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Development of E-LKPD in Motion System Materials for High School Class Using PageFlip 3D Software

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Abstract: The need for education in the 21st century is increasing. Technology facilities in learning are increasing rapidly and sophisticated. Technology must be utilized to the maximum with everyone, especially learners and teachers. E-LKPD is a worksheet or teaching material made using 3D PageFlip Software in accordance with technological developments. This research aims to develop, know the feasibility and know the response of teachers and learners to the electronic use of LKPD (e-LKPD) High School class XI motion system material using PageFlip 3D Software. This type of research is a Research and development or R&D with a development model referring to the ADDIE model. The developed product is validated by material experts and media experts, and then assessed by the teacher of class XI biology subjects. The data used is qualitative and quantitative data, obtained from the results of analysis of questionnaire calculations and interviews. The results from research and development that have been written in this paper, it can be concluded that the e-LKPD media developed can be used as an additional medium in the learning process in motion system materials.

Keywords: E-LKPD; Motion System; PageFlip 3D software; Website

Introduction

Education is a process that encompasses the three dimensions, the individual, the society or national community of the individual, and the whole content of reality, both spiritual and material. According to Zuhdi et al. (2021), education is a conscious and planned effort to make learning activities fun to make students play an active role in optimizing their potential to become religious individuals, able to control themselves, intelligent and noble, and skilled, in social and state life. Education is a very important thing for life because education is a parameter to measure a person's interaction so that a person's character can be seen from the level of education obtained (Istiningsih, 2016).

The need for education in the era of the 21st century is now increasing (Malik, 2018). Technology facilities in learning are growing rapidly and sophisticated (Yusupov et al., 2022). Only by using a cellphone or cellphone, students will find it easier to access learning. As it is felt at this time, with the outbreak of the corona virus or known as covid 19, all audiences are required to work and study from home (Pokhrel et al., 2021). Unconsciously, with this epidemic, all humans are forced to take advantage of technological advances, usually only a few use technologies to work and study. However, with the current situation, technology must be utilized optimally by everyone, especially students and teachers. Students and teachers must adapt to carry out teaching and learning activities by utilizing technology (Astuti et al., 2021; Munastiwi, 2021). This learning system is carried out with an online system or online learning. Therefore, it is necessary to do a new method in getting the expected quality of education starting from the curriculum, schools, and teachers. Information and Communication Technology (ICT) as part of science and technology in general is all the use of technology related to the retrieval, acquisition (processing), storage, distribution, and presentation of information (Fazil et al., 2019). The development of science and technology increasingly encourages renewal efforts in the benefits of the results of information and communication technology (Information and Communication

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Technology or ICT), namely multimedia (Effendi, 2018; Fazil et al., 2019).

Multimedia is one of the learning media that is familiar in modern times (Budiarto et al., 2020). Learning media is one of the needs that must be made to help students and teachers in carrying out the teaching and learning process. The development of technology and communication has presented the computer as a learning medium. Students need to learn, both the theoretical and practical foundations needed when programming computers (Thuné et al., 2019), both in terms of using applications and making applications. One survey conducted by Darlstrom 2012 in the review journal Schindler et al. (2017) showed that two-thirds of students use mobile devices for learning and believe that technology can help them achieve learning outcomes and better prepare them for an increasingly technology-dependent workforce. Students, especially high school students, must master computers with the help of teachers or anyone else because they receive lessons with computer support or not, students will still face challenges in their lives as computer users.

Based on the results of interviews with Biology teachers at Senior High School (SMAN) 4 Muaro Jambi High School, online learning that has been done is less effective because teachers do not meet directly with learners. The lesson hours given is only 30 minutes and must be fulfilled for the delivery of materials and assignments so that not all biological materials are delivered properly. Likewise, biological practicum is also not done in the pandemic period. Media used by teachers in the form of ppt, package books, and LKPD (Student Worksheet). Teachers provide video media, and this LKPD through the Google classroom application as well as students send their assignments through the application. Class XI biology subjects in accordance with the curriculum, learners learn one of the materials, namely the system of motion. Based on the results of observation questionnaires at SMAN 4 Muaro Jambi only 46.7% understand the material of the motion system, and 53.3% do not understand the material. Some of the learners, 76.7% had difficulty in learning the material of the motion system. Existing learning resources still do not help to understand the material of the motion system. So that learners need new learning resources to understand the material. 76.7% of learners strongly agreed and 23.3% agreed that they needed new learning resources for motion system materials. 80% of learners are very fond of electronic learning materials that can support the understanding of biological materials. From questionnaires, learners are interested in using e-LKPD, which is a percentage of 73.3% strongly agree and 26.7% agree. Furthermore, 76.7% of learners strongly agree, 23.3% agree if the development of e-LKPD is carried out to help the learning of motion system materials.

