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Android-based Serli E-Module (Seroid E-Module) on Solar System Material for Sixth-Grade Elementary School Students

Melyani Sari Sitepu[1], Azizah[2*], Astri Dwi Wulandari[3]

[1] Elementary School Teacher Education Program, Universitas Muhammadiyah Sumatera Utara, Medan, Indonesia
[2,3] Elementary School Teacher Education Program, Tadulako University, Palu, Indonesia

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ABSTRAK

Pembelajaran materi tata surya pada siswa sekolah dasar masih dilaksanakan dengan hanya memanfaatkan buku ajar cetak. Kurangnya penggunaan media kemudian berdampak pada rendahya motivasi serta hasil belajar siswa. Adapun tujuan dari penelitian ini yakni menciptakan media pembelajaran elektronik berupa emodul serli berbasis android (E-modul Seroid) pada materi tata surya. Penelitian ini tergolong kedalam jenis penelitian pengembangan, yang dikembangkan dengan menggunakan model ADDIE. Subjek yang terlibat dalam penelitian ini terdiri dari 6 siswa pada ujicoba kecil dan 20 siswa pada ujicoba lapangan. Pengumpulan data dilakukan menggunakan metode observasi, wawancara, kuesioner, dan tes, dengan Instrumen penelitian berupa lembar observasi, lembar kuesioner, dan tes berbentuk pilihan ganda. Data hasil penelitian kemudian dianalisis secara kualitatif dan kuantitatif. Analisis data kualitatif dilakukan dengan central tendency dan kategorisasi data. Analisis data kuantitatif dengan uji wilcoxon. Hasil penelitian diperoleh nilai validasi media sebesar 84 atau sangat valid. Validasi materi sebesar 87,5 atau sangat valid. Hasil kepraktisan sebesar 89,6 atau sangat praktis. Hasil uji wilcoxon, memperoleh nilai signifikan sebesar 0,001. Hal ini berarti emodul seroid efektif digunakan dalam pembelajaran. Berdasarkan analisis data disimpulkan bahwa e-modul serli berbasis android (E-modul Seroid) pada materi tata surya yang diciptakan telah valid, praktis dan efektif digunakan bagi siswa kelas VI sekolah dasar.

ABSTRACT

Learning solar system material for elementary school students is still carried out using printed textbooks. The lack of media use then impacts low motivation and student learning outcomes. This study aims to create electronic learning media in the form of an Android-based Serli module (E-Module Seroid) on solar system material. This research belongs to the type of development research which was developed using the ADDIE model. The subjects involved in this study consisted of 6 students in the small trial and 20 in the field trial. Data collection was carried out using the method of observation, interviews, questionnaires, and tests, with research instruments in the form of observation sheets, questionnaire sheets, and multiple-choice tests. The research data were then analyzed qualitatively and quantitatively. Qualitative data analysis was carried out with central tendency and data categorization—quantitative data analysis with the Wilcoxon test. The study results obtained a media validation value of 84 or very valid. Material validation is 87.5 or very valid. The practical result is 89.6, or very practical. The Wilcoxon test results obtained a significant value of 0.001. It means that the seroid module is effectively used in learning. The data analysis concluded that the android-based serli e-module (Seroid E-module) in the solar system material was valid, practical, and effective for sixth-grade elementary school students.

1. INTRODUCTION

Natural Science is the science used to understand and answer phenomena that occur in nature (Gazali & Ningsih, 2019; Pratama et al., 2017). One of the science subjects studied at the elementary school level is the solar system (Mutaqqin et al., 2021; Qoridatullah et al., 2021). The solar system is subject material that discusses the collection of celestial bodies consisting of the sun and all the objects that revolve

Corresponding author
*E-mail addresses: azizah88@gmail.com (Azizah)

around it (Adi et al., 2021; Darojat et al., 2022; Nadzif et al., 2022). This material began to be taught at the high school level, grade six. Solar system material has a broad scope, where students cannot see directly what and how the solar system is, so learning media is needed that can be adequate for students to learn and understand more deeply what the solar system is (Hulqi & Arifin, 2022; Sentarik & Kusmariyatni, 2020). Learning media is one part that supports the success of learning. Media use in the teaching and learning process can arouse students' interest and enthusiasm, motivate and stimulate learning activities, and even bring psychological influences to the learning process (Negara & Putra, 2021; Sahari & Wahyudi, 2020; Sujana & Supeno, 2020). The selection of learning media must adapt to the needs of students and teachers (Abdurrochim et al., 2022; Yunus & Fransisca, 2020).

