



Development of Interactive E-LKPD Liveworksheets Based on Differentiated Instruction in IPAS Subjects Fifth Grade

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Abstract: This research aims to produce Interactive Liveworksheets E-LKPD products based on Differentiated Instruction to improve science and science learning outcomes in class V of Cepoko State Elementary School. The output products developed are assessed in terms of the validity of the material and media content, practicality and effectiveness. This research uses R&D research with the Borg and Gall development model. The subjects in this research were fifth grade students at Cepoko State Elementary School, Semarang City. The data collection techniques used are test techniques in the form of pre-tests and post-tests as well as non-test techniques which include observation, interviews and documentation. The validation results by material and media expert validators show that the E-LKPD Interactive Liveworksheets Based on Differentiated Instruction is very suitable for use with a percentage of 93% from material expert validators and 100% from media expert validators. Meanwhile, the practicality of the media being developed is based on the average percentage of teacher response questionnaires of 98% and students of 89.5% on product trials in the very practical category. Based on the results of the pre-test and post-test, it is known that E-LKPD Interactive Liveworksheets Based on Differentiated Instruction can improve student learning outcomes. This is proven by the results of an increase in the average pre-test score from 53.46 to 83.08 in the post-test. Then the N-Gain test results obtained a score of 0.64 in the medium category.

Keywords: Differentiated Instruction; E-LKPD; IPAS; Liveworksheets

Introduction

Recently the Indonesian government implemented a new curriculum at the education unit level known as the independent curriculum. The independent curriculum is motivated by national and international studies which state that Indonesia is experiencing a learning crisis, where these studies find that there are still many students in Indonesia who have difficulty understanding simple reading and applying basic mathematical concepts (Wijaya et al., 2015). An independent curriculum is a curriculum that gives schools the freedom to explore their capabilities based on the facilities, input and resources they have, and gives

teachers the freedom to convey essential and urgent material to the students they teach (Coman et al., 2020). The aim of the independent curriculum is to provide opportunities for students to learn creatively, flexibly and interactively during the learning process (Denaya Mehra Syaharani & Achmad Fathoni, 2023).

Natural and Social Sciences (IPAS) is one of the subjects implemented in the independent elementary school level curriculum. The combination of science and social studies subjects in the independent curriculum in elementary schools is motivated by the tendency of elementary school age children to see everything as a whole and integrated, they are still in the simple or concrete, holistic and comprehensive but not detailed

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thinking stage (Hallo & Nguyen, 2021). The aim of science and science learning in the independent curriculum is to develop students in aspects of inquiry skills, understanding themselves and their environment which develops concepts and knowledge in learning (Strat et al., 2023). Science education plays an important role in training scientific attitudes (high curiosity, critical, analytical thinking skills, and high decision-making abilities) of students through the basic principles of scientific methodology which will give birth to wisdom in students (Sellars et al., 2018).

The problem found by researchers through observations and interviews with class V teachers at Cepoko State Elementary School is that the science and science subject is one of the subjects that has a low average Mid-Semester Summative (STS) score compared to other subjects. The low science learning outcomes are caused by the unmet learning needs of each student. Not all students understand the learning flow that has been determined by the teacher based on the learning model applied. Another problem is that the teaching materials used by teachers in learning do not vary, the teaching materials used only focus on books provided by the school. In science and science subjects, teachers have never used teaching materials in the form of E-LKPD to support problem or project-based learning. This causes a lack of student motivation to learn which then has an impact on low science learning outcomes in class V of Cepoko State Elementary School.

In the independent curriculum, learning is emphasized on students, where students are the center of learning activities, teachers only act as facilitators, therefore learning must be well designed to meet students' needs (Dejene, 2019). The learning needs of students in one class are different from one another. Each student has their own uniqueness, meaning that no student has exactly the same conditions under any circumstances (Darling-Hammond et al., 2020). The learning needs of students in one class must be met so that students are able to achieve the learning goals set by the teacher. One learning approach that can accommodate the diversity of students is differentiated learning (Setyo Adji Wahyudi et al., 2023).