The existence of the above problems requires alternative sources of learning as desired and can assist teachers in conveying motion system learning materials. One alternative source of learning that can be used is LKPD. Since so far teachers have only used LKPD in the form of sheets containing text and assignments that must be filled out by students, so along with the times, an electronic LKPD (e-LKPD) can be developed. Teachers can use electronic worksheets to provide alternative sources of learning (Rahayu et al., 2021). Electronic LKPD can be abbreviated as e-LKPD is learning in the digital learning era which is very useful for the development of science in the industrial revolution era 4.0 (Febriansyah et al., 2021). E-LKPD uses e-Learning-based learning where according to Pangondian et al. (2019) learning has shifted and left conventional learning in the era of the industrial revolution 4.0 where IoT (Internet of Things) plays an important role in everything. E-LKPD is very helpful for learning during the Covid-19 Pandemic which changes the learning process into distance learning or online (Rahayu et al., 2021).

This e-LKPD contains learning materials that are equipped with pictures, and videos, working procedures that can attract the attention of students in the learning process. This e-LKPD has the advantage that it is more practical to use in learning, and it looks more attractive. The advantage of the LKS made is that it can be done remotely so that student learning activities can be carried out anytime and anywhere with the help of the internet network (Ihwan et al., 2021). According to Kopniak (2018), electronic student worksheets containing multimedia (text, images, and videos) can support students' understanding in answering the questions in the student worksheets. The e-LKPD provided is based on solving problems associated with everyday life, so that students can more easily understand the material taught through e-LKPD (Mulyasari et al., 2022). The e-LKPD can be made using the 3D PageFlip software.

3D PageFlip Professional Software is a kind of professional page flips software for converting pdf files to page-turned publications. Each digital page of the resulting pdf can be flipped (back and forth) like a real book. With 3D PageFlip Professional software you can add images, videos, audio, hyperlinks and multimedia objects. According to Koderi et al. (2019) 3D FlipBook is software to convert files in PDF format into an animated 3D book in which music, videos, images, buttons, and animations can be included. The advantage of the 3D PageFlip software is that it provides many pre-set templates that function to create interesting books, magazines, and digital learning media. With PageFlip 3D Software we can design our own button settings, images, backgrounds, music, and other settings. Based on the above, it is necessary to develop an Electronic

LKPD entitled "Development of E-LKPD for Class XI High School Movement System Materials Using 3D PageFlip Software".

Method

This research is a development research. Research and development is a process or steps to develop a new product or improve an existing product, which can be accounted for. The development model in this study uses the ADDIE model. This development model was chosen because it has several advantages: (1) More Precisely Used as a Basis for Developing Learning Systems, (2) The description is more complete and systematic, (3) In Its Development Involving Expert Assessment, So That Before the Trial Is Revised Based on expert advice.

The ADDIE development model consists of 5 main steps, namely: (1) analysis, (2) design, (3) development, (4) implementation, and (5) evaluation. The selection of ADDIE in this study because the ADDIE model can adapt very well in various conditions, the level of flexibility is quite high, is a descriptive model that is widely used and proven results are valid and reliable, and provide opportunities to evaluate and revise in each stage (Aldoobie, 2015).

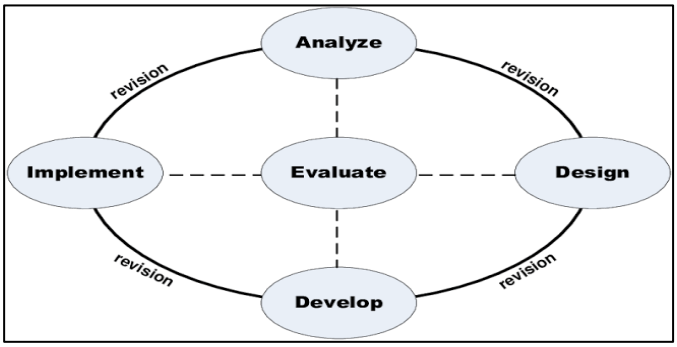

Figure 1. ADDIE development model scheme (Widyastuti et al., 2019)

The test subjects in this study were teachers and students of class XI SMAN 4 Muaro Jambi with the following description: (1) Trials on teachers Trials on teachers are conducted on biology teachers. This trial was conducted to find out the teacher's perception of the product developed. (2) Small group trials were conducted on 6 participants with different cognitive abilities. The purpose of this small group trial is to find out the response of learners to the products developed. (3) Large group trials were conducted on 30 learners. Large group trials are conducted to find out the response of learners on a large scale.