It is just that the reality on the ground shows that the use of learning media still needs to be addressed for several reasons, such as limited time to make teaching preparations, difficulty finding the right media, and unavailability of costs. It aligns with the observations and interviews conducted in sixth grade at SD Inpres Bumisagu. The observations and interviews show that this school completed full online learning during the pandemic, so there was no learning practice. Meanwhile, students sometimes practice learning on certain materials, such as electricity, for offline learning. As for solar system material, students only learn through books and do not practice due to incomplete learning tools and media. It shows that in the learning process, the teacher is still dominant in using textbooks as a reference for teaching without using learning media. The lack of use of learning media then impacts the low interest and motivation of student learning. If allowed to continue, this will certainly impact low student learning outcomes.

One effort that can be made to overcome this problem is by implementing media that suits the needs of students, one of which is media in the form of e-modules. E-module is a module that transforms into an electronic form (Dwiyanti et al., 2021; Wulandari et al., 2021). E-module is a form of technology utilization in education. Learning media in the form of e-modules can be used as independent teaching materials which contain video, animation, and audio presented in electronic form and connected by a link so that learning becomes interactive (Puspitasari et al., 2020; Widiastuti, 2021; Yasa et al., 2018). The advantage of e-modules is that the contents of electronic teaching materials, which include material and practice questions, are presented in various ways, not only text but pictures and videos that support learning material. E-modules can make it easier for students to learn in certain parts as desired (Azizah et al., 2022; Herawati & Muhtadi, 2018; Romayanti et al., 2020). In addition, E-module also has other advantages, such as having interactive characteristics making it easier to navigate, increasing student motivation and enthusiasm in learning, being able to display or load images, audio, video, and animation, as well as formative tests that allow immediate automatic feedback (Azizah et al., 2022; Noviyanita, 2019).

Using e-modules can stimulate students to think critically in answering each evaluation question. It is because in the e-module, when discussing and answering questions from the teacher (Qoridatullah et al., 2021; Sugihartini & Jayanta, 2017). The advantage of using e-modules in the learning process lies in the stages of problem-based learning, the orientation of students to problems, organizing students to learn, guiding individual and group investigations, developing and presenting work, and analyzing and evaluating problem-solving processes (Artiniasih et al., 2019; Maharcika et al., 2021). Another advantage lies in learning patterns that allow students to learn independently, and the teacher is no longer the only source of learning for students (Haeriyah & Pujiastuti, 2022; Pramana et al., 2020). In addition, the amount of teaching time can be reduced, and the learning process can be carried out anywhere and anytime by students independently (Artiniasih et al., 2019; Novrianti, 2018; Sugihartini & Jayanta, 2017). The application of e-module media in the learning process will be more effective if it is developed based on Android. Using Android-based e-modules will make it easier for teachers to carry out the learning process and support the development of electronic learning media (Rasyid & Partana, 2021; Ricu & Najuah, 2020). Android-based e-modules have features that can support student learning both materially and practically (Afrianti & Qohar, 2019; Irawati & Setyadi, 2021). Using Android-based e-modules also makes it easier for students and teachers to learn offline and online (Masruroh & Agustina, 2021).

Several studies that have been carried out previously revealed that interactive e-modules can make learning take place in a conducive manner because it contains features that can help students gain an understanding of the material, especially during this pandemic, where learning cannot take place face-to-face (Wulandari et al., 2021). The results of other studies also reveal that problem-based learning-based E-modules have very good qualifications and are suitable for use in the learning process (Pramana et al., 2020). The results of further research revealed that the interactive E-module learning media assisted by the anyflip application on circle material was effectively used as a learning medium during the online learning process (Haeriyah & Pujiastuti, 2022). Based on some of these research results, the e-module learning media has very good qualifications, so it is feasible to apply in the learning process. In previous studies, no studies specifically discussed the development of Android-based serli e-modules (seroid e-modules) on solar system material for sixth-grade elementary school students. So this research is focused on this study

to create electronic learning media in the form of an android-based serli module (E-module Seroid) on solar system material.

