Test questions sheets will be sent through other media, such as Google Classroom or WhatsApp Group.

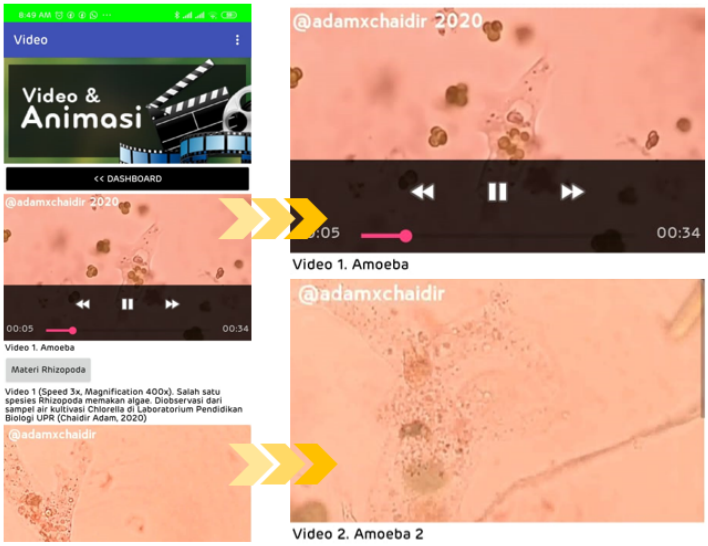

Figure 3. eLEMA Video & Animation: *Amoeba* sp. video

Implementation

The research data includes the pretest and posttest, and student responses to the implementation of eLEMA-SCL Protozoa in Invertebrate Zoology lectures. Detailed pretest and posttest data are presented in Table 1 below.

Table 1. Pretest and Posttest Data of eLEMA-SCL Protozoa Implementation

Data	N	Mean	Highest	Lowest	sd	Var	N-Gain
Pretest	58	50.00	80	10	17.98	323.21	0.52
Posttest	58	77.24	95	10	15.27	233.19	

Table 1 shows the summary data of pretest and posttest in the eLEMA-SCL Protozoa implementation. The range between pretest and posttest means showed a significant increase. The results of the Normalized gain analysis show that the gain score mean of the data is 0.52 in the Medium category. Details of the gain score are presented in Figure 4 below:

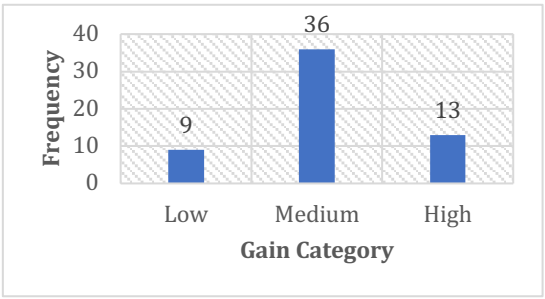

Figure 4. N-gain Scores of Pretest and Posttest in Protozoa Lecture Distribution Diagram

The data of student's responses to the eLEMA-SCL Protozoa implementation in detail is presented in Table 3. Based on the results, the students' response to the eLEMA-SCL Protozoa implementation is positive with a score of 4.31.

The development product produced in this study is eLEMA-SCL Protozoa which is an Android-based mobile application. eLEMA-SCL Protozoa was developed based on a needs analysis and was created using services from the MIT App Inventor. Most of the content on the eLEMA-SCL Protozoa application can be accessed offline, so students can access it easily without an internet connection. Besides, there is also online content, including Material Supplement and the TEST feature as an evaluation tool.

Table 3. Student's Responses to the eLEMA-SCL Protozoa Implementation

No	Question(s)	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1	The design of the eLEMA-SCL Protozoa is attractive	55%	31%	14%	0%	0%
2	the operation of eLEMA-SCL Protozoa is very easy	48%	34%	14%	3%	0%
3	Videos on the eLEMA-SCL Protozoa application help you learn and understand the Protozoa	66%	28%	3%	3%	0%
4	The material supplements available in the eLEMA-SCL Protozoa application are very relevant to the lecture material and help you to study and understand the Protozoa	59%	34%	7%	0%	0%
5	The eLEMA-SCL Protozoa application can motivate to learn Protozoa	41%	41%	17%	0%	0%
6	the material presented in the eLEMA-SCL Protozoa application is easy to understand	34%	41%	24%	0%	0%
7	the material presented in the eLEMA-SCL Protozoa application helps you in answering test questions	31%	45%	24%	0%	0%
8	the shape, style, and size of the letters used in the eLEMA-SCL Protozoa application are simple and easy to read	59%	24%	7%	10%	0%

Featured content from the eLEMA-SCL Protozoa application is on the Video & Animation menu, which consists of Protozoa videos (*Amoeba* sp. and *Euglena* sp.) recorded and directly observed from water samples collected from the environment around the University of Palangka Raya. This content provides students with contextual experiences indirect observation of Protozoa

through the eLEMA-SCL Protozoa application.

The implementation results show the effectiveness of eLEMA-SCL Protozoa as an electronic learning material in Invertebrate Zoology lectures. In its implementation, the eLEMA-SCL Protozoa application is combined with other platforms, namely Google Classroom and Zoom Meeting as instructional media. Student learning outcomes showed a significant increase with a pain score on average is 0.52. The eLEMA-SCL Protozoa application helps students to study independently with the content available in it. In independent learning, a student acquires knowledge by his or her efforts and develops the ability for inquiry and critical evaluation (The Higher Education Academy, 2014). The most important benefits of independent learning for students appear to be engaged with the real world and developing graduate attributes (Thomas, Jones, & Ottaway, 2015).

Students showed positive responses to the implementation of eLEMA-SCL Protozoa in the Invertebrate Zoology lecture. The results showed that the eLEMA-SCL Protozoa application is very attractive and can help students learn and understand Protozoa with the content available in it. (van den Berg et al. (2003) said that digital materials will gain significance for learning both in and outside of school settings.

The advantages of the eLEMA application include: (1) It is mobile, can be installed on Android smartphones without high specification requirements; (2) Has a content navigation menu that makes it easy to use; (3) Has offline content that can be accessed by students without an internet connection; and (4) Its use can be combined with other online learning platforms, such as Google Classroom, Zoom Meeting, etc. With these advantages, eLEMA-SCL Protozoa provides learning motivation to students.

Motivation is an essential component required in the learning process. It encourages students to implement the learning process effectively. Students who have high motivation can achieve higher performance than those who have low motivation. The greater motivation achieved greater learning goals (Alessi & Trollip, 2001).

CONCLUSION

The product developed in the form of an Android-based eLEMA application made using the MIT App Inventor is feasible to implement. The implementation results show: (1) the effectiveness of online and offline lectures with a gain score of 0.52 in the Medium category; (2) student response to the implementation of eLEMA is positive. Thus, the eLEMA application can be used for online and offline lectures during the COVID-19 pandemic.

ACKNOWLEDGEMENT

We are grateful to the Rector of the University of Palangka Raya and Head of LPPM UPR for providing a fund to support this research.

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