The type of data collected in e-LKPD development research of motion system materials is qualitative and quantitative data. Qualitative data is obtained from validation results from both material and media experts in the form of suggestions and inputs on developed products. Quantitative data will be obtained from the results of the number of validator assessment questionnaire scores as well as teachers and learners as respondents who provide responses and assessments to the use of e-LKPD motion system materials that have been developed. The instruments used to obtain data from the validation stage by a team of experts are open and closed questionnaires, and the questionnaire instruments used on test subjects i.e. teachers and learners are closed questionnaires. The results of the filling of the instrument will be used to evaluate and revise the product of teaching materials in the form of e-LKPD in the motion system material to be developed. The likert scale used using 4 measurement response points is: Very Good (SB), Good (B), Not Good (TB), Very Bad (STB). According to Mohajan (2017) a valid instrument means that the measuring instrument used to obtain the data (measuring) is valid. Valid means the product can be used to measure what should be measured. The formula used to measure the validity of the instrument is as follows:

$$\%\text{Validity} = \frac{\text{number score obtained}}{\text{maximum score amount}} \times 100\% \quad (1)$$

Information: number of scores obtained = number of items x weight of assessment for selected criteria, maximum score amount = maximum rating score weight per item x number of descriptor items x number of respondents.

Result and Discussion

Results

The results of this development research are: (1) e-LKPD material of class XI high school motion system, (2) Assessment of product validation by a team of material experts and media experts to products categorized as worthy of sanctification, (3) Assessment of teacher perception of biology subjects to the development of e-LKPD is carried out by spreading questionnaires to biology subject teachers at SMAN 4 Muaro Jambi, (4) Assessment of learners' perception is carried out by spreading questionnaires to 6 learners (as a small group) and 30 learners (as a large group) in class XI MIA 2 SMAN 4 Muaro Jambi.

Analysis Stage

The needs analysis was conducted with observations at SMAN 4 Muaro Jambi found that online learning that has been done is less effective because the lesson hours provided are only 30 minutes so that not all biological materials are conveyed properly. Based on the interview of biology teachers and some questions to students the media used is still simple, learners prefer

media that is not boring and interesting and can be accessed through mobile phones to help and facilitate the learning process. Because the LKPD media provided by teachers is only in the form of sheets of paper containing text and tasks, then with the increasing times, it can be developed electronic LKPD (e-LKPD) to help the learning process of learners.

Analysis of this material is carried out in discussions with biology teachers to find what materials are suitable for learning media and pay attention to the curriculum and syllabus used in schools, so that the material that will be contained in the media will be in accordance with the competencies that must be mastered by learners. The results of the interview can bring up material that can be made in the learning media where the media is motion system material. The learning media created is e-LKPD which contains motion system materials and activities and quizzes that can be used for the learning process, because practicum is not carried out when online learning then in this e-LKPD there are also practicum activities that can be done independently at home. Media analysis was conducted with interviews and observations at SMAN 4 Muaro Jambi. The results of interviews with teachers in the field of biological studies are at the time of teacher learning using media such as package books, student worksheets (LKS), student worksheets (LKPD) and power points (PPT). Teachers feel that the media used still does not vary; especially the LKPD used is still very simple. Based on observations that have been, it made found some of the responses of learners regarding LKPD. Learners only use LKPD in the form of sheets of paper, learners also like if there is electronic media that is easily accessible and interesting.

Design Stage

The design stage begins by determining the title, then knowing the basic competencies, indicators, learning objectives and also the material that will be included in the learning media. Product design developed using PageFlip 3D software application with the end result in the form of web. Next determine the steps used in the creation of media with several stages, namely schedule, media specification team material structure, and evaluation. The schedule for the manufacture of media products begins by collecting materials and the manufacture of products. Product specifications include the programs used and the elements used in developing learning media. The resulting specifications in the form of e-LKPD with the display of text, images, learning videos, learning activities such as quizzes, problem exercises and practicums published in the form of web in the form of links that are easily accessible. The link that used in this research is https://hph2z24yvnlxdnvhc9q8qa-on.drv.tw/project%20diah/e-LKPD%20sistem%20Gerak/eLKPD%20sistem%20Gerak%20kelas%2011.html. E-LKPD is made using PageFlip 3D Software. This is made interesting to understand the material of the motion system that has been validated by a team of material experts and media experts can be piloted to learners. Product design includes:

– Cover

The cover section consists of the title e-LKPD, the author's name, NIM, and the logos of UNJA and Kemendikbud. Here's an example of a cover that can be seen in Figure 2 (a).