2. METHOD

This research is a type of research and development or Research and Development (R&D) which is a research method to produce a product (can be a model or module or something else, and there is the effectiveness of a product. This research was developed using the ADDIE model, which consists of five stages: Analyze, Design, Development, Implement, and Evaluation. The analysis stage is the initial stage in formulating problems from real conditions in the field by making initial observations at SD Inpres Bumisagu. Direct observation and interviews with the sixth-grade homeroom teacher carry out information collection. Bumisagu Presidential Instruction. This research was conducted by analyzing the basic competencies of natural science subjects regarding the solar system. This analysis was carried out using a literature study of the curriculum regarding basic competencies KD 3.7, KD 3.8, KD 4.7, and KD 4.8 following the fourth grade 2013 curriculum thematic book on themes 8 and 9.

The second stage is the design stage, which is the stage of making module designs and applications. The design was made by adjusting and considering the needs of students and teachers in science subjects on the solar system. This stage produces interactive module design sketches and applications and application work diagrams. This stage is carried out by collecting product requirements through images for cover designs and application icons, material sources, and application marker images. Then proceed with making product appearance sketches and application work diagrams that refer to the product design formulations produced earlier. Next, determine the deadline so that the manufacture of products goes according to plan. The third stage is the development and coding stage of compiling all the requirements obtained in the previous stage and developing modules and applications to become an initial product. Therefore several things are done at this stage, developing interactive modules, developing augmented reality applications, making instruments, and testing initial products. Testing is carried out to obtain modules and applications that follow expectations and ensure the feasibility of the learning media developed to be tested on research subjects.

The fourth stage is the product trial or implementation stage, the stage of testing the feasibility of the modules and applications being developed. This stage includes module validation by expert judgment (experts) and user trials (users). This application is a module in electronic form that can be accessed via Android to help elementary school students understand learning material, especially solar system material, and assist teachers in the distance learning process. The product trial phase includes product validity or feasibility testing and practicality testing. The product developed, the seroid e-module, must meet valid and practical criteria. Therefore, after the seroid e-module has been developed, the next step is to test the validity of the e-module. Testing the validity of the seroid e-module was carried out by expert judgment (experts). The e-module validity test consists of 2 aspects: the media and material. Informatics Engineering lecturers carried out the validity test of the media aspect seroid e-module.

Meanwhile, to test the validity of the seroid e-module, the material aspect was carried out by lecturers in the Natural Sciences, PGSD study program field. After experts declare the seroid e-module valid or feasible from the media and material aspects, conduct limited field trials. A limited trial was conducted to find out the practical aspects of the seroid e-module. The user conducts the limited trial. Users of this seroid e-module are teachers and sixth-grade elementary school students. There were six students involved in the limited trial. The student is from the sixth grade of SD Inpres Bumisagu. Seroid e-modules that have been declared valid and practical are then tested in a large scope or wide field trials. The subjects of this study were 20 sixth-grade students of SD Inpres Bumisagu.

Data collection in the study was carried out using interviews, observation, questionnaires, and tests. Data collection was carried out to obtain all the data and information needed for data analysis. Interviews and observations are used to obtain data at the analysis stage in development, while questionnaires are used to retrieve validity assessment data by experts and module users. The test measures student learning outcomes in the solar system material. The test instrument grid includes grouping planets, identifying planet names based on their characteristics, determining events resulting from moon/earth rotation/revolution, and determining the occurrence of eclipses. Furthermore, the research instrument grids of material and media experts are presented in table 1 and table 2.

Table 1. Material Expert Instrument

No	Aspect	Indicator
1	Self-instructional	Indicators of the formulation of learning objectives
		Presentation of learning material
		Use of examples and illustrations
		Contextual learning materials
		Language and material summary
2	Self-contained	The material follows the module title
		The material follows the learning objectives.
		Material is packaged from easy to difficult levels.
3	Stand alone	Dependence on teaching materials/other media
4	Adaptive	Adjustment of modules with developments in science and technology
		Module flexibility in use in various learning situations and conditions
5	User friendly	Ease of use of the module
		Instructions and information are easy to understand
		The material is easy to understand, and there is a glossary.

