JPPIPA 10(8) (2024)

Jurnal Penelitian Pendidikan IPA

Journal of Research in Science Education

http://jppipa.unram.ac.id/index.php/jppipa/index

Development of e-LKPD Using Flip PDF Professional on Coordination System Material for F Phase Students

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Received: April 19, 2024
Revised: July 15, 2024
Accepted: August 25, 2024
Published: August 31, 2024

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DOI: 10.29303/jppipa.v10i8.7437

Abstract: Coordination system is a complex material due to its many sub-discussions. Teachers' limited time to discuss questions with students causes students to have difficulties in understanding the material. To overcome this problem, e-LKPD which can streamline learning time and act as a solution to students' difficulties related to the lack of time to do practice questions is required. This research aims to develop an e-LKPD using Flip PDF Professional on coordination system material and analyze the feasibility of the developed product. This research uses the ADDIE development model which consists of Analyze, Design, Develop, Implement and Evaluation. The results of the research show that the e-LKPD developed obtained a percentage of 93.30% in the "very feasible" category. In the media validation stage, a percentage value of 81.67% was obtained in the "very feasible" category. Biology teachers' perceptions regarding the quality of the developed product obtained a percentage of 96.70% in the "very good" category. Small group trials with students obtained a percentage of 86.70% in the "very good" category and large group trials obtained a percentage of 89.60% in the "very good" category. Therefore, it can be concluded that the developed product is feasible and practical for students to use.

Keywords: Coordination System; E-LKPD; F Phase Student; Flip PDF Professional

Introduction

The rapid development of technology has influenced all sectors of life in the economic, political, social and cultural sectors, and also in the educational sector (Jamun, 2018). The application of technology in the sector of education is very diverse, from simple learning media to media using modern technology. The use of learning technology by teachers has the potential to support learning and teaching activities in the classroom Salsabila et al. (2021), as well as student thinking skills (Mataniari et al., 2020; Mataniari et al., 2024). The application of learning tools in the teaching and learning process can be very helpful in creating a conducive learning atmosphere and can make learning more efficient to increase students learning motivation (Saputra et al., 2024).

The choice of learning tools determines the effectiveness and efficiency of the learning process. Inappropriate media selection can reduce students' comprehension of the subject matter being studied (Miftah & Nur Rokhman, 2022). The application of learning tools can become the basis for learning activities in the classroom. Learning tools used by teachers in the teaching and learning process in class to solve problems in class (Siburian et al., 2022).

Based on the results of a student analysis questionnaire conducted on students in class XI Science (phase F) of Xaverius 2 High School Jambi, It is known that the student problem is that students have difficulty understanding the coordination system material, this result is based on the results of a questionnaire which showed that of all the learning material that had been studied by class XI students (phase F), 48.30% (14 out of 29 students) still had difficulty understanding the coordination system material.

In the coordination system material, students are expected to be able to understand the relationship between the structures that make up the organs in the coordination system and their relationship to

How to Cite:
Meydi, R., Hamidah, A., & Mataniari, R. (2024). Development of e-LKPD Using Flip PDF Professional on Coordination System Material for F Phase Students. *Jurnal Penelitian Pendidikan IPA*, *10*(8), 5900–5908. https://doi.org/10.29303/jppipa.v10i8.7437

coordination and regulatory mechanisms as well as disturbances that occur in the coordination system in humans. According to Rozalina (2017), coordination system is material that has high complexity and the material is abstract. The complexity of the coordination system material is due to the fact that the coordination system material consists of sub-sections which include material on the nervous system, hormone system, and sensory system, as well as abnormalities in each sub-section of the coordination system material.

One of solution to overcome difficulties in studying biology among students is to use learning tools in teaching. This is in accordance with the statement by Nasution et al. (2023), which states that learning tools help and reduce the burden on students in understanding the subject matter. Learning tools provide information that is systematically arranged, explains learning material, provides example questions, and practice questions that enable students to learn new concepts more easily and effectively. According to (Khaerani et al., 2022), student worksheets (LKPD) are one of the learning tools. LKPD includes learning activities in which the LKPD contains theory, demonstrations, work instructions and work procedures for an investigation as well as questions that are adapted to the indicators to be achieved in the ongoing learning process.