– Usage instructions

This section contains 4 points of instruction in the use of e-LKPD in motion system materials. Usage instructions are created so that users can use the media properly. Here is an example of user instructions can be seen in Figure 2 (b).

– Material

This section consists of motion system material. Can be seen in Figure 2 (c).

– Learning activities

This section consists of completing images, quizzes, let's explore, and practicum activities can be seen respectively in Figure 2 (d), Figure 2 (e), Figure 2 (f), and Figure 2 (g).

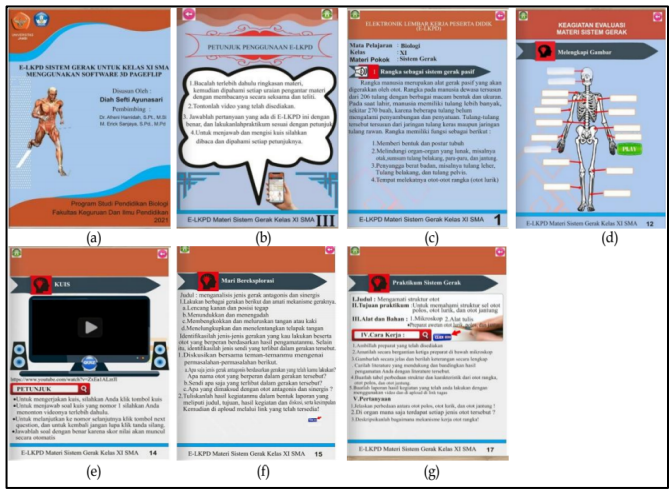

Figure 2. e-LKPD sections use PageFlip 3D Software with e-LKPD (a) Covers, (b) Usage instructions, (c) Motion system materials, (d) Completing a picture, (e) Quiz activities, (f) Let's explore, and (g) Usage instructions

Development Stage

The development stage is the stage where a pre-designed learning media product is tested for eligibility by a validator. The validation process is carried out by expert validators in the field of materials and media. The process in this stage of development is as follows:

– *Product validation*

Product validation is done in accordance with the consideration of the expert team. Product validation uses a questionnaire based on the instrument grid for expert validation of materials and media.

– *Materials expert*

Validation of material that has been done by the material validator as much as 2x, after revision based on the suggestion of the material validator obtained a decent product and can be used in the learning process. The results of the material validation process can be seen in Table 1.

Table 1. Material Validation Results

Assessment Indicator	Validation Value		
	Validation 1	Validation 2	Validation 3
Meet e-LKPD with KI, KD, Indicators and Learning Objectives	2	3	3
Clarity of instructions for use e-LKPD	2	2	3
Ease of understanding material concepts	3	3	4
Material coverage	2	2	3
Clarity Video	2	4	4
Clarity of sound recording material	3	3	3
Conformity of learning activities with material	2	3	3
Conformity of the language used with the rules of Indonesian	2	3	4
Percentage (%)	53.1	68.8	84.4
Criteria	Bad	Good	Excellent

Based on table 1 it can be known that from the results of validation carried out increased from validation to 1 to validation 3 after revision. Then also done media validation by the media validator. The results of media validation can be seen in Table 2.

Table 2. Media Validation Results

Assessment Indicator	Validation Value	
	Validation 1	Validation 2
E-LKPD early view	2	3
Color and image suitability	2	3
Type and size of e-LKPD letters	3	4
Video clarity	3	4
E-LKPD neatness	2	3
e-LKPD design or format	2	4
Clarity of instructions for use on e-LKPD	2	4
Creativity and innovation of e-LKPD	3	4
Simplicity e-LKPD	3	4
Presentation of e-LKPD free from errors that result in the program stopping	3	4
Ease of operation e-LKPD	3	4
Practicality e-LKPD	3	4
Percentage (%)	61.3	91.3
Criteria	Bad	Excellent

Based on table 2 it can be known that media validation results have increased from validation 1 to validation 2 after revision. Then continue with the product trial. Results can be seen in Table 3.