Table 2. Media Expert Instrument

No	Aspect	Indicator
1	System quality	Ease of use
		Appearance
		Reliability
		Relevant
2	Information quality	Accuracy
		Information satisfaction
		Format for presenting information
		Relevant

The data obtained in the study were then analyzed qualitatively and quantitatively. Qualitative data analysis was carried out with central tendency and data categorization. Quantitative data analysis with Wilcoxon test. Wilcoxon test to determine the effectiveness of seroid e-modules. The descriptive analysis includes the measurement of central tendency, reliability, frequency distribution, and data categorization. Central Tendency measurement is a statistical technique determining a single score as the center of the distribution. There are several methods commonly used in measuring central tendency, mean (average), median (middle value), and mode (values that appear frequently). The method used in the central tendency of this development research is the mean (average). The categorization of data resulting from data analysis in quantitative data will be converted into qualitative data by classifying scores into score intervals. This stage is carried out to determine the score category of the analysis results. The data categorization stage in this development research uses a conversion table, a conversion table for product validation tests, and product trials. The tables used in categorizing research data can be seen in table 3 and table 4.

Table 3. Product Trial Feasibility Conversion Table

Score Intervals	Category
$X > Xi + 1{,}80Sbi$	Very good
$Xi + 0{,}60Sbi < X \leq Xi + 1{,}80Sbi$	Good
$Xi - 0{,}60Sbi < X \leq Xi + 0{,}60Sbi$	Enough
$Xi - 1{,}80Sbi < X \leq Xi - 0{,}60Sbi$	Not enough
$X \leq Xi - 1{,}80Sbi$	Very less

Table 4. Value Conversion Table

Score Intervals	Category
$X > 83{,}94$	Very good
$67{,}98 < X \leq 83{,}94$	Good
$52{,}02 < X \leq 67{,}98$	Enough
$36{,}06 < X \leq 52{,}02$	Not enough
$X \leq 36{,}06$	Very less

3. RESULT AND DISCUSSION

Result

Serli e-module development uses an Android-based application using the ADDIE development model. Based on the development procedures that have been carried out using the ADDIE model. The results of each research stage are as follows: the first stage is the analysis stage needed to identify problems and find the right solution to the problems that have been found. After conducting initial observations at SD Inpres Bumisagu, it was found that this school used the 2013 curriculum, where solar system material was found in grade six, theme 8 and theme 9 in KD 3.7, KD 4.7, KD 3.8, and KD 4.8. KD 3.7 understands the solar system and the characteristics of the members of the solar system, KD 4.7 makes a model of the solar system, the indicators make and present a model of the solar system, KD 3.8 understands the events of earth's rotation and revolution as well as the occurrence of lunar eclipses and solar eclipses, the indicators carry out rotation and revolution simulations earth by using props, and KD 4.8 to make models of lunar eclipses and solar eclipses, the indicators display models of lunar eclipses and solar eclipses. In the initial observation, interviews were also conducted with the sixth-grade homeroom teacher. The results show that in learning, there are gaps in the form of a lack of teaching materials for solar system material, where the teaching materials available are only thematic books, and there has never been practice regarding solar system material. After analyzing the basic competencies and the gaps in the learning process, the next step is to analyze the product requirements, regarding what is needed in the module and application materials, user needs, application development needs, design formulation, and product work diagrams.

The second stage is the media product design stage. After obtaining the data, the product is designed according to user needs. E-modules are designed by selecting components ranging from fonts, font sizes, covers and backgrounds, images, videos, materials, and experimental activities, to evaluation questions. The fonts used in the main module are Comic Sans MS and Arial Fonts, with sizes adjusted to the application's appearance. Materials, experimental activities, and evaluation questions contained in the e-module Serli cover Solar System material, celestial bodies, rotation and revolution, lunar eclipses, and solar eclipses. There are 25 evaluation questions consisting of 20 multiple-choice and five essay questions. More smoothly, e-modules are designed by requiring users to log in to access them. Users are divided into teachers and students, so users are expected to log in according to their respective professions. User teachers and students are interconnected. Student users are required to enter the class code obtained from the teacher user to access materials, evaluation questions, and other features. The preparation of the e-module framework generally consists of three main parts: learning activities, multiple choice evaluation, and essay evaluation. Learning activities include Basic Competencies, Core Competencies, learning objectives, concept maps, material descriptions about the solar system, experimental activities, summaries, glossaries, and bibliography. The following results of the design of the e-module framework and solar system material can be seen in Figure 1.