Differentiated learning is defined as a learning process that facilitates students to learn according to their unique abilities, preferences and needs (Gusteti & Neviyarni, 2022). In differentiated learning, teachers should differentiate based on content, processes and products, apart from that, learning activities should also be carried out in groups (Haelermans, 2022; Mochammad Yasir et al., 2023). Differentiated learning provides opportunities for students to develop their potential by carrying out learning according to their

readiness, interests, profile or learning style (Ramadhan et al., 2023).

Differentiated learning allows students to learn according to their respective learning styles, so that they can achieve optimal learning goals. In relation to technological developments, differentiated learning will be more optimal if it is integrated with the help of digital technology. The content in digital learning media is flexible, so it can facilitate all students' learning styles, whether visual, auditory or kinesthetic learning styles (Arisanto et al., 2023; El-Sabagh, 2021).

The concept of an independent curriculum is to integrate literacy abilities, knowledge proficiency, skills and attitudes, as well as mastery of technology (Hämäläinen et al., 2021; Lestari & Santoso, 2019; Wei, 2023). In line with this concept, in the era of globalization, education must make more use of technology in the learning process. The use of electronic LKPD is one form of utilizing technology to answer these challenges. Electronic LKPD is defined as teaching materials in the form of sheets containing lesson material, summaries, and instructions that students must complete in digital form (Ignasia Erlina et al., 2022). E-LKPD can be used as an effort to increase student interaction and interest in learning (Komang Tri Yoga Pramana et al., 2022). One website that can be used to create E-LKPD is Liveworksheets.

Liveworksheets is a worksheet provider platform that converts conventional worksheets into interactive worksheets by using technology so that it can increase students' motivation in learning. Teachers can use the E-LKPD which is available on the Liveworksheets site or make their own interactive online. Through live worksheets, learning activities will be more interactive, effective and time efficient. It is more effective and time efficient because the teacher does not have to check manually one by one, but after the students have finished doing the evaluation, the system will automatically give a score on the worksheets that the students have done.

Using the liveworksheets site can increase the attractiveness of students because by using the liveworksheets site someone can create LKPD with added images, video, audio and other. Liveworksheets also provide various types of evaluation questions such as drag and drop, check boxes, joint with arrow, drop and down, multiple choice, and listening-speaking. In line with this, E-LKPD Liveworksheets can be used as a solution for teachers to create more varied teaching materials so that they can motivate students to learn.

The results of research conducted by (Atmojo et al., 2022), show that there is an increase in learning outcomes in the cognitive domain of students after implementing interactive LKPD live worksheets. This is

shown by the average score of students who completed stage I being 63 to 73 in stage II and 95 in stage III. Apart from that, the activities of teachers and students in learning activities also show positive results. This is proven by the results of assessing student activity in stage II with an average of 81.09% to 93.151% in stage III after receiving improvements. E-LKPD Liveworksheets are suitable for use in learning activities and can help increase students' interest and motivation to learn (Wijaya et al., 2023). The latest in this research is that E-LKPD Liveworksheets were developed by integrating differentiated learning.

Based on the background that has been explained, researchers developed Interactive E-LKPD Liveworksheets based on Differentiated Instruction for the science and science subject for fifth grade students at Cepoko State Elementary School, Semarang City. The aim of this research and development is to produce a product in the form of E-LKPD Interactive Liveworksheets Based on Differentiated Instruction in science subjects and to test the feasibility, effectiveness and user response to the product being developed.

Method

The researcher used the Research and Development (R&D) method which produced product output in the form of Interactive E-LKPD Liveworksheets based on Differentiated Instruction in class V science subjects. The development model used by the researcher was the Borg and Gall development model which has ten implementation steps (Ayuningtias et al., 2018). However, in this research, the researchers were limited to stage 8, namely trial use, this was due to limited costs and time that the researchers had so they did not reach the point of making mass products. The steps in this research are: potential and problems; data collection; product design; design validation; design revision; product testing; product revision; and trial use. The research scheme can be seen in Figure 1.

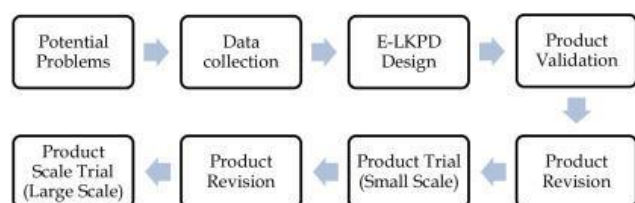


Figure 1. Modification of the Borg and Gall model

Researchers used two types of data to support this research, namely qualitative data and quantitative data. Qualitative data includes interview sheets, observations, questionnaires and documentation carried out in class V

of Cepoko State Elementary School. Meanwhile, quantitative data includes the Mid-Semester Summative (STS) results of class V students at SD Negeri Cepoko in the science and science subject, pre-test and post-test scores, assessment results by media and material expert validators, as well as teacher and student response results. of the products being developed.