Table 3. Test Results

Assessment Aspects	Small group trials %	Large group trials %	Teacher Perception %
Media Presentation	90.47	90.71	100
Instructional Presentation of Materials	92.36	89.58	95.8
Language Presentation	91.66	88.33	100
Average (%)	91.66	91.66	100
Criteria	91.4	89.7	98
	Excellent	Excellent	Excellent

Implementation Stage

– *Data perception of teachers in biological studies*

Learning media that has been considered feasible by material and media experts will be piloted in teachers in the field of biology studies class XI at SMAN 4 Muaro Jambi, this is done to find out the teacher's response to the media developed so that later the developed media is suitable for use as a medium of learning by students in high school, the trial was conducted to Mr. Sumadi, S.Pt., M.Pd. Based on the results of the assessment of teachers in the field of biology studies of SMAN 4 Muaro Jambi Showed that all aspects of the trial stage for assessment get a score of 73 with a percentage of 91.3% included in the category of "excellent", based on the assessment that has been done, the e-LKPD developed is feasible to use in the learning process. Here is the average percentage obtained from the assessment by teachers of the field of biological studies on e-LKPD developed:

$$\text{Answer Percentage (\%)} = \frac{73}{80} \times 100\% = 91.3\ \% \quad (2)$$

– *Small group trial results*

Data Small group trials are conducted to see the deficiencies present in the developed product will then be trialed in large groups. Small group trials were conducted in class XI MIA I with learners randomly selected by biology teacher class XI SMAN 4 Muaro Jambi as many as 6 learners, then conducted the dissemination of media assessment questionnaires/ questionnaires developed with 20 statements. Small group trial results mentioned that the overall score aspect of the small group trial obtained a score of 441 with a percentage of 91.9% included in the category of "excellent". The results of the assessment showed that e-LKPD has met the needs of learners. Here are the calculations from small group trials:

$$\text{Answer Percentage (\%)} = \frac{441}{480} \times 100\% = 91.9\ \% \quad (3)$$

– *Large group trial results data*

The large group trial was conducted in class XI MIA II SMAN 4 Muaro Jambi to 30 learners, and then conducted the dissemination of media assessment questionnaires containing 20 statements. The results of the large group trial mentioned that the overall score of aspects of the small group trial obtained a score of 2215 with a percentage of 92.3% included in the category of "excellent". The results of the assessment showed that e-LKPD has met the needs of learners. Here are the calculations from small group trials:

$$\text{Answer Percentage (\%)} = \frac{2215}{2400} \times 100\% = 92.3\ \% \quad (4)$$

Evaluation

The evaluation stage in the research conducted aims to determine the feasibility of the media developed. Evaluation in the early stages is carried out by a team of material experts and media experts who are indicators of improvements in e-LKPD learning media using PageFlip 3D software developed. In addition to evaluation from a team of experts, there is also an assessment of teachers in the field of biological studies and then small group trials and also large groups with the aim to see the utilization of developed media. The evaluation stage occurs at every stage of the model used, ranging from analysis, design, development to implementation. Evaluation at the analysis stage is on the determination of the schedule that is estimated to only take 3 months but at the time of manufacture of the product takes 5 months. Then at the validation stage of the material, there are some statements that are composed because they are not appropriate.

Discussion

E-LKPD is made using 3d PageFlip Software that contains motion system material. E-LKPD is a teaching material and also a variety of learning media used by class XI MIA learners (Safitri et al., 2021). Media developed with the ADDIE model, the model has stages of analysis, design, development, implementation, and evaluation (Wibawa et al., 2017). The selection of ADDIE in this study because the ADDIE model can adapt very well in various conditions, the level of flexibility is quite high, is a descriptive model that is widely used and proven results are valid and reliable, and provide opportunities to evaluate and revise in each stage (Angko et al., 2013; Atika et al., 2020; Purnawati et al., 2020).

Based on the results of the analysis stage, the results of interviews with teachers in the field of material biology studies that can be made in the learning media are motion system materials. The learning media created is e-LKPD which contains motion system materials and activities and quizzes that can be used for the learning process, because practicum is not carried out when online learning then in this e-LKPD there are also practicum activities that can be done independently at home. Media analysis is related to interviews with teachers in the field of biological studies, namely at the time of teacher learning using media such as package books, student worksheets (LKS), student worksheets (LKPD) and power points (PPT).

Teachers feel that the media used still does not vary; especially the LKPD used is still very simple. Based on observations that have been made, it found some of the responses of learners regarding LKPD. Learners only use LKPD in the form of sheets of paper, learners also like if there is electronic media that is easily accessible and interesting (Kharisma et al., 2021; Magdalena et al., 2021). At this stage, the prototype e-LKPD and storyboard e-LKPD are first made. Furthermore, product validation is carried out by a team of media experts and material experts and then revised improvements to more improve the developed media. Based on the results of validation of the material that has been done can be seen in Figure 3.

Based on the results of material expert validation in the first stage get a score of 53.1%, suggestions and improvements from material experts have been improved in order to improve the e-LKPD made again. Furthermore, validation of the second stage obtained a score of 68.8% because there are still some improvements by adding supporting images in the material and improving the list of activity names in the table of contents. In the third validation, a score of 84.4% was included in the excellent category. The three validation stages that have been done can be concluded that the e-LKPD developed is worth testing.