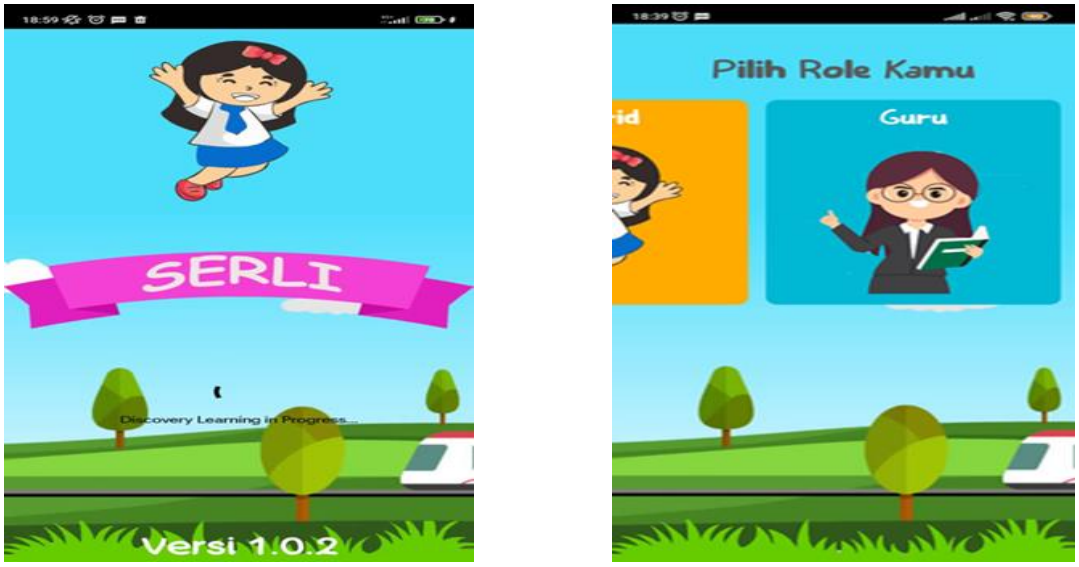

Figure 1. An Example of the Display Design of the Serli E-module for Solar System Material

The third stage is the development stage, which consists of four steps: the development of interactive modules, the development of augmented reality applications, the manufacture of instruments, and the initial product testing. This stage is carried out to get a product that is suitable for use. The Serli e-module is the development of the Serli print module, which was developed into an Android application-based electronic module. The Serli module used as the basis for the Serli e-module has been tested on users,

and it found that the Serli module can improve student learning outcomes. Developing the serli module into a seroid e-module of solar system material can make it easier for users not to bother carrying printed media. However, it is already available as an application on the user's mobile phone to be accessed anytime and anywhere. The solar system material serli e-module is an Android application-based electronic module developed from the serli module. In this stage, the application is made based on the design results made in the previous stage. The application was developed considering the material's content, the quality of multiple-choice evaluation questions and essays, and the quality of the images and videos.

The instrument was created to obtain valid and practical values for using the original e-module. The actual e-module can be disseminated to users if it has been deemed valid and practical by material experts, media experts, and users. The instrument is arranged based on the features of the original e-module application. The assessment instrument in the form of a questionnaire that has been made is then submitted to material experts, media experts, and users to be assessed based on the contents of the serli e-module application. Material experts and media experts carry out validation to assess the feasibility of the original e-module. The results of the validation obtained from media experts and material experts are that the e-module serli based on the android application is feasible to use so that it can be tried out to the implementation stage to find out the response of teachers and students.

The e-module product, which has been declared valid by material experts and media experts, is then tested on teachers and students as users. The e-module for solar system material was tested on one sixth-grade homeroom teacher at SD Inpres Bumi Sago and a small group of sixth-grade students at SD Inpres Bumi Sago, totaling six people. Teacher and student response trials were carried out offline on the same day. After testing the serli e-module product, teachers and students as users filled out user response questionnaires to find out the practical value of the serli e-module application. The e-module validation also involves two validators: the media expert validator and the material expert validator. After the media has been developed, it is validated by the material expert validator. This validation process aims to assess the feasibility of the e-module and solar system material in terms of material, language, and presentation. The validation process was carried out once and obtained feasible results for using e-modules and solar system materials. The results obtained from material experts can be seen in table 5.