The data collection techniques used in this research are test techniques and non-test techniques. The test technique used is pre-test and post-test in the form of a Multiple Choice Test. The use of tests in this research aims to determine the effectiveness of using E-LKPD Interactive Liveworksheets Based on Differentiated Instruction. Data analysis was viewed from the difference between the pre-test and post-test N-Gain values. The non-test techniques in this research were obtained through observation, interviews, documentation and questionnaires. Validation questionnaires and student response questionnaires are used to determine the feasibility and practicality of the products developed by researchers.

Table 1. Categorization Criteria for Validity Results

Percentage (%)	Category
90 - 100	Very Valid/Decent
80 - 89	Valid/Eligible
65 - 79	Fairly Valid/Decent
55 - 64	Not Valid/Appropriate
<54	Invalid/Eligible

(Aryani, 2022)

Table 2. Categorization Criteria for Practical Results

Percentage (%)	Category
86 - 100	Very Practical
76 - 85	Practical
60 - 75	Quite Practical
55 - 59	Less Practical
0 - 54	Impractical

(Prastika & Masniladevi, 2021)

Table 3. Categorization Criteria for Effectiveness Results

N-gain score	Criteria
N-Gain > 0.70	Tall
0.30 < N-Gain ≤ 0.70	Currently
N-Gain ≤ 0.30	Low

(Akramida & Distrik, 2020)

Result and Discussion

Potential Problems

The problem found by researchers through observations and interviews with class V teachers at Cepoko State Elementary School is that the science and science subject is one of the subjects that has a low average STS (Mid Semester Summative) score compared

to other subjects. The low science learning outcomes are caused by the unmet learning needs of each student. Not all students understand the learning flow that has been determined by the teacher based on the learning model applied. Apart from that, the teaching materials used by teachers in learning do not vary, the teaching materials used only focus on books provided by the school. In science and science subjects, teachers have never used teaching materials in the form of E-LKPD to support problem or project-based learning. This causes a lack of student motivation to learn which then has an impact on low science learning outcomes in class V of Cepoko State Elementary School.

Data collection

Researchers collect data based on interviews, observations and documentation. Observations were carried out by observing the learning process in class V of Cepoko State Elementary School, Semarang City. Interviews were conducted with class V teachers at Cepoko State Elementary School to dig deeper into the information and problems faced in learning activities. Documentation is obtained by taking pictures of the Mid-Semester Summative (STS) results as well as teacher and student documentation during learning.

After data collection, researchers analyze the most pressing problems to find solutions. Next, the researcher made a plan to develop Interactive E-LKPD Liveworksheets Based on Differentiated Instruction. Researchers conduct literature reviews from various sources as reference material that strengthens the basis for product development and manufacture. Apart from conducting a literature review, researchers also provided non-cognitive diagnostic test sheets to determine students' learning styles, so that this could then be used as a reference in product development to accommodate the needs of each student.

E-LKPD Design

The product design was developed based on the recapitulation of the teacher and student needs questionnaire. In Interactive E-LKPD Liveworksheets Based on Differentiated Instruction, the material presented adapts to learning outcomes and the flow of learning objectives that students want to achieve. The e-LKPD developed contains video, audio, images, as well as learning evaluations in the form of attracting and sticking, matching, providing checklists for correct answers, and searching for words so that they can attract more students' attention. Interactive E-LKPD Liveworksheets based on Differentiated Instruction were created by preparing materials and designs using the Canva application. Next, the material and design results are downloaded in PDF form and then entered

into the LiveWorksheets site to add elements in the form of video, audio and answers to evaluation questions. The final product will be saved on the liveworksheets site and can be shared with students via a link. Students can access the link using electronic devices connected to the internet network. The product design is as follows:



Figure 2. Cover



Figure 3. Instructions for Using E-LKPD



Figure 4. Learning Achievements and Learning Objectives



Figure 5. Summary of Material



Figure 6. Visual Group Worksheet



Figure 7. Audio Group Worksheet



Figure 8. Kinesthetic Group Worksheet



Figure 9. Observation Results Sheet

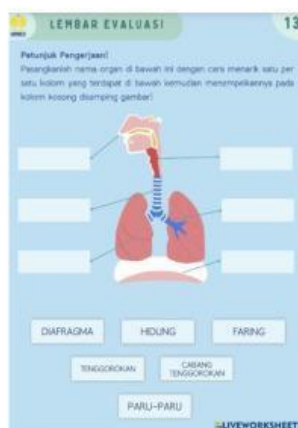


Figure 10. Evaluation Sheet

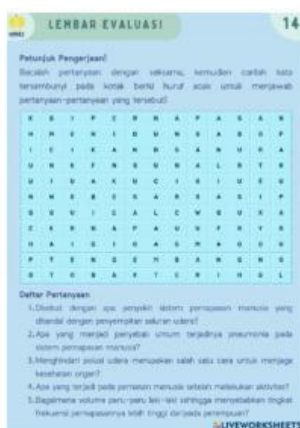


Figure 11. Evaluation Sheet

Product Validation

The media that has been developed needs to be tested for reliability so that it can be used in field trials or learning (Dwivedi et al., 2023; Taber, 2018). Product

validation is carried out by expert validators, namely material experts and media experts. Each expert provided suggestions for improving the media before the media was suitable for use in learning activities (Abdulrahman et al., 2020). The results obtained from expert validators will later be used to conclude the suitability of the media that has been developed so that it can be used.

Table 4. Expert Validator Assessment Results

Feasibility Aspect	Percentage	Qualification
Appearance	100%	Very Valid/Decent
Contents	93%	Very Valid/Decent

Based on Table 4, the product developed by researchers, namely E-LKPD Interactive Liveworksheets Based on Differentiated Instruction, shows that it is suitable for use in learning activities with a media or appearance percentage of 100% and is included in the very feasible category. Meanwhile, the assessment results based on content or material obtained a percentage of 93% and was included in the very feasible category. Based on assessments from media and material expert validators, E-LKPD Interactive Liveworksheets Based on Differentiated Instruction is very worthy of being tried out because it gets a percentage in the 90-100% interval in the very feasible category (Melindawati, 2021).

Design Revision

Researchers revised the design based on input and suggestions from media experts and material experts. Suggestions and input from material expert validators include adjusting assessment questions to the flow of learning objectives and the use of punctuation marks in the media. The comparison of E-LKPD Interactive Liveworksheets based on Differentiated Instruction before and after being revised by researchers is as follows:



Figure 12. Instructions for use do not include a period (.) at the end of the sentence



Figure 13. Instructions for use accompanied by a period (.) at the end of the sentence



Figure 14. Command sentences end with an exclamation mark (!) instead of a period (.)



Figure 15. Command sentences end with an exclamation mark (!)

Practicality of Liveworksheets Interactive E-LKPD Based on Differentiated Instruction

The practicality of the product is based on the results of teacher and student response questionnaires after product trials. In the small-scale trial, the researchers involved 6 students who were selected heterogeneously, namely 2 students with low scores, 2 students with medium scores, and 2 students with high scores. After the researcher implemented the Interactive E-LKPD Liveworksheets Based on Differentiated Instruction in a small-scale trial, the researcher gave a response questionnaire to teachers and students containing fifteen questions and assessments regarding their experience using the product developed by the researcher.

Table 5. Results of Teacher and Student Responses in Small-Scale Trials

Respondent	Percentage (%)	Criteria
Teacher	96	Very Practical
Student	94	Very Practical

Based on Table 5, it can be seen that the results of teacher responses in small-scale trials of E-LKPD Interactive Liveworksheets Based on Differentiated Instruction are in the interval 86 – 100% in the very practical category. Meanwhile, the results of student responses in small-scale trials obtained a score of 94% and were included in the very practical category. Suggestions and input given by teachers after small-scale trials include the need to provide spare electronic devices because not all students have devices.

Table 6. Results of Teacher and Student Responses in Large-Scale Trials

Respondent	Percentage (%)	Kriteria
Teacher	100	Very Practical
Student	85	Practical

Table 6 shows that the results of teacher responses in large-scale trials have increased to 100% in the very practical category. Meanwhile, the results of the student response questionnaire to the Liveworksheets Interactive E-LKPD based on Differentiated Instruction obtained a score of 85% in the practical category. The product developed received a positive response from teachers and students because of the 15 questions, it almost got a score of 3 – 4 which is included in the very practical and practical category.

The average percentage of response questionnaires in small-scale and large-scale trials obtained a percentage of 98% teacher responses and 89.5% student responses, so it can be concluded that Differentiated Instruction-Based Interactive Liveworksheets E-LKPD is very practical to use in learning activities. This is supported by previous research which explains that the teacher and student response questionnaire to the developed E-LKPD obtained results of more than 86% showing very positive and practical results so that it can be used in learning activities (Fitri et al., 2022; Ghaisani & Setyasto, 2023).

Effectiveness of Interactive E-LKPD Liveworksheets Based on Differentiated Instruction

The effectiveness of the products developed by researchers is based on student learning outcomes in product trials (Herlina & Melani, 2022); (Rosman & Hidayati, 2023). Researchers provide pre-test questions before carrying out learning activities. After knowing the initial abilities of the students, the researcher then applied the Interactive E-LKPD Liveworksheets Based on Differentiated Instruction in learning activities and then carried out a post-test.

Table 7. Student Pre-Test and Post-Test Results on Product Trial

Test Type	Average	Average Difference
Pre-Test	53.46	
Post-Test	83.08	29.62

Based on Table 7, it can be seen that there is a difference of 29.62 between the pre-test and post-test results in product trials. The average pre-test score of 53.46 was obtained before the learning activities were carried out. Then it increased to 83.08 in the post-test after implementing the Interactive E-LKPD Liveworksheets based on Differentiated Instruction. The average post-test score was 83.08 in the interval 83-91 on the cognitive competency test in the good category (Fimala et al., 2022). Next, the researcher carried out the N-Gain test to determine the criteria for the average increase between the pre-test score and the post-test score.

Table 8. N-Gain Test Results

Average Difference	N-Gain	Criteria
29.62	0.64	Currently

Based on Table 8, it is known that the average difference between pre-test and post-test results is 29.62 in small-scale and large-scale trials. This shows that the average increase in learning outcomes for class V students at SD Negeri Cepoko was 0.64, which is included in the medium criteria. The increase in average learning outcomes shows that the use of E-LKPD Interactive Liveworksheets based on Differentiated Instruction used in science and science subjects in class V of Cepoko State Elementary School has proven to be able to improve student learning outcomes.

The statement regarding the success of using E-LKPD Liveworksheets in improving student learning outcomes is supported by research conducted by Minarni & Barus (2023), Suniasih & Sujana (2023), which stated that there was an increase in student learning outcomes after implementing E-LKPD Liveworksheets in thematic learning in class V amounting to 81.03 in the high category. The success of increasing student learning outcomes after implementing E-LKPD Liveworksheets is also supported by research conducted by Puspita Sari et al. (2022), stating that Liveworksheets-based E-LKPD can improve student learning outcomes with an increase of 26.6 which is included in the medium category. Therefore, it can be concluded that the use of interactive E-LKPD Liveworksheets based on Differentiated Instruction is feasible and effective for use in learning activities because it can improve student learning outcomes (Agustina et al., 2023; Wiradimadja et al., 2023).

Conclusion

Based on the research that has been conducted, it can be concluded that E-LKPD Interactive Liveworksheets based on Differentiated Instruction is feasible, practical and effective for use in learning activities. This is proven by the results of material expert validation which obtained an average percentage of 93% and media validation of 100% with a very feasible category. The average percentage of practicality in small-scale and large-scale product trials was 98% for teachers and 89.5 for students in the very practical category. Furthermore, the effectiveness of Interactive E-LKPD Based on Differentiated Instruction was obtained from student learning outcomes through pre-test and post-test with an average difference of 29.62 and an N-Gain of 0.64, which is included in the medium category.

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Author Contributions

R. M. F. contributed to conducting research, developing, analyzing and compiling articles. M. F. as supervisor for research activities up to the preparation of articles.

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Conflicts of Interest

The authors declare no conflict of interest.

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