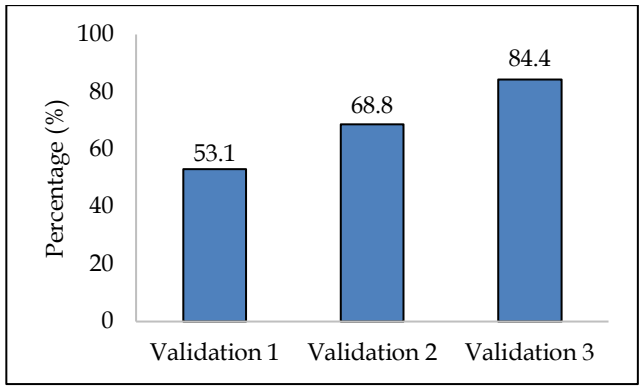

Figure 3. Material expert validation results diagram

Based on the results of media validation in the first stage, the score of 61.3%, suggestions and improvements from media experts have been improved in order to improve e-LKPD again i.e. the revision of the logo on the cover of the e-LKPD, the revision of back ground color changes, and the changes in the title and font of writing.

Revise menu back button, home and page on e-LKPD display. Revision of learning video resources is the results of revisions by including sources on the learning video. Furthermore, second stage validation was carried out and got a score of 91.3% included in the category of excellent and products worthy of trial. The media validation diagram can be seen in Figure 4.

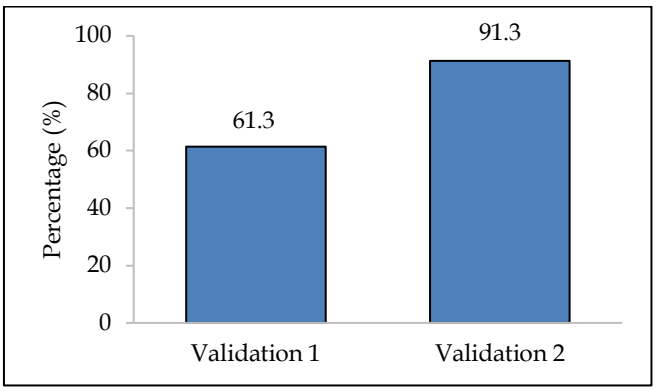

Figure 4. Media validation results diagram

Products that have been completed at the validation stage of expert TIM, will then be piloted on the ground. The e-LKPD trial was conducted at SMAN 4 Muaro Jambi, with a small group of 6 learners in class XI MIA 1 and the number in a large group of 30 learners in MIA class 2. The results of the product trial to teachers, small groups and large groups can be seen in Figure 5.

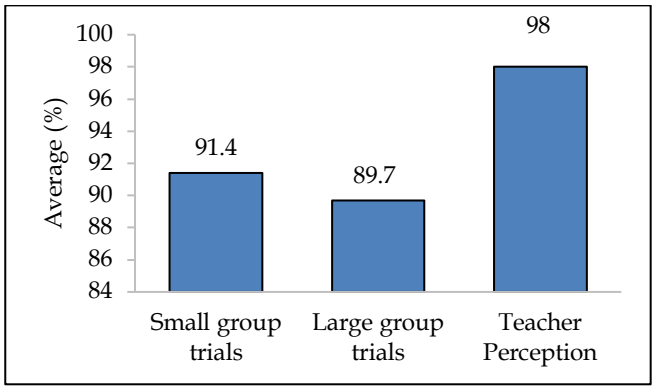

Figure 5. The results of teacher response, small groups, and large groups

Based on the results of the trial can be seen in the diagram image the percentage of teacher responses got a score of 91.3%, small group trials get a score of 91.9% and large groups score 92.3% with excellent categories. This trial is the implementation stage, the implementation stage is one stage in the development of e-LKPD media using PageFlip 3D Software. Based on the results obtained, it can be concluded that e-LKPD media created using PageFlip 3D Software can be used in the learning process, because it is easy to use, accessed through google links, and makes it easier for learners to understand the material, with this e-LKPD learners can do independent learning because e-LKPD contains materials and learning activities such as quizzes, problem exercises, and practicum activities that can be done independently. In addition, the material in e-LKPD is supported by material recordings so that it makes it easier for learners to better understand the learning video material and do not forget to be in the e-LKPD (Febriansyah et al., 2021).