Table 5. Results of the Material Validation Assessment

No	Assessment Aspect	Score	Category
1	Self-instruction	95,8	Very good
2	Self Contained	100	Very good
3	Stand Alone	75	Good
4	Adaptif	91,7	Very good
5	User friendly	75	Good
	Average	**87,5**	**Very good**

Based on the data in table 5, it is known that the material validation results from the self-instruction aspect is 95.8 or very good, the self-continued aspect is 100 or very good, the stand-alone aspect is 75 or good, the adaptive aspect is 91.7 or very good and user friendly aspect of 75 or good. Overall the material validation value is 87.5, or very good. After being declared valid and feasible to use in terms of material, the next step is to validate the e-module product media and solar system material. A media expert validator carried out this validation. This validation process aims to assess the e-module media's eligibility from system quality and information quality. Media validation was carried out twice to obtain a product that is valid and suitable for use.

Furthermore, based on the results of the validation of media experts for system quality and information quality indicators, a score of 84 was obtained in the very good category. Even though a very good category has been obtained, which means the product is feasible to be tested, there is a suggestion from the validator to add pretest and posttest menus so that improvements are needed to achieve a higher level of feasibility. The appearance of the e-module before and after media validation can be seen in Figure 2.

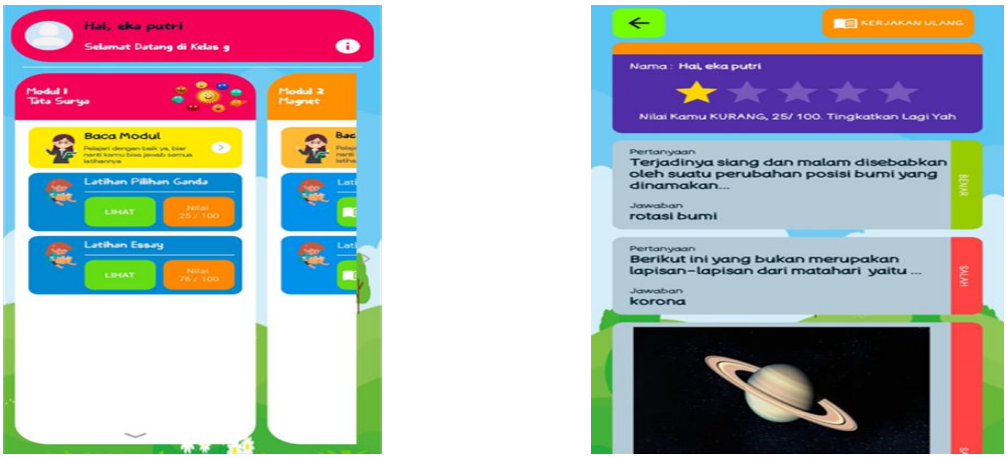

Figure 2. Display of the e-Module Before and After Media Validation

The fourth stage is the media trial/implementation stage. E-modules declared valid regarding material, and media can be tested on users. User trials started with small trials and then continued with large field trials. Small trials were carried out on a small scale involving teachers and students. The test subjects involved in this small trial were homeroom teachers and sixth graders of SD Inpres Bumisagu Palu. The results of the trial of the e-module and solar system material are described in table 6.

Table 6. Practicality Assessment Results From Users

User	Aspect	Score	Category
Student	Effective	85	Very good
	Efficient	85	Very good
	Overall satisfaction	80	Good
	User convenience	86,7	Very good
Teacher	Effective	90	Very good
	Efficient	90	Very good
	Overall satisfaction	100	Very good
	User convenience	100	Very good
Average		**89,6**	**Very Good**

The results of the practicality assessment shown in table 4 show that the average user practicality value of students and teachers is 89.6, with a very good category. The acquisition of this value indicates that the developed seroid e-module is in the practical category. Thus the seroid e-module can be used in field trials or for large-scale users. The results of field trials or large-scale users are shown in table 7.