Based on an observation conducted, the existing LKPD in schools is still general in nature and most of the LKPD only contain a summary of the material with a few pictures and explanations. The material presented in the LKPD is very short and without detailed explanations and no instructions for use. This causes students to be less interested in the existing LKPD. The packaging of material is often monotonous, resulting in students only memorizing the material without understanding the concepts contained in the LKPD, which easily results in students forgetting easily. So, when given questions that are slightly different it can make students confused (Mayasari et al., 2023).

The coordination system material consists of many sub-materials so there is limited time to discuss questions. Therefore, it is necessary to develop innovative LKPD that can help train students' understanding of coordination system material. This is reinforced by the results of the preliminary study questionnaire that students tend to easily understand the material by seeing, reading, hearing and doing it. This means that the media developed must contain text, images, videos and practice questions that can be done directly, besides that students prefer learning using electronic devices compared to printed devices because they are more practical and easy to access.

Based on Artalia et al. (2022), student worksheets (LKPD) have advantages, including helping to improve student learning outcomes, providing encouragement to students to be able to learn independently, students being able to develop concepts well. Based on Trissa et al. (2022), e-LKPD has advantages such as being able to make it easier for students to understand learning material because e-LKPD can add animated video features of learning material, and also material concepts that are easy for students to understand.

Trissa et al. (2022), conducted research on the development of e-LKPD in class XI on coordination system material where the product developed consisted of material and questions consisting of multiple choice questions and essays. The novelty of this research is the development of e-LKPD which consists of material in the form of text and learning videos as well as pictures containing explanations and questions consisting of multiple choice questions, essays, matching questions, crossword puzzles and final evaluation questions and with practical activities.

Based on the problems found, this research aims to develop a product in the form of e-LKPD using the ADDIE development model and analyze the feasibility of developing e-LKPD using Flip PDF Professional on coordination system material.

Method

This research is development research (Research and Development). Based on (Purnama, 2016), this type of research and development is a type of research that is useful in creating or producing a product and testing its effectiveness.

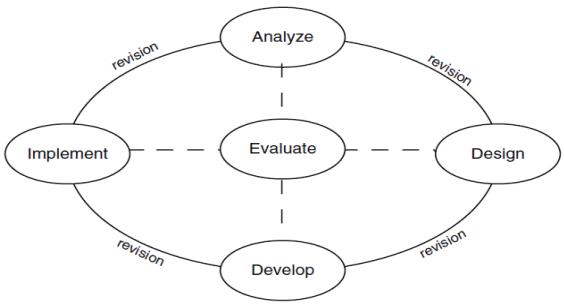

Figure 1. Development Model Scheme ADDIE (Branch, 2009)

The test subjects in this research consisted of two teachers, namely biology study teachers and students in class XII science (phase F) at Xaverius High School, Jambi city. Based on Setyosari (2013), test subjects for small groups consist of 5-8 people, while test subjects for large groups consist of 15-30 people. This research involved 6 students as a small group trial and 23 students as a large group trial. The type of data used is qualitative and quantitative data. Instrument data collection is in the form of interviews and questionnaires. The product measurement scale for

validation questionnaires and product trials uses a Likert scale with an interval of 1 to 4. Validation is carried out by material experts and media experts by providing an assessment questionnaire to test the suitability of the product.

Result and Discussion

Based on the ADDIE development model, it consists of 5 stages, namely Analysis, Design, Development Stages, Implementation and Evaluation. The five stages implemented in a student worksheet development is in accordance with previous research (Fatimah & Rohani, 2022; Nurhaisa et al., 2023; Sanudin & Aminatun, 2023; Taqiyyah et al., 2023; Wahyuni et al., 2021).

Analysis Stage

The analysis stages carried out are validating performance gaps (needs analysis), setting instructional goals, identifying available resources, and identifying student characteristics (Hasibuan et al., 2023; Lisanti et al., 2022; Windayani & Pertiwi, 2023). Based on the results of the validation of the performance gap, the results obtained were that high school teachers Xaverius 2 Jambi City needs innovative LKPD to maximize the learning process and make it easier for students to understand the material because. This is because the LKPD in schools is still printbased and electronic LKPD has never been used which can be accessed online. Apart from that, as many as 51.70% (15 out of 29 students) stated that it was necessary to develop a learning tool that contained lots of practice questions to make it easier to understand material that was difficult to understand. Based on the results of the preliminary questionnaire, it was found that of all the material that had been studied in Phase F (Class XI), 48.30% (14 out of 29 students) still had difficulty understanding the coordination system material. Students stated that the difficulties experienced in the coordination system material were that the material was too much, complex and there was a lack of examples and practice questions in the material. The media commonly used by teachers are Power Point (PPT), videos and LKPD. However, the LKPD used is still printed and is still very simple because some of the LKPD are adopted directly by teachers via the internet and are less varied because they only consist of text (sentences) with a few pictures. Based on the results of the student characteristics questionnaire, it was found that when studying material, students tend to easily understand it by seeing, reading, hearing and doing it. Students prefer electronic learning devices that can be accessed via electronic devices compared to printed devices because they are practical. The analysis stage conducted in the research is accordance with the previous research (Alzoebi et al., 2023; Redhana et al., 2024).

Design Stage

The design stage implemented is in accordance with the previous research (Bani & Masruddin, 2021; Salas-Rueda et al., 2020; Zhang, 2020) The e-LKPD product was designed using the Canva application, practice and evaluation questions were developed using wordwall and Google forms, then continued using the Flip PDF Professional v 2.4.10.2 application which was published in link form.

Development Stage

The development stage conducted is in accordance with the previous research (Almelhi, 2021; Alodwan & Almosa, 2018; Mutlu, 2016). At this stage, E-LKPD material validation is carried out experts, media experts, and product trials. The results obtained are:

Table 1. Material Validation Results

Indicator	Validation result (%)	
	1	2
Quality of e-LKPD content	79.20	91.67
Questions accuracy	75.00	100.00
Language usage	75.00	83.30
Presentation	75.00	100.00
Product percentage	76.70	93.30
Category	Feasible	Very feasible

Table 2. Media Validation Result

Indicator	Validation result (%)	
	1	2
E-LKPD design	58.30	83.30
Ease of use	68.75	75.00
Utilization of e-LKPD	87.50	87.50
Product percentage	65.00	81.67
Category	Feasible	Very feasible

Table 3. Biology Teacher Assessment Results

Indicator	Results (%)
Presentation components	92.85
Ease of use	100.00
Clarity	100.00
Product percentage	96.70
Category	Very good

Table 4. Student Trial Assessment Results

Indicator	Results (%)	
	Small groups	Big groups
Content or material	83.30	84.78
Clarity	87.50	90.65
Ease of use	88.90	92.02
Language	85.42	90.76
Interest to learn	85.42	86.95
Product percentage	86.70	89.60
Category	Very good	Very good

Implementation Stage

The implementation stage in this research was not carried out, this research was only limited to the product development stage to analyze the feasibility of the product being developed, in accordance with the previous research (Madrin & Ratnawati, 2024; Nurhayati et al., 2021; Syam, 2020). Researchers introduce e-LKPD to students, then students try to study and fill in the practice questions contained in e-LKPD. The final evaluation by students consisting of 10 multiple choice questions obtained an average score of 87, from 29 students consisting of small groups and large groups. As many as 10% of students got a score below the minimal passing grade/KKM (KKM=65), and 90% of students got a score above the KKM. In this way, students can access, study and work on the questions contained in the e-LKPD.

Evaluation Stage

The evaluation stage carried out is a formative evaluation. Formative evaluation activities carried out material expert validation, media expert validation and product trials (Fratiwi et al., 2020; Lesmanawati et al., 2024; Villarino et al., 2022).

Development of e-LKPD using Flip PDF Professional on Coordination System material developed using the ADDIE development model. The ADDIE development model consists of 5 stages. The first stage is the analysis stage. This analysis stage was carried out with the aim of finding out the problems that occur in the field by conducting interviews with biology study teachers and distributing questionnaires on the needs and characteristics of students at Xaverius 2 High School Jambi City, so that data can be obtained on what problems exist in biology learning at the school. Based on the results of the analysis carried out, it can be seen that the problems that occur in students of class XI Science (Phase F) at Xaverius 2 High School Jambi in biology learning, students still have difficulty understanding the coordination system material. This result is based on a questionnaire which shows that of all the material that has been studied by Phase F (Class XI) students, 48.30% (14 out of 29 students) still have difficulty understanding the material coordination system. The difficulties experienced in the coordination system material were that the material was too much, complex and there was a lack of examples and practice questions in the material.

Coordination system is complex material and difficult to understand because students are expected to relate one concept to another concept, however, the coordination system material has a wide range of material which makes it difficult for students to understand the entire material. This is confirmed by the results of teacher interviews which state that of all the learning material that has been taught, students have difficulty understanding the coordination system material because the coordination system material includes broad sub-sections, in one chapter consisting of material on the nervous system, hormonal system, and sensory system. Apart from that, the factors that cause coordination system material to be difficult for students to understand are because there are many mechanisms that must be understood and the lack of practice questions due to limited time in delivering the material in the learning process. Coordination system material is material that is difficult to manage in biology learning because of the complexity of the material, so it requires a lot of time to study and discuss in learning.

Based on statements from students and teachers that the material on coordination systems is very complex and there is a lack of examples and practice questions on this material, then the teacher at Xaverius 2 High School, Jambi City requires innovative LKPD to maximize the learning process and make it easier for students to understand the material. This is because the LKPD in schools is still print-based and electronic LKPD has never been used which can be accessed online. The LKPD used is still printed and is still very simple because some of the LKPD are adopted directly by teachers via the internet and are less varied because they only consist of text (sentences) with a few pictures. Teachers feel that in learning coordination system material, students' interest or interest is still low because the material covers a lot, for this reason, innovative LKPD is really needed. Innovative LKPD can be adapted to the characteristics of students so that they can make students more interested in understanding learning. Based on the results of the student characteristics questionnaire, it was found that students tend to understand easily by seeing, reading, hearing and doing. This means that students understand the material better with media that contains text and images, videos and direct practice questions. Students prefer electronic learning devices that can be accessed via electronic devices compared to printed devices because they are practical. Based on Sari & Wulandari (2020), e-LKPD has the advantage of minimizing the teacher's role in learning activities, so that complex material can be achieved completely. e-LKPD is also effective in helping students understand the material because there is material that is easy to understand because it is in summary form. Apart from that, e-LKPD is very practical to use because it contains exercises that can be done straight away. Based on these benefits, e-LKPD is an innovative learning tool that can attract students' learning attention and is effective in reducing the time required for learning coordination system material. Therefore, the solution offered in this research is to

develop e-LKPD using Flip PDF Professional on coordination system material for Phase F students.

The next stage is the design stage. This stage is the e-LKPD design stage which is developed before it begins to be realized. At this stage the researcher creates a storyboard. After creating a storyboard, the researcher collected references used to create e-LKPD in the form of materials, videos and images. Next, e-LKPD was created using the Canva application and continued using Flip PDF Professional to make the e-LKPD feature more interactive. Once completed, the e-LKPD is published in the form of an html link.

The first stage of material validation obtained a feasibility percentage of 76.70% in the "Feasible" category. However, there are still suggestions and comments for product improvement. After improvements were made, the second stage of validation was then carried out, obtaining a feasibility percentage of 93.30% in the "Very Feasible" category and it could be concluded that the product was suitable for field testing without any revisions. This result was obtained because the e-LKPD developed had good content quality because the explanation of the material was adjusted to the goals that students had to achieve. The material is presented systematically, coherently, using sentences that are easy for students to understand and using simple language that is in accordance with refined spelling so that it is easy for students to understand. Apart from that, the e-LKPD questions presented are adapted to the realities of daily life because many of the questions contain cases of coordination systems that are often heard by students so that students are able to connect the theory they have obtained with benefits in everyday life. Apart from that, the use of images and videos in the developed e-LKPD can support students' understanding of coordination system material.

A good e-LKPD is an e-LKPD that explains the material and practice questions in accordance with the goals that must be achieved by students. Apart from that, e-LKPD that is easy to understand is e-LKPD that uses language appropriate to the level of intellectual development of students, using clear, coherent and simple sentences. Then, a good e-LKPD is an e-LKPD that does not only display material in written form but is supported by pictures and videos. This aims to summarize the material presented to students and avoid the impression of being bored and boring because there is too much material. The advantages of using images in media according to Utami (2018), are 1) to make it easier for students to understand, especially abstract material, 2) to increase students' attractiveness 3) to shorten information that requires a long description. The advantages of using video in e-LKPD based on Wisada et al. (2019), It is very good to explain a process or mechanism so that the message received by students is more even, besides that it can be repeated and stopped according to students' needs and gives a deep impression that can attract students' learning attention.

After the e-LKPD coordination system material is validated by the material validator, media validation is then carried out. Media validation was carried out twice. Media validation consists of 3 assessment aspects consisting of aspects of e-LKPD design, ease of use, utilization of e-LKPD. The results of material validation. The first stage of media validation obtained a feasibility percentage of 65.00% in the "Feasible" category. However, there are still suggestions and comments for product improvement. After improvements were made, the second stage of validation was then carried out, obtaining a feasibility percentage of 81.67% with the "Very Feasible" category and it could be concluded that the product was suitable for field testing without any revisions. This result was obtained because the e-LKPD developed has an attractive appearance design, degradation and the combination of colors used in the background with font colors is appropriate and has clear readability elements and the layout between writing, images and videos is balanced. The instructions for use and practical work steps are easy to understand, the available navigation (buttons) can be operated easily, the e-LKPD is very practical because it can be accessed via electronic devices and the developed e-LKPD contains various practical activities and practice questions that can be responded to by participants educate.

Based on Nurmasita et al. (2023), attractive cover design, content and colors can arouse students' interest and enthusiasm for learning. Apart from that, ease of operating navigation and ease of understanding usage instructions are important for the continuity of students' learning process using e-LKPD. Next, according to Syahputri et al. (2023), an interesting e-LKPD is an e-LKPD which includes video features, images, links and various forms of questions as well as a series of learning activities such as investigations or performance and problem solving which are useful for students' understanding of concepts.

After the e-LKPD using Flip PDF Professional on the material coordination system was declared feasible by the material and media validator, the product was then tested on biology teachers and students consisting of a small group of 6 students and a large group of 23 class XII students Xaverius 2 High School, Jambi. The trial was carried out by distributing student perception questionnaires in the form of Google forms, and teacher perception questionnaires in printed form. The results of biology teachers' perceptions of the developed e-LKPD obtained a percentage of 96.70% in the "Very Good" category. The results of the small group student perception questionnaire regarding e-LKPD obtained a

percentage of 86.70% in the "Very Good" category. The results of the large group student perception questionnaire obtained a percentage of 89.60% in the "Very Good" category.

Based on the results of the questionnaire regarding the perceptions of teachers and small group and large group students, it can be concluded that e-LKPD using Flip PDF Professional coordination system material can be used in the learning process because it provides a new learning experience for students because there are different forms of questions. varied, attractive appearance, especially the presentation of supporting images and videos which can streamline students' learning time and make the material presented easier to understand, as well as practical because it can be accessed via electronic devices. Based on Putri Fauziah Yazmin & Risda Amini (2023) the use of e-LKPD which has never been used by teachers in previous lessons can provide new experiences for students and increase students' curiosity so that students can better master the material.

The next stage is Implementation. In this research, the implementation stage was only carried out during product testing. This is due to limited teaching hours, so this research does not allow for implementation in the learning process directly. This stage is carried out during testing, students try to do several practice questions and final evaluation on e-LKPD. The final evaluation by students consisting of 10 multiple choice questions obtained an average score of 87, from 29 students consisting of small groups and large groups. As many as 10% of students (3 students) got a score below the KKM (KKM=65), and 90% of students (26 students) got a score above the KKM. In this way, students can access, study and work on the questions contained in the e-LKPD.

The evaluation stage is the final stage of this research. The evaluation carried out is a formative evaluation. Formative evaluation is an evaluation carried out at each stage of ADDIE. At the analyze stage, an evaluation is carried out in the form of adjusting the material needed for the development and adjustment of the newly implemented curriculum, namely the Merdeka Curriculum. At the design stage, material references are collected and storyboards are designed. At the development stage, evaluations are carried out in the form of material validation feasibility tests and media validation and product trials to obtain teacher and student perceptions. At the implementation stage, only a limited amount of time was carried out during product testing to introduce e-LKPD and provide direction to students to study e-LKPD and fill in practice questions on e-LKPD, with the aim of seeing whether students could easily access the link. and working on questions, with the limitations of the implementation carried out, this becomes a note for improving future research.

The e-LKPD product developed using Flip PDF Professional on Coordination System material has several advantages and disadvantages. The advantages are 1) easy to use and flexible because it can be accessed via a shared link and can be used anytime and anywhere, 2) Increases students' understanding of coordination system material which includes many sub-materials because e-LKPD is designed to be concise, 3) Provides a new learning experience for students because the material does not only present writing, but is equipped with images, videos, QR-Code and several activities that students can do. However, apart from having advantages, this e-LKPD also has disadvantages, including 1) it only contains coordination system material so it needs to be developed into other material according to learning needs, 2) e-LKPD can only be accessed online and requires a good internet network and stable. Another alternative that can be used to overcome this problem is to publish it in FLB file format and users must have the Flip PDF Professional application installed on their computer or laptop to access it offline.

Conclusion

E-LKPD coordination system material was developed using the ADDIE development model through 5 stages, namely the analyze, design, develop, implementation, evaluation stages. The e-LKPD, which was developed using Flip PDF Professional coordination system material for Phase F students, was declared suitable for testing. Based on the results of material validation twice, a final percentage of 93.30% was obtained in the "Very Feasible" category and media validation was carried out twice with a final percentage of 81.67% in the "Very Eligible" category so that e-LKPD was suitable for use. tested in the field. Next, product trials were carried out on biology teachers and class XII science students at SMA Xaverius 2 Jambi, consisting of 6 small group students and 23 large group students. The assessment of biology teachers' perceptions of the developed e-LKPD obtained a percentage of 96.70% in the "Very Good" category. so that it can be well received by teachers and can be used in the learning process. Furthermore, the assessment of students' perceptions of the e-LKPD development product that has been developed obtained a small group trial percentage of 86.70% with the "Very Good" category and a large group trial percentage of 89.60% with the "Very Good" category so that e -LKPD on the coordination system material that was developed was well received by students to be used

as a learning tool that supports students' learning process on the coordination system material.

Acknowledgments
We would like to thank all the Teacher Training and Education Faculty (FKIP) Study Program of Biology Education Officials for the research facilitation. We would like to also honor the stakeholders of SMA Xaverius 2 Jambi who are a part of this research and have contributed thoroughly for the completion of this research.

Author Contribution
The three Authors of this research have played an essential role in conducting observation and the ADDIE design.

Funding
This research does not receive internal nor external funding. This research is independently funded by the Authors.

Conflicts of Interest
The authors clarify that there is no conflict of interest.

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