Conclusion

Based on the results of research and development of e-LKPD using PageFlip 3D Software in motion system materials for SMA XI MIA learners, it can be concluded that e-LKPD motion system material as a learning medium for high school students XI MIA, declared worthy of use as a learning medium. Based on the results of expert validation of media twice with a final percentage of 91.3% and included in the category of "excellent". Expert validation of the material was also done three times with a final percentage of 84.4% including the "excellent" category. Assessment by teachers of e-LKPD developed received a percentage of 91.3% with the category of "very good" so that it can be well received by teachers to be used as a source of learning learners. Assessment by learners of e-LKPD developed earned a percentage in small group trials of 91.9% with the category "very good" and the percentage in large group trials of 92.3% with the category "very good" then the developed media was well received by learners.

References

Aldoobie, N. (2015). ADDIE Model. *American International Journal of Contemporary Research*, *5*(6), 68–72. https://rb.gy/zg8xv0

Angko, N., & Mustaji. (2013). Development of Teaching Materials with ADDIE Model for Mathematics Subjects Grade 5 SDS Mawar Sharon Surabaya. *KWANGSAN: Jurnal Teknologi Pendidikan*, *1*(1), 1–15. https://doi.org/10.31800/JTP.KW.V1N1.P1--15

Astuti, M., Sudira, P., Mutohhari, F., & Nurtanto, M. (2021). Competency of Digital Technology: The Maturity Levels of Teachers and Students in Vocational Education in Indonesia. *Journal of Education Technology*, *5*(1), 254–262. https://doi.org/10.23887/jet.v5i3.35108

Atika, N., Roza, Y., & Murni, A. (2020). Development of Learning Tools by Application of Problem Based Learning Models to Improve Mathematical Communication Capabilities of Sequence and Series Materials. *Journal of Educational Sciences*, *4*(1), 62–72. https://doi.org/10.31258/jes.4.1.p.62-72

Budiarto, M. K., Joebagio, H., & Sudiyanto, S. (2020).

Student's View of Using Digital Learning Media in Classroom Activities: A Case of Public Senior High School in Cirebon, Indonesia. *Jurnal Pendidikan Progresif*, *10*(1), 47–54. https://doi.org/10.23960/jpp.v10.i1.202006

Effendi, D. (2018). the Development of Science and Technology and Its Impact on Human Moral Life. *International Seminar on Education and Development of Asia 1st INseIDEA*, 175–179. https://jurnal.unimus.ac.id/index.php/psn12012010/article/view/3627

Fazil, M., Zulham, & Subhani. (2019). Realization of information and communication technology (Ict) innovation in several Aceh districts (study Lhokseumawe city). *International Journal of Recent Technology and Engineering*, *7*(6), 1423–1429. https://www.ijrte.org/wp-content/uploads/papers/v7i6s5/F12510476S519.pdf

Febriansyah, F., Herlina, H., Nyeneng, I. D. P., & Abdurrahman, A. (2021). Developing Electronic Student Worksheet (E-Worksheet) Based Project Using Fliphtml5 to Stimulate Science Process Skills During the Covid-19 Pandemic. *INSECTA: Integrative Science Education and Teaching Activity Journal*, *2*(1), 59–73. https://doi.org/10.21154/insecta.v2i1.2555

Ihwan, M. A., Prasetyo, Z. K., & Septiyono, W. E. (2021). Student Worksheet Based on E-Learning Development to Improve Problem-Solving Skills of Class X MAN 3 Yogyakarta Students in 2019/2020. *Advances in Social Science, Education and Humanities Research*, *541*, 380–387. https://doi.org/10.2991/assehr.k.210326.054

Istiningsih, I. (2016). Character Education of the Most Developed Countries in ASEAN. *Journal of Education and E-Learning Research*, *3*(1), 32–37. https://doi.org/10.20448/journal.509/2016.3.1/509.1.32.37

Kharisma, F. T. N., Zaini, M., & Kaspil, K. (2021). The Development of Electronic Student Worksheets on the Concept of Animalia to Improve High School Level Critical Thinking Skills. *BIO-INOVED: Jurnal Biologi-Inovasi Pendidikan*, *3*(3), 227–233. https://doi.org/10.20527/bino.v3i3.11168

Koderi, K., Latifah, S., Fakhri, J., Fauzan, A., & Sari, Y. P. (2019). Developing Electronic Student Worksheet Using 3D Professional Pageflip Based on Scientific Literacy on Sound Wave Material. *IOP Conf. Series: Journal of Physics: Conf. Series*, *1467*(012043), 1–8. https://doi.org/10.1088/1742-6596/1467/1/012043

Kopniak., N. B. (2018). The Use Of Interactive Multimedia Worksheets At Higher Education Institutions. *Information Technologies and Learning Tools*, *63*(1), 116–129. https://doi.org/10.33407/itlt.v63i1.1887