Table 7. Student Learning Outcomes in the Experimental and Control Classes

Class	Treatment	Average Score
Experiment	Pretest	39
	Posttest	83
Control	Pretest	34,5
	Posttest	63,5

Large-scale field or user trials were carried out in the sixth grade of SD Inpres Bumisagu Palu. The test subjects involved 20 students. Student learning outcomes show that the pretest score in the control class is 34.5, and the experimental class is 39. This value indicates that the acquisition of learning outcomes in the two classes is similar. The values of these two classes were obtained before using the seroid e-module treatment. After the treatment, seroid e-module media in the experimental class and book media in the control class was continued by measuring the learning outcomes. The posttest score in the control class was 63.5, and in the control class was 83. These results showed a significant difference in the control and experimental classes. Significant test results are shown in Table 8.

Table 8. Wilcoxon Test Results

	Learning outcomes
Mann Withney U	8.000
Wilcoxon W	63.000
Z	-3,201
Asymp.Sig. (2-tailed)	0,001

Table 8 shows that the significant value of the Wilcoxon test calculation results is 0.001. This result is less than the significance value of 0.05 (0.001<0.05). It indicates that hypothesis Ho is rejected and Ha is accepted. The seorid e-module is effectively used in solar system material for sixth-grade elementary school students.

Discussion

The serli e-module is an Android application-based electronic module developed from the serli print module. The serli e-module is a medium for sixth-grade science learning, especially solar system material. The results obtained from this study show that the Android-based Serli e-module on solar system material has been successfully tested and meets valid, practical, and effective criteria, and is suitable for use in schools. The serli e-module was developed to emphasize the teacher's role as a guide, and students learn to actively analyze, practice and then make their conclusions. Thus students can build their knowledge (Puspitasari et al., 2020; Widiastuti, 2021; Yasa et al., 2018). So that the Serli E-module can be an electronic learning media that helps teachers and students in learning, especially in science subjects. Through this media, teachers and students can easily carry out practical learning. E-modules have advantages over other media, such as containing Core Competencies, Basic Competencies, learning objectives, practicum activities, glossaries, and multiple choice and essay evaluations; equipped with music, pictures, and learning videos that can add interest and ease to students in learning serli is also adapted to the vision of students (Dwiyanti et al., 2021; Wulandari et al., 2021).

The application of e-modules in the learning process can make learning take place in a conducive and effective manner because it contains features that can help students understand the material (Azizah et al., 2022; Herawati & Muhtadi, 2018; Romayanti et al., 2020). In interactive e-modules, the material is presented in text and pictures. It is complemented by animations and videos that make it easier for students to understand the material being taught (Azizah et al., 2022; Noviyanita, 2019; Wulandari et al., 2021). Furthermore, the E-module developed based on Android technology makes it easier for students and teachers to use it because it can be used anywhere and anytime (Azizah et al., 2022; Noviyanita, 2019). In addition, through e-module technology, students can learn practically, independently, and flexibly whenever and wherever, independently (Qoridatullah et al., 2021; Sugihartini & Jayanta, 2017). The size of this application is also small, around 45 Mb. The Serli module is equipped with learning videos about solar system material, making it easier for students to understand. The evaluation system for evaluation will automatically enter the teacher's application. Teachers can also download class grades in excel format to make it easier to manage student assessments. Multiple choice evaluation questions are automatically recorded for true and false. At the same time, essay evaluation requires the role of the teacher to give how correct the star symbol in the application denotes the student's answers. The more stars are given, the more correct the student's answer is (Haeriyah & Pujiastuti, 2022; Pramana et al., 2020). Teachers and students can see the results of the assessment of the evaluation that has been done.

The results obtained in this study are in line with the results of previous research, which also revealed that interactive e-modules could make learning take place in a conducive manner because they contain features that can help students gain an understanding of the material, especially during this pandemic, where learning is not can take place face to face (Wulandari et al., 2021). The results of other studies also reveal that problem-based learning-based E-modules have very good qualifications and are suitable for use in the learning process (Pramana et al., 2020). The results of further research revealed that the interactive E-module learning media assisted by the anyflip application on circle material was effectively used as a learning medium during the online learning process (Haeriyah & Pujiastuti, 2022). Based on the results supported by previous research, the e-module learning media has very good qualifications, so it is feasible to apply in the learning process.

4. CONCLUSION

This research and development resulted in an android-based serli e-module on solar system material that met valid, practical, and effective criteria. It is evidenced by the average results of expert validation, media validation, and user ratings that fall into the very good criteria. Android-based serli e-

module (Seroid) helps students in learning material, especially solar system material. This e-module is also easy to use without being limited by space and time, with various features that students are more interested in using.

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