Magdalena, M., Putra, A. P., & Winarti, A. (2021). The Practicality of E-LKPD Materials on Environmental Pollution to Practice Critical Thinking. *BIO-INOVED : Jurnal Biologi-Inovasi Pendidikan*, *3*(3), 210–215. https://doi.org/10.20527/bino.v3i3.11099

Malik, R. S. (2018). Educational Challenges in 21St Century and Sustainable Development. *Journal of Sustainable Development Education and Research*, *2*(1), 9. https://doi.org/10.17509/jsder.v2i1.12266

Mohajan, H. K. (2017). *Two Criteria for Good Measurements in Research: Validity and Reliability* (Vol. 17, Issue 3). Annals of Spiru Haret University. https://doi.org/10.26458/1746

Mulyasari, D. W., Gunahardi, G., & Roemintoyo, R. (2022). E-LKPD based on Problem Based Learning (PBL) Approach to Measure Mathematics Literacy Ability of Elementary Students. *International Journal of Elementary Education*, *6*(3), 393–402. https://doi.org/10.23887/ijee.v6i3.47532

Munastiwi, E. (2021). Adaptation of Teaching-Learning Models Due to Covid-19 Pandemic: Challenge Towards Teachers Problem-Solving Skills. *Jurnal Ilmiah Sekolah Dasar*, *5*(1), 33–44. https://doi.org/10.23887/jisd.v5i1.32695

Pangondian, R. A., Paulus Insap, P., & Dkk. (2019). Faktor-Faktor Yang Mmempengaruhi Pembelajaran Daring Dalam Revolusi Industri. *Seminar Nasional Teknologi Komputr & Sains (SAINTEKS)*, *3*(1), 56–60. https://www.prosiding.seminar-id.com/index.php/sainteks/article/view/122

Pokhrel, S., & Chhetri, R. (2021). A Literature Review on Impact of COVID-19 Pandemic on Teaching and Learning. *Sage Journal: Higher Education for the Future*, *8*(1), 133–141. https://doi.org/10.1177/2347631120983481

Purnawati, H., Murni, A., & Saragih, S. (2020). Development of Learning Tools by Applying The MASTER Plan Technique Based on A Scientific Approach to Improve Student Learning Outcomes on Number Pattern Material. *Mathematics Education Journals*, *4*(2), 126–136. https://doi.org/10.22219/mej.v4i2.12660

Rahayu, S., Ladamay, I., Wiyono, B. B., Susanti, R. H., & Purwito, N. R. (2021). Electronics Student Worksheet Based on Higher Order Thinking Skills for Grade IV Elementary School. *International Journal of Elementary Education*, *5*(3), 453–460. https://doi.org/10.23887/ijee.v5i3.36518

Safitri, R., Haryanto, H., & Harizon, H. (2021). Development of PBL-STEM-based E-LKPD to improve students' science literacy skills on reaction rate materials. *Jurnal Pendidikan Kimia*, *13*(2), 113–129. https://doi.org/10.24114/jpkim.v13i2.26980

Schindler, L. A., Burkholder, G. J., Morad, O. A., & Marsh, C. (2017). Computer-based technology and student engagement: a critical review of the literature. *International Journal of Educational Technology in Higher Education*, *14*(25), 1–28. https://doi.org/10.1186/s41239-017-0063-0

Thuné, M., & Eckerdal, A. (2019). Analysis of Students' learning of computer programming in a computer laboratory context. *European Journal of Engineering Education*, *44*(5), 769–786. https://doi.org/10.1080/03043797.2018.1544609

Wibawa, S. C., Harimurti, R., Anistyasari, Y., & Sumbawati, M. S. (2017). The Design And Implementation Of An Educational Multimedia Interactive Operation System Using Lectora Inspire. *ELINVO*, *2*(1), 75–79. https://doi.org/10.21831/elinvo.v2i1.16633

Widyastuti, E., & Susiana, S. (2019). Using the ADDIE model to develop learning material for actuarial mathematics. *IOP Conf. Series: Journal of Physics: Conf. Series*, *1188*(012052), 1–8. https://doi.org/10.1088/1742-6596/1188/1/012052

Yusupov, A. K., & Suyunov, I. (2022). Teaching and Learning with Technology: The Effectiveness of ICT Integration in Schools. *Journal of Pharmaceutical Negative Results*, *13*(2), 2461–2463. https://doi.org/10.47750/pnr.2022.13.S08.307

Zuhdi, A., Firman, F., & Ahmad, R. (2021). The importance of education for humans. *SCHOULID: Indonesian Journal of School Counseling*, *6*(1), 22–34. https://doi.org/10.23916